



KEER 2018

Go Green with Emotion

7th

International Conference on Kansei Engineering & Emotion Research 2018

19 - 22 March 2018

Kuching, Sarawak, Malaysia

PROCEEDINGS



Organizers



Japan Society of Kansei Engineering
日本感性工学会

MAKE



社團法人台灣感性學會
Taiwan Institute of Kansei

Technical Collaborator



UNIVERSITI
TEKNOLOGI
MARA



Supporters & Sponsors



KEMENTERIAN PENDIDIKAN TINGGI



Official Airline
Partner



malaysia airlines



KEER2018
Go Green with Emotion

7th International Conference on Kansei Engineering
& Emotion Research 2018, 19-22 March 2018,
Kuching, Malaysia

Editors:

Anitawati Lokman and Simon Schütte

Series: Linköping Electronic Conference Proceedings No. 146
Linköping University Electronic Press
Linköping, Sweden 2018
ISSN: 1650-3696
eISSN: 1650-3740
ISBN: 978-91-7685-314-6
URL: <http://www.ep.liu.se/ecp/contents.asp?issue=146>

© The Authors, 2018

Conference Chair

President Emeritus: Prof. Hisao SHIIZUKA, Kogakuin University, Japan

General chair: Assoc. Prof. Dr. Anitawati Mohd Lokman, Universiti Teknologi MARA, Shah Alam

Co-chair: Asst. Prof. Ir. Dr. Pierre LEVY, Eindhoven University of Technology, The Netherlands

Co-chair: Prof. Toshimasa YAMANAKA, University of Tsukuba, Japan

Co-chair: Prof. Jeff C. Chen, National Kaohsiung Normal University
KEER Steering Committee

Prof. Masayuki TAKATERA, Shinshu University, Japan – JSKE, President

Prof. Toshimasa YAMANAKA, University of Tsukuba, Japan – JSKE

Prof. Hisao SHIIZUKA, Kogakuin University, Japan – JSKE

Prof. Dr. Min-Yuan MA, National Cheng Kung University, Taiwan – TIK

Prof. Kuohsiang CHEN, I-Shou University, Taiwan – TIK

Prof. Jeff C. Chen, National Kaohsiung Normal University – TIK, President

Dr. Brian HENSON, University of Leeds, U.K. – EKG

Assoc. Prof. Dr. Simon SCHÜTTE, Linköping University, Sweden – EKG

Dr. Lluís MARCO-ALMAGRO, Universitat Politècnica de Catalunya | BarcelonaTech, Spain – EKG

Carole FAVART, Toyota Motor Europe, Belgium – Industrial advisor

Asst. Prof. Ir. Dr. Pierre LEVY, Eindhoven University of Technology, The Netherlands – Coordinator

Prof. Dr. Shinichi Koyama, University of Tsukuba, Japan – Coordinator

Scientific Committee

Prof. Masayuki TAKATERA, Shinshu University

Prof. Toshimasa YAMANAKA, University of Tsukuba

Prof. Hisao SHIIZUKA, Kogakuin University

Prof. Dr. Min-Yuan MA, National Cheng Kung University

Prof. Kuohsiang CHEN, I-Shou University

Prof. Jeff C. Chen, National Kaohsiung Normal University

Dr. Brian HENSON, University of Leeds

Assoc. Prof. Dr. Simon SCHUTTE, Linköping University

Dr. Lluís MARCO-ALMAGRO, Universitat Politècnica de Catalunya | BarcelonaTech

Carole FAVART, Toyota Motor Europe, Belgium

Asst. Prof. Ir. Dr. Pierre LEVY, Eindhoven University of Technology

Dr. Shinichi Koyama, University of Tsukuba

Dr. Hideyoshi Yanagisawa, Tokyo University

Prof. Dr. Hiroko Shoji, Chuo University

Dr. Shigeru Ozaki, University of Tsukuba

Prof. Dr. Naoya Kashiwazaki, Tokyo Denki University

Prof. Dr. Hiroshi Nunokawa, Iwate Prefectural University

Dr. KyoungOk Kim, Shinshu University

Prof. Dr. Fauziah Noordin, Universiti Teknologi MARA

Assoc. Prof. Dr. Anitawati Mohd Lokman, Universiti Teknologi MARA

Dr. Fauziah Redzuan, Universiti Teknologi MARA, Shah Alam

Prof. Dr. Shing Sheng Guan, National Yunlin University of Science and Technology

Prof. Dr. Ding-Bang Luh, National Cheng Kung University

Prof. Dr. Kevin C. Tseng, Chang Gung University
Prof. Dr. Yang-Cheng Lin, National Taipei University of Business
Prof. Dr. Chun-Heng Ho, National Cheng Kung University

Local Organizing Committee

Advisor: Professor Dato Dr. Jamil b. Hj Hamali, Rector, UiTM Sarawak
Assoc. Prof. Dr. Anitawati Mohd Lokman, Universiti Teknologi MARA
Shamsiah Abdul Kadir, Kansei Resources
Assoc. Prof. Dr. Hanafiah Yussof, Universiti Teknologi MARA
Khairul Khalil Ishak, Tokyo Universiti of Technology
Dr. Siti Salwa Salleh, Universiti Teknologi MARA
Mudiana Mokhsin, Universiti Teknologi MARA
Roshaliza Rosli, Kansei Resources
Nor Azlin Rosli, Universiti Teknologi MARA
Assoc. Prof. Dr. Nazlina Shaari, Universiti Putra Malaysia
Azhar Abdul Aziz, Universiti Teknologi MARA
Shamsudin Md Sarif, Universiti Teknologi MARA
Saidatul Rahah Hamidi, Universiti Teknologi MARA
Dr. Shuhaida Shuhidan, Universiti Teknologi MARA
Dr. Noorafiza Mat Razali, Universiti Pertahanan Malaysia
Prof. Madya Dr Ag. Asri Ag. Ibrahim, Universiti Malaysia Sabah
Norzehan Sakamat, Universiti Teknologi MARA
Noorazida Mohd Idris, Universiti Teknologi MARA
Ismail Amat, Kansei Resources
Nik Nor Nabila Nik Ismail, Kansei Resources
Ahmad Azran Awang, Kansei Resources
Dr Sharifah Syahirah Syed Syeikh, Kolej Universiti Poly-Tech MARA

Table of Contents

Investigation into the Geographical Superiority for Carrying Our Games Development: A Comparison between the US and Japan <i>Kazuhiro Masuda and Youji Kohda</i>	1
Investigation of Factors Producing A Sense of Virtual Reality Using Substitutional Reality <i>Momoka Kinoshita, Jue Zhang and Hisaya Tanaka</i>	12
Development and Application of Online Tools for Kansei Engineering Evaluations <i>Simon Schütte and Lluís Marco Almagro</i>	20
Gaze-Voting Interface for Interactive Evolutionary Computation Considering the Kansei Evaluation of Multiple People <i>Hiroki Isoda, Hiroshi Takenouchi and Masataka Tokumaru</i>	29
A Study of the Perception of Caricature Creation <i>Wenting Fang, Jiede Wu and Rungtai Lin</i>	39
Malaysian Perceptions Towards Bemban Product Design <i>Ain Syafiqah Abu Bakar and Abdul Muta'ali Othman</i>	49
A Study on the Perception of Local Taiwanese and Immigrants in Taiwan Towards the Color Imagery Applied on Calico of the "Fortune <i>Shi-Mei Huang, Ming-Chyuan Ho and Yuan Hua Lu</i>	60
A Study on Cultural and Creative Product Design Model from the Perspective of Paper Cutting <i>Chiang Chang Tzu and Hui Huang Shu</i>	71
A Study of Service Design Applied on Traditional Martial Arts <i>Ming-Chw Wei, Yung-Chenga Hsieh, Shu-Huib Huang and Liang-Yu Chen</i>	81
Exploration on the Emotion Factors of the Inheritance of the Indigenous Traditional Skills: A Case Study of the Weaving of the Seediq <i>Huang Hsiu-Mei and Hwang Shyh-Huei</i>	91
Communication During Design Information Phase: A Reflection on Cross- Cultural Tools <i>Alejandra Vilaplana, Alexandre Gentner and Carole Favart</i>	101
A Proposal of Participatory Design Tools for East Asia Focus on Anonymity and Playfulness <i>Yuki Taoka, Kaho Kagohashi and Celine Mougenot</i>	111
A Study of Product Anticipant Images of the Elderly <i>Yung-Chuan Ma and Shih-hung Cheng</i>	122
Framework for Evaluation of Show Window: Using Communication Items Reflecting Designers' Intention of Production <i>Chenyan Zou and Shinji Wakiyama</i>	133

Characteristics of Pattern Making Work of Modelistes in France in Comparison with Pattern Makers in Japan	
<i>Emi Nakanishi, Kyoung Ok Kim, Tsuyoshi Otani and Masayuki Takatera</i>	144
Comparative Study on Visual Impression Structure for Car Front Grill Between Japan and Thailand	
<i>Shun Kou, Nana Moriyama and Mikiko Kawasumi</i>	151
Emotional Bionics - A Pickup Truck is a Lion! A Study Using Emotional Profiling to Analyse Bionic Analogies in Car Design	
<i>Susan Gretchen Zöller, Tina Schröppel, Sandro Wartack</i>	157
A Study on the Kansei Image of the Packing Color of the Instant Noodles for Consumers	
<i>Zhongzhen Lin, Chun-Heng Ho and Xingmin Lin</i>	167
Successful Points of Kansei Product Development	
<i>Mitsuo Nagamachi</i>	177
The Effects of Store Display and Consumer's Personality on Information-Seeking Behavior for OTC Drugs	
<i>Shinichi Koyama, Kana Akiyama, Saki Nakamura, Mayu Kamifuji, Hikari Tachino, Seiya Ishihara, Ayaka Hayashi and Megumi Izumisawa</i>	188
Case Study of Renovation Design Plan of Golf Club House by Color Marketing Method and Kansei Value Evaluation Analysis	
<i>Miyuki Ito, Takashi Sakamoto and Toshikazu Kato</i>	193
The Effect of Mood Valence and Arousal on Car Following, Evidence from Driving Behaviour and Eye Tracking	
<i>Tatjana Zimasa, Samantha Jamson, Brian Henson, Andrew Tomlinson, Richard Donkor and Lee Skrypchuk</i>	199
Comparision of Respondent Images Between Picture and Text Surveys: Implications of New Research Methods Using Pictures	
<i>Katsue Edo, Hiroharu Ochiyara, Fusae Kukihara and U Hiroi</i>	213
The Compilation of Emotional Evaluation Parameters	
<i>Eric Chen-F Hsieh, Min-Yuan Ma, Maggie Yei-Mei Sheu and Yu-Chun Huang</i>	221
Segmentation in Kansei Engineering Studies Based on the Emotional Response	
<i>Lluís Marco-Almagro, Xavier Tort-Martorell and Simon Schütte</i>	231
A Basic Consideration of Evaluation Method and Construction Model of Mental Model	
<i>Toshiki Yamaoka</i>	239
Measuring Affective Responses to Confectionaries Using Paired Comparisons	
<i>Farzalnizam Ahmad, Raymond Holt and Brian Henson</i>	245
An Investigation on the Life-Style and Diet and Cooking of Single Young House-Renter: Case Studies of Cities in Guangdong and Taiwan	
<i>Ching Yang and Gui-Qi He</i>	255
Increasing the Intergenerational Interactions Between the Elder and the Child: Taking Life Experience as Example	
<i>You-Zhen Lu, Min-Yuan Ma and Chun-Heng Ho</i>	266

Evaluating Human-Robot Interaction from Inside and Outside Comparison Between the First-Person and the Third-Party Perspectives <i>Kazuki Yanai, Aiko Murata, Ryota Mizutani, Akira Ichiboshi, Kazunari Komatsuzaki, Roshan Thapliya and Katsumi Watanabe</i>	276
Preliminary Research on the Method of Food Preservation <i>Chin-Lai Wu, Bao-Yan Chen, Tung-Long Lin and Shu-Ming Wu</i>	287
How Cool is Bebop Jazz: Clustering and Decoding of Jazz Music <i>Antonio Rodà, Edoardo Da Lio, Maddalena Murari and Sergio Canazza</i>	298
Study of the Effect of Backgroundmusic Tempo on A Rrest: Physiological Evaluation Using a Mental Stress Task <i>Masashi Murkami, Takashi Sakamoto and Toshikazu Kato</i>	309
Investigation of Pleasantness in the Manipulation of Deformable Interfaces for Musical Expression <i>Yuichiro Kinoshita, Masato Nishio, Shota Shiraga and Kentaro Go</i>	315
The Effects of Musical Pieces Composed by Hiroyuki Sawano: A Study Using the Anime, Attack on Titan <i>Ruiji Sasaki, Naoto Hayashi and Masashi Yamada</i>	325
Taiwan Arts Exhibition Poster Category and Layout Searches <i>Hsiu-Ju Lee and Tzu-Chiang Chang</i>	335
Drawings of Mothering Practices: A New Narrative of Being Mothering <i>Tzu-Ching Hsu</i>	346
A Case Study of Difference Between Sand Animation and Micro Film <i>Jun Wu, Tzu Chiang Chang, Yang Gao and Rungtai Lin</i>	354
Impression of Signboard in Considering Landscape <i>Hiroshi Takahashi, Yohei Shoji and Takashi Irikura</i>	364
The Impressions of Posters and Their Effects on Attracting Tourists <i>Natsuhiro Marumo, Nobuyuki Watanabe, Masashi Yamada and Takuya Sugimoto</i>	373
Specifying Kansei Requirements with the Application of Environmental Psychology Research Methods <i>Toru Yoshida, Masami Maekawa, Yoshio Tsuchida and Yukari Nagai</i>	379
An Experiential Semantic Analysis of "EXHIBITION" and Its Pedagogical Implication on English for Arts Purpose: A Linguistic Perspective <i>Li Larry Hong-lin, Tiffany Shuang-Ching Lee and Lin Po-Hsien</i>	390
Lacking of Social Interaction at Open Spaces in the City of Baghdad, Iraq <i>Sarah Abdulkareem Salih and Sumarni Ismail</i>	401
An Information Presentation System for Wobbling Elderly People and Those Around Them in Walking Spaces <i>Koshi Ogawa, Takashi Sakamoto and Toshikazu Kato</i>	414
Experiencing User Operation Beyond the First Metaphorical Impression <i>Shih-hung Cheng, Yung-Chuan Ma and Ming Huang Lin</i>	423

Proposal of a Quantitative UX Analysis Method Based on a Psychometric Questionnaire Survey	
<i>Yuka Sugiyama, Toshikazu Kato and Takashi Sakamoto</i>	434
A User Evaluation System Using Sensors of Smartphones	
<i>Ryo Yamaguchi, Jue Zhang and Naiwala P. Chandrasiri</i>	444
Designing User Experiences Focused on Multimodal Perception	
<i>SuKyoung Kim</i>	454
Sensation and Perception in Surface Properties, Using Kansei Surface Engineering	
<i>L. Eriksson, B-G. Rosen and M. Bergman</i>	464
A Case Study of the Fashion Show Curatorial and Experience Marketing: The Perspective of the Actor Network Theory	
<i>Shu Hui Huang and Tzu Chiang Chang</i>	478
Difference Between Japanese and French Tastes in Women's T-shirts for Sportswear	
<i>Marsac Eva, KyoungOk Kim and Masayuki Takatera</i>	489
Evaluation of Psychological and Physiological Responses Under Gradual Change of Thermal Conditions with Aim to Create Index to Evaluate Thermal Comfort of Clothes	
<i>Tomohiro Uemae, Mayumi Uemae and Masayoshi Kamijo</i>	495
A Statistical Study on Female Fashion Coordinates in Japan	
<i>Tsubasa Kawakatsu and Masashi Yamada</i>	504
An Evaluation Case Study of Sun Hat Design for College Students Based on Kansei Engineering	
<i>Jiawei Zou, Weizhen Wang and Xin Chen</i>	512
Tactile Sensation Induced by Images of Clothes with Motion Parallax	
<i>Miki Kumamaru, Atsushi Osa and Ken Matsuda</i>	523

INVESTIGATION INTO GEOGRAPHICAL SUPERIORITY FOR CARRYING OUT GAME DEVELOPMENT - A COMPARISON BETWEEN THE US AND JAPAN -

Kazuhiro MASUDA^{*a} and Youji KOHDA ^{†a}

^a School of Knowledge Science Japan Advanced Institute of Science and Technology, Japan,
keith-masuda@jaist.ac.jp

^a School of Knowledge Science Japan Advanced Institute of Science and Technology, Japan,
kohda@jaist.ac.jp

ABSTRACT

Bases for game development in Japan and the US are integrating. In Japan, Although Tokyo is the center of game development, there are other bases. As for the US, game development is focused in California. Integration of development bases in Japan and the US cannot be compared using the same criteria, however, the game industry in the US has congregated in California which suggests that it has some geographical superiority. In Japan, many industries are in Tokyo, thus, we speculate that the game industry is too. Here we discuss how geographical superiority in countries like the US affect game development. The research question is 'What effect has the integration of game development had on the development system?' Research was carried out by interviewing 15 key personnel in both the game development and management. In the US, where human resource mobility is high, the growth of the entertainment industry is noteworthy. Especially the booming of game development in Los Angeles, and the Silicon Valley. Whereas, in Seattle, despite being the home to Nintendo of America and Microsoft, the industry is not growing. No other city has seen integration like that in California. In Canada, measures to boost the industry have seen growth particularly in British Columbia and Toronto. The results find that in the US CG technology from the film industry can

^{*} Kazuhiro MASUDA

be applied and developed for the US game industry. Employees in the film industry realized the attraction of the interactive elements of games, which movies lack, and this is paramount to procuring development capital and partner research universities. The movement of human resources from the film industry influenced both the development and management of the game industry. In Japan, it is yet to be seen that there are any influence from geographical superiority.

Keywords: *geographical superiority, cluster, Standardization, tacit knowledge, explicit knowledge*

1. INTRODUCTION

While there are many ways that industries can be categorized, one way to do so is to divide industries into those with vertical integration and those with horizontal specialization.

Currently in Japan, a prototypical example of a vertically integrated industry that has long succeeded in the global market is the automobile industry. Japanese automobiles have gained popularity in many markets, chiefly in the US and Europe. The subcontracts and the systemization of the automobile industry falls into a vertical structure, with the parent company responsible for the final product at the top and primary and secondary subcontractors falling below it (Harada, 2009). This has allowed the parent company to establish a competitive advantage in all aspects, including technical expertise and information. This, they argue, is the result of companies striving for greater productivity by shifting from specialization within the company to specialization across companies. One difference between the Japanese automobile industry when compared to many home appliances is that they have not moved manufacturing to developing countries for the lower wages, and have instead focused on moving manufacturing to countries which hold large markets. In other words, they manufacture in locations close to the markets.

In contrast, an example of a horizontally specialized industry is the gaming industry. Starting with the release of the Nintendo Entertainment System (NES) in the US, Japan, and Europe, this industry evolved from 1983 to 1986 as a horizontally specialized industry.

In this research, we will examine the gaming industry as an example of a horizontally specialized industry with its developmental origin in Japan, and comparing it with vertically integrated industries. By doing so, this will make clear what leads to a successful horizontally specialized industry. One characteristic of gaming devices is that there is a complete separation between the hardware, whether it be a gaming console or a handheld device, and the software. This separation can be said to have led to the increase in the number of games available, as well as improvements in the qualities of those games.

Game developments in Japan is typically done on a per-project basis, planned around hardware updates, with the development divided into planning, programming, graphics, and

sound divisions. The mobility of workers in Japan is generally quite low, but in the entertainment industry, which the game industry is emblematic of, it is common for people to move from company to company due to a number of factors. Firstly, the research and development departments of service sector companies in Japan are highly concentrated in Tokyo. Secondly is that within the gaming industry itself, there are a number of industries, such as the tech industry and the animation industry, where many of the same technologies are used, so there is a smooth interaction between people working in these industries. Also, in the game industry, it is quite easy for workers to switch jobs after the completion of a game (Hanzawa, 2005). Actually, when workers switch jobs, it is common practice to have them sign non-disclosure agreements (NDAs), but it is difficult to enforce them. However, it can be said that this high mobility of talented people has led to the development of the gaming industry as a horizontally specialized industry.

In the United States, the mobility of talented people has been examined from a number of different angles. In Silicon Valley and on the west coast of California, especially in the tech industry, a high mobility of talented people can be observed.

Previous research examining the game industry from the perspective of geographical superiority exists, focusing on the Japanese market alone (Hanzawa, 2005). However, this study was conducted when the dominant hardware was the PlayStation 2, two generations prior to the current generation. Since then, software development environments have changed drastically. With the spread of network games and the advent of Indy games, modern game consoles have evolved significantly, but there are a few studies which have examined the current development systems of the US and Japanese companies from the perspective of geographical superiority. In addition, Porter (2000) discusses and defines the industry clustering in the Japanese game market from a cluster stand point. However, there are very little additional researches that touch upon development systems from a cluster or geographical superiority view point.

This research examines how software development systems have evolved from the perspective of geographical superiority. The study started with the release of the PlayStation 3, released in November 2006 in the US and Japan, and in March 2007 in Europe, popularizing 3D and CG technologies and leading to the mainstream adoption of game downloads, and continues to the PlayStation 4, the most popular game console in the global market today.

2. REVIEW OF PREVIOUS RESEARCH

The game industry, R&D, management, and agile development have been researched from the perspective of various fields. Ogawa (2011) examined the transition from NES to PS2 and Nintendo's Wii, while Okamoto (2011) investigated the same subject from the viewpoint of the hardware and software. Meanwhile, Cornelia et al. researched the mobility and innovation of

human resources. Tanaka (2005) researched innovation and industrial organization. Ikuine focused on development productivity (2012), and Shintaku et al. focused on the gaming industry from an economic point of view. Lee et al. (2006) studied the role of the producer in a broader sense. Masuda et al. (2016) researched the mobility of human resources from the film production industry as the key to success of the United States' game manufacturers.

3. RESEARCH QUESTION

What effect has the integration of game development had on the development system?

4. METHOD AND INTERVIEWEES

The interviews were conducted with primal publishers and consultants in both the US and Japan, by the method of semi-structured interview. A list of the interviewees is shown in Table 1. The questions asked during these interviews were, "What are the reasons for the increased integration among developers in the game industry?" and "How can this increased integration be taken advantage of?".

Table 1: The interviewees' lists of the month/year, category, department, title and place from March 2015 to August 2016

Month/Year	Category	Department	Title	Place
May/2015	Publisher in Japan	Overseas license	Manager	Japan
June/2015	Publisher in the US	-	Board member	U.S.
June/2015	Publisher in the US	Overseas license	Vice president	U.S.
June/2015	Publisher in the US	Development department	Senior producer	U.S.
July/2015	Publisher in the US	Overseas license	Marketing Manager	Japan
July/2015	Global publisher	Overseas license	Vice president	Japan
August/2015	Publisher in the US	-	Board member	U.S.
August/2015	Publisher in the US	Development department	Senior producer	U.S.
August/2015	Game's consultant in the US	-	CEO	U.S.
August/2015	Publisher in the US	Development department	Producer	U.S.
December/2015	Publisher in Japan	Foreign affairs department	Vice president	Japan
December/2015	Global game's consultant	-	CEO	Japan
March/2016	Publisher in Japan	Foreign affairs department	Manager	Japan
March/2016	Global publisher	-	Board member	Japan
August/2016	Publisher in the US	Development department	Senior producer	U.S.

5. INTERVIEW RESULTS AND ANALYSIS

In this research, we asked foregoing questions to 15 interviewees, and obtained results offering a comparison between the United States and Japan. Although there are differences in position among engineers/arts, managers, and executives, we extracted the interview results that were common to all of them, compared our results to previous studies and research the authors had conducted, and finally analyzed them.

In Japan, increased concentration in the capital city of Tokyo has progressed in many different industries, and this has been especially prevalent among research and development departments. A noteworthy exception is only to Nintendo in the game industry, as it has experienced the successful integration of both hardware and software development. Some accumulation is seen outside of Tokyo such as in Osaka and Fukuoka. A previous paper has examined the integration i.e. cluster in Fukuoka (Wada, Ichikohji, Hanzawa, Ikuina, & Cho, 2012). There are different types of clusters such as: "naturally occurring themselves", "materials produced and commodification", "Produced by policy guidance" and so on. (Harada, 2009).

Many industries have become increasingly concentrated in Tokyo, and at the same time higher education institutions such as universities are too heavily concentrated in Tokyo. Game-related education and research is no exception. Therefore, it is only natural that young people who are hoping to work in the gaming industry in the future look for work in Tokyo, where the development departments are. This is how the Tokyo game industry cluster has been formed.

In the gaming industry in Tokyo, we could not clearly confirm the existence of clusters, but as innovative industries become increasingly integrated in Tokyo, entertainment industries of every sort, advertising agencies, and freelancers are also increasingly becoming clustered in Tokyo. One characteristic of the Japanese gaming industry is that specifications—the development details—are vague when compared to the United States. Thus, the role of the face-to-face meetings are of greater significance in determining the specifications. On the other hand, agile development and the outsourcing of effects, motion capture, sound, and debugging has become more common. Therefore, frequent meetings depending on the development status are essential. Conducting most meetings at the development site also allows for a better understanding of the current development status and has the benefit of leading to smooth progress in development. These are some of the sample of narrow cluster's superiority. These are the reasons why industries are so heavily concentrated in Tokyo and is evidence of clusters functioning effectively.

On the other hand, due to differences in geographic size when comparing the United States to Japan, dynamic changes accompanying movement are limited to some personnel, such as the position of a person or a heavy responsibility. From our interviews with a senior producer in the

development department at one of the publisher in the US, we found that California is a well-known and a dynamic tech industry. In California, it is common for talented people working in the vibrant movie and tech industries in Hollywood and Silicon Valley to switch jobs. 54% of all workers in the US gaming industry are employed in California (ESA, 2017). Note that this percentage includes workers in non-developer roles in the game development department. Hence, California can be considered to be an important gaming industry hub. Also, from our interview with a game consultant, we found that within California, it was common and extremely easy of workers to move between Silicon Valley in the north and LA in the south, since they are in the same state. Many of these developers are limited to what roles they can put their expertise to use, so it is common for them to mostly sign contracts per-project.

When switching jobs, most find new jobs through public listings, but it is a common practice for people of the gaming industry to find their next jobs through recommendations from friends and word-of-mouth. News of new jobs through word-of-mouth is popular. Many of these cases are with former coworkers and business partners, and even if they are currently working in different industries, they are typically people who have left their mark. Among art workers, planners and CG designers etc., there are many game publisher/development companies in LA. It is especially true that CG technologies for the movie industry in Hollywood tends to be one step ahead of the gaming industry. However, many talented people in the film industry realize the attraction of the interactive elements of games, which movies lack. (Masuda & Kohda, 2016). Currently, the US gaming industry is growing. Therefore, many talented people in the film industry, who are interested in games, have come with their know-how. Not only do they understand the technology knowledge but they also have effectual knowledge on how to move forward in the gaming industry (Masuda & Kohda, 2016). Looking to the industry-academia cooperation in Silicon Valley, companies have strong relationships with universities in the area, such as Stanford and UC Berkley. Furthermore, unlike in Japan or on the US East Coast, it is relatively easy to receive funding from venture capital firms. This environment makes it easier for people to start companies and large-scale research and development. These two facts have had positive effects on the gaming industry, as well as other sectors of the tech industry.

Silicon Valley's population is said to be approximately 3 million people, with many researchers and developers from India and other parts of Asia making significant contributions.

There are three international airports in the San Francisco Bay area including the Silicon Valley. People, not just from the above mentioned countries, but from all across the world are coming in and supporting the tech industry, both in the US and globally. During our interview, a board member of a large-size US publisher mentioned, that within the Silicon Valley cluster there are a diverse set of cultures, and the people in it hold different values. From this, it can be inferred that it would be difficult to move development forward with the vague specifications common to Japan. Hence, both R&D and business management would not have a shared understanding of many of the specifications, that goes without saying applies too in Japan. In other words, many clusters can make the IT industries and the game industries excellent. To

keep and maintain human resources in the US, it is strongly recommended to have clear specifications.

In contrast, although it is also located on the US West Coast, both Nintendo of America and Microsoft have headquarters in Seattle, but the game software development industry is not as vibrant as California (ESA, 2017). Up until 2000, when Nintendo's hardware was dominating the global market, many in the gaming industry set up their offices in Seattle. Japanese companies also tended to set up US branches in Seattle. However, there are currently no major developments in terms of software development. The same is true for Microsoft. Much of game development is centered in California (ESA, 2017). However, the situation is different in Canada. Vancouver's entertainment industry has developed over the years, initially as a subcontracting region for Hollywood. After that the diverse parts of the entertainment industry—CG, sound, effects, as well as the game industry—have flourished. Vancouver has done especially well due to in part a favorable tax policy. With the reduced tax rates from the Government of Canada (17%) and the Province of British Columbia (17%) put together, approximately 40% of taxes are waived for these companies. This benefit can then be diverted to employees' pay. This has given rise to a tight cluster which has resulted in having games becoming global hits (GAME WATCH, 2016). These policies, combined with the fact that culture is very similar to the US, have made Canada the world's third largest game development country after the US and Japan.

6. CONSIDERATION

This study, in addition to examining previous studies, investigated the effects of geographical superiority in game development through interviews with key people who have: responsibilities in R&D, management, board members, US and Japanese game publishers, consultants, and so on. As stated previously, we could not observe a clear instance of geographical superiority in Japan. However, a cluster can be found in Vancouver as well as in Hollywood. When comparing these two places, it can be seen that the clusters formed in different ways. The film industry of Hollywood had initially developed on the East Coast, but is now mainly on the West Coast, as the industry faced legal problems and also sought the warmth of the Mediterranean, which is suitable for filming. Similarly, Vancouver is located on the West Coast in North America, which is a suitable location for filming as the weather is temperate throughout the year, the location offers great scenery and there is one of the strengths point which has no time difference with California. These also provided the advantage of cheaper productions. As a consequence, Vancouver is a city that has been contributing to the growth of the gaming industry's cluster.

In terms of game development, checking progress, adjusting the schedule, and bringing ideas in pursuit of games that offer more excitement and realistic sensations, are all accomplished through frequent meetings with those involved. In the game development process, even with advanced technology, many adjustments still have to be done manually. This creates a problem because, there are time constraints and limits to human ability. In the final stages of each

development, those involved have to work for long hours, and the informative meetings for creating final master version become indispensable. In this difficult environment, a large number of the US game companies have shown initiative to create standards for game development. The US aims for efficiency, and an environment which allows developers to contribute immediately and directly after transferring to a different company.

Also because of this diverse environment, a large number of the US game companies have introduced standardization development engines (unity, unreal etc.) as an initiative that aims for efficiency. Introducing standardization development engines in a company may benefit not only the company but also the artists and engineers. First, artists and engineers can discuss games using the same tools. Second, it is easy to respond to the sudden increase and decrease in workers. Viewed from the management perspective, a company can save the time and cost to develop their own engine. Also, in regards to the mobility of talented people, they could contribute immediately and directly after transferring to a different company. Both companies and workers can make a win-win relationship by using standardized development engines. Of course, it has some disadvantages. For example, realistic CG depiction, speed, capture and so on.

Standardization is often seen in IT industries other than the gaming industry, but comparing the US and Japan indicates that the US shows more progress in explicit knowledge, and interviews with numerous developers' position have confirmed their view that efficiency in standardization is high. This comparison is consistent with the vagueness of Japanese specifications mentioned in the previous section. In the US, developing according to the specifications can lead to its completion, and the quality of specifications is much more advanced than in Japan. In Japan, the culture of discussing and creating to reach completion strongly persists. Both ways have their advantages and disadvantages, but the latter requires more labor for regular meetings, and this means that development is slower. The method in the US, which is to firmly establish the specifications and prioritize the deadlines, is far more advantageous for developing game software that has a set deadline, such as sports games. Furthermore, if the specifications are firmly established, the developers are able to communicate sufficiently using conference calls and various development kits even if they are working remotely, so that the meetings do not hamper progress.

In Japan, research development is centralized in Tokyo; a cluster phenomenon that arose naturally. Although it is different to the case of the West Coast in the US, it is thought that the current game's development system arose from the proximity of the entertainment industries aggregated in Tokyo, and the culture of tacit knowledge caused by vague specifications. In comparison, although the US has implemented methods such as agile software development, it has been focusing on explicit knowledge and improvement in efficiency. In conclusion, these factors show that the differences between the current development systems in the US and Japan is one of the reasons why the US is now the dominant country in the global market. The following figure, figure 1, shows this phenomenon.

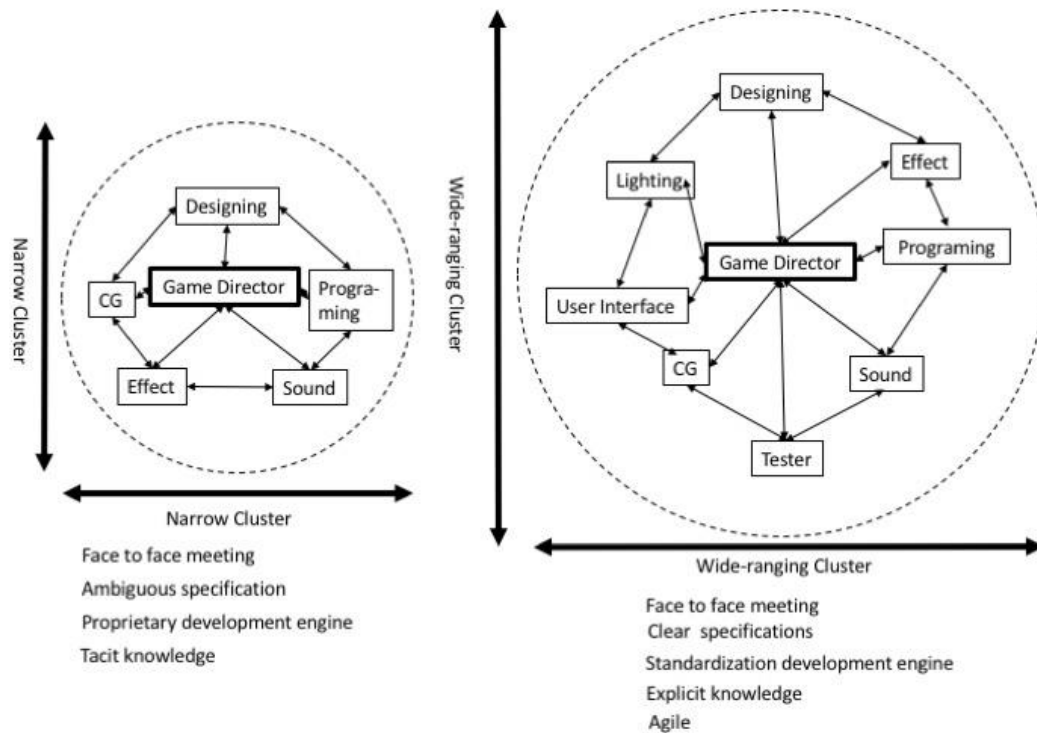


Figure 1: Visual representation of the proximity of related industries aggregated in a narrow (Japan) and wide-ranging (the US) cluster

7. ACKNOWLEDGEMENTS

We would like to thank the interviewees in the gaming industries both in the US and Japan for their participation.

REFERENCES

Cornelia, S., Federico, R., Moritz, J. (2014). Mobility and innovation: A cross-country comparison in the video games industry, Elsevier, pp. 122–128.

Fukuda K., (2012), Emergent Innovation and strategy formation by the video game development companies (in Japanese), *Core Ethics*, 8, 364–365.

GAME WATCH (2017). Retrieved from <http://game.watch.impress.co.jp/docs/news/744678.html> (in Japanese)

Harada, S. (2009). On M. Porter's clustering: competitiveness and policies of industry clusters (By Japanese) *Japanese Institutional Repositories Online*, Nagaoka University 7pp.21-42, 2009-07 ISSN:1883-1583.

Hanzawa, S. (2008). Characteristics of the Division of Labor and Geography in the Japanese Home Video Game Industry (By Japanese) *Geographical Review of Japan* Vol. 78 (2005) No. 10 607-633.

Ikuine, F. (2012). Development productivity dilemma (in Japanese), Yuhikaku, pp. 254–318.

Lee J. J. Jr., & Holt R. (2006). *The Producer's Business Handbook*, Elsevier, pp. 139–172.

Masuda, K., & Kohda Y. (2016). Mobility of human resources from the film production industry as the key to success of United States game manufacturers. *Proceedings of the 10th International Conference on Project Management (ProMac 2016)*, pp. 847-853.

Ogawa, S. (2011). Recent Development in Video Game Technology in Japan (in Japanese). *Toyo University Repository for Academic Resources*, pp. 6–14.

Okamoto, M. (2011). *For concentration in the home video game industry (in Japanese)*, Research Organization of Information and Systems, pp. 7–11.

Michle, P. E., Takeuchim H., & Sakakibara, M. (2000). Can Japan compete? (in Japanese) *DAIAMOND, Inc.*

SIWEK E. S (2017) VIDEO GAMES IN THE 21ST CENTURY *Entertainment Software Association (2017)*

Tanaka, S. (2005). Innovation and Industrial Organization (in Japanese), Taga Shuppan, pp. 83–90.

Wada, T., Icgikohji, T., Hanzawa, S., Ikuine, F., & Zhang. (2012) Survey report on the industrial cluster and possibilities of innovation management in the game industry of Fukuoka (By Japanese) *Manufacturing Management Research Center*

INVESTIGATION OF FACTORS PRODUCING A SENSE OF VIRTUAL REALITY USING SUBSTITUTIONAL REALITY

Momoka KINOSHITA^a, Jue ZHANG^b and Hisaya TANAKA^c

^a Graduate school of Kogakuin University, Japan, em17007@ns.kogakuin.ac.jp

^b Kogakuin University, Japan, zhangjue@cc.kogakuin.ac.jp

^c Kogakuin University, Japan, hisaya@cc.kogakuin.ac.jp

ABSTRACT

Substitutional reality (SR) technology blurs the boundary between the real and the virtual by unnoticeably substituting past images for live images. In this study, we further investigated such factors, and conducted experiments to verify whether they were indeed effective factors in SR. In the verification experiments, the subject was presented with an image in which two persons appear, wearing head-mounted displays (HMDs) and are photographed in advance; after which it was explained that one person was in a live image and the other in a past image, and the subject was asked which one the live image was. In the case where the psychological / social distance was reduced by performing cooperative action to imitate the action of the opponent, when the line of sight matches with that of only one person; and in the case of two patterns, when one person goes in and out of the personal space and does not shake or wave their hand; these three factors were verified. In the comparative experiment, the same past / live image content as in the verification experiment was employed. The results suggested that it is ineffective to conduct cooperative actions to reduce the psychological and social distance, and to enter and exit the personal space without waving. And further, it is effective when the gaze matches and when the personal space is entered / left with a hand wave. In sum, it was found that SR reality can be enhanced by adding communication.

Keywords: *substitutional reality, virtual reality, head mounted display, communication*

1. Introduction

In recent years, Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), Substitutional Reality (SR), and other forms of similar technology are increasingly being put into practical use. SR is a technology that blurs the lines between reality and virtual, as it switches in and out of past footage that was filmed previously, without being noticed. While VR awaits advancements in video technology to reduce the gap between reality and virtual, SR is attracting attention as a system that can provide a sense of reality and presence through a method other than video technology.

Because SR enables the user to experience the experiences of others, it is expected to be applied in a wide range of fields, such as in the medical field, where doctors can better understand the sensations of dementia and schizophrenia by experiencing them, the field of video games and entertainment, and toward previously impossible experimental methods for Kansei science and cognitive psychology [1]. In SONY's event to exhibit their new HMD, attempts have already been made to clear away the barrier between watching and experiencing the world views of movies using cognitive psychology tricks [3]. However, this type of research only relates to the effects of using SR, and there has not been much research that verifies which factors have an effect and how. Accordingly, this research has investigated the factors regarding the application of SR and verified whether or not they can be used practically, in order to verify whether or not they are effective factors for SR.

2. Research Method

2.1. Investigation of Factors

After investigating factors that were considered to be effective for SR through prior research, we focused on 2 factors. The first is that when the psychological and social distance to the other party is closed through concerted actions, such as deliberately flattering the other party's actions, the impact that you receive from the information from the other party, such as from their actions, will be stronger [3][4]. The second is that when experiencing SR, the act of characters repeatedly entering and exiting personal space of roughly 1.2m by 2m serves as an interaction with reality, allowing the user to get used to reality through the HMD [3]. We conducted verification experiments on these factors.

2.2. Development Environment

In this research, VR footage was developed through Unity 5. As shown in figure 1, panoramic footage was attached to a sphere, and we enabled the user to see 360 degrees around them, as they do in reality, by looking at the footage from the center of the sphere.

To show the VR footage, we used HTCvive, the HMD made by HTC. In addition, the 360 degree

panoramic video was filmed using a camera called THETA S made by RICOH.

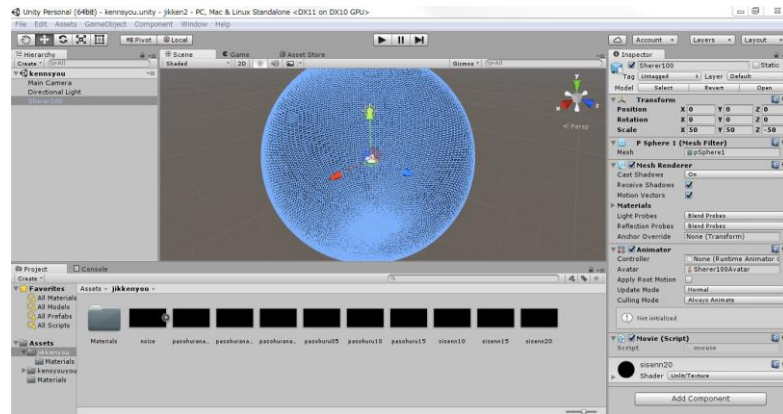


Figure 1: Screen of the development environment

3. Experiments on the Effect of Concerted Actions on Psychological and Social Distance

3.1. Experiment Outline

Through prior research, it has been made clear that when the psychological and social distance from the other party is closed through concerted actions, such as deliberately flattering the other party's actions, the impact that you receive from the information from the other party, such as their actions, will be stronger [3][4]. Accordingly, in this experiment we focused on the fact that the impact of the information received from the other party becomes stronger, performed concerted actions through VR, and conducted verification research to clarify whether the characters that have closed the psychological and social distance will be recognized as characters from reality.

3.2. Experiment Method

In order to produce the video for the experiment, footage of characters entering the experiment room from the entrance, lining up in front of the test subject, performing actions for roughly 20 seconds, and leaving through the exit was filmed using THETA S. Characters were filmed one at a time, and the footage was edited so that the characters would appear as 2 at a time before being seen through the HMD. Test subjects wore the HMD and headphones as shown in figure 2.



Figure 2. Image of the HMD being worn

When beginning the experiment, we explained to the test subjects that one of the characters is live footage, while the other character is past footage that was filmed in the past. When the movements of the 2 characters were the same, we had the test subject mimic the character that they selected, and when the movements of the 2 characters were different, we had the test subject mimic the movements of the character we specified. For the characters, there were the 3 variations of footage where the characters are different, footage where the characters are the same males, and footage where the characters are the same females, and for the movements, there were the 2 variations of the same movements and different movements, resulting in 6 total variations. From the headphones, we played footsteps that matched the footage, making it impossible to make a determination based on the sounds.

The concerted actions were to open and close the arms to the side of the body, where it is difficult for the hands to come into peripheral view without moving the head. Also, surveys were conducted for each trial before and after the experiment, and test subjects were asked which of the 2 characters they believed were from live footage and why, among other questions. The test subjects were made of 20 university students in their 20s, and the experiments were conducted in the room that the footage was filmed.

3.3. Results and Observations

As a result of computing the ratio of test subjects who determined that the character for whom they mimicked movement was the live footage for each trial, the maximum was 65% and the minimum was 40% for the 6 trials. This shows that there is not a clear trend that the character for whom movement was mimicked tends to be believed to be from reality, and it can be interpreted that there is not a clear trend that closing the psychological and social distance through concerted actions does not lead to believing that the character is from reality.

As for reasons that the test subject selected the character that they believed to be from reality, many responses were given that, "I felt awkwardness or roughness in picture quality for the character on the right" or, "I felt eye contact." From the responses test subjects believed characters with whom they made eye contact to be from reality, it can be thought that there is a possibility that eye contact will serve as a factor that provides a sense of reality.

4. Verification Experiment for the Usefulness of Eye Contact and Personal Space

4.1. Experiment Outline

During the experiment to investigate the impact of concerted actions, there were responses that, "We made eye contact" regarding the reason for selecting the character that they believed to be from reality. Also, prior research states that when experiencing SR, the act of characters repeatedly entering and exiting personal space of roughly 1.2m by 2m serves as an interaction with reality, allowing the user to get used to reality through the HMD [2]. Accordingly, in this experiment, we conducted verification experiments to clarify whether characters who make eye contact or characters that enter and exit personal space will be recognized as characters from reality.

4.2. Experiment Method

Similar to the previous experiment, we had the test subjects wear the HMD and headphones, look at footage where the same character appears twice, and determine which character is from reality.

Because the footage would be distorted if the line of sight is shifted due to differences in height, we used an adjustable height chair to make sure that the test subject's line of sight would be equivalent to the position of the camera at the time of filming. Also, we played noise through the headphones to prevent the footsteps from being a factor, and set the distance between the 2 characters and the fluorescent light to be equivalent to prevent a difference in brightness.

Under the same experimental environment, we conducted a preliminary experiment in order to verify whether the gaze can be felt by the direction of line of sight or the distance. As a result, by moving the face and the eyes together, it was felt that the gaze could match when the line of sight was directed or not directed, regardless of the distance. Therefore, regarding the footage used for this experiment, for the footage related to eye contact, 2 experimenters appeared simultaneously (the same character), lined up in front of the test subject, each facing their face and eyes together in various directions, and one character looked toward the test subject 5 times during each trial. For the distance that the character stands from the test subject, there were the 3 variations of 1.0m, 1.5m, and 2.0m. For the footage related to personal space, 2 characters lined up in front of the test subject, and one character approached the test subject

while moving back to front, while the other character did not approach the test subject while moving side to side. For the character moving back to front, there were 3 variations of the closest distance of 0.5m, 1.0m, and 1.5m, and there were the 2 variations of the character waving a hand or not waving a hand for a total of 6 variations. Surveys were conducted for each trial before and after the experiment, and test subjects were asked which of the 2 characters they believed were from live footage and why, among other questions. The test subjects were made of 20 university students in their 20s, and the experiments were conducted in the room that the footage was filmed.

4.3. Results and Observations

For the trials related to eye contact, the ratios of test subjects who believed that the character with whom they made eye contact was from reality for each distance were 55% for 1.0m, 75% for 1.5m, and 25% for 2.0m.

At a distance of 1.0m, 30% of test subjects responded that they did not make eye contact. The reason for this can be thought to be that when the distance between the test subject and the characters is close, it is difficult for both characters to be in the test subject's peripheral view simultaneously, so the test subject could not see the character when they were supposed to be making eye contact.

The ratios of test subjects who believed that they made eye contact with both characters were 5% for 1.0m, 0% for 1.5m, and 60% for 2.0m. The ratio of test subjects who believed that they made eye contact with both characters was clearly higher for a distance of 2.0m. The reason for this can be thought to be that the gaze of the virtual character looking in the vicinity of the test subject could be perceived as making eye contact when the distance between the test subject and the virtual character is far. The fact that there was not a clear trend for which character the test subject believed was from reality, as 40% thought that the character on the right was from reality and 60% thought that the character on the left was from reality, can also be thought to be because there were many test subjects who believed that they made eye contact with both characters.

Excluding the 1 test subject who believed they did not make eye contact at a distance of 1.5m, 79% of test subjects thought that the character that they made eye contact with was from reality. Also, excluding the test subjects who believed that they did not make eye contact at a distance of 1.0m, 78% of 1.5m test subjects thought that the character that they made eye contact with was from reality. Therefore, feeling that eye contact is made can be thought to be a factor that provides a sense of reality.

For the trials related to personal space, the ratios of test subjects who believed that the character who enters and exits personal space was from reality for each distance were 55% for

0.5m, 60% for 1.0m, and 50% for 1.5m when the character did not wave a hand, and 75% for 0.5m, 60% for 1.0m, and 60% for 1.5m when the character waved a hand. Also, the average 5-step rating of how unpleasant it was when the character approached, with 1 being most unpleasant and 5 being least unpleasant, for each distance were 3.80 (S.D.: 0.98) for 0.5m, 4.00 (S.D.: 0.89) for 1.0m, and 4.15 (S.D.: 0.91) for 1.3m when the character did not wave a hand, and 4.10 (S.D.: 0.83) for 0.5m, 4.25 (S.D.: 0.77) for 1.0m, and 4.10 (S.D.: 0.83) for 1.5m when the character waved a hand.

The ratios of test subjects who believed that the character who entered and exited personal space were from reality are listed in table 1, and the results of a t-test for each distance are listed in table 2.

Table 1. Ratio of test subjects who thought the character was from reality in personal space experiment

	0.5m	1.0m	1.5m
Did not wave a hand	55%	60%	50%
Waved a hand	75%	60%	60%

Table 2. T-test results for each trial for personal space

$p < 0.05$	0.5-1.0m	0.5-1.5m	1.0-1.5m
Did not wave a hand (p value)	0.104	0.015	0.186
Waved a hand (p value)	0.083	1.000	0.083
Yellow: Significant difference White: No significant difference			

In both trials for characters who did and did not wave a hand, for the farthest distance of 1.5m, the distance between the test subject and the character who moves side to side and the character who enters and exits personal space (1.5m – 2.0m) was hardly different and can be thought as the reason why the ratio of test subjects who believed that the approaching

character was from reality is the lowest value. Also, out of the 6 trials, a relatively high ratio was the 75% for the conditions of waved a hand and a distance of 0.5m. It can be thought that within the ranges set up in this experiment, the entry and exit of personal space at the closest distance provides a sense of reality.

For the 3 trials where the character did not wave a hand, the highest ratio was 60%, so it can be thought that simply entering and exiting personal space is not enough to provide a sense of reality. Also, the highest ratio of test subjects who believed that the character who waved a hand was from reality is 75%, which is a higher result than for the character who did not wave a hand. This can be thought to be because the action of waving a hand in addition to entering and exiting personal space provided a sense of familiarity to the test subject.

In the 3 trials where the character did not wave a hand, the distance of 0.5m was felt to be most unpleasant, and there was a significant difference between the closest distance of 0.5m and the farthest distance of 1.5m. The reason for this can be thought to be that the virtual character repeatedly approaching without any expression provides a sense of fear and tension, resulting in an increased sense of unpleasantness when the character came within 0.5m. Also, in the 3 trials where the character waved a hand, there was no significant difference between the distances. The reason for this can be thought that the sense of unpleasantness was reduced because familiarity was created by waving a hand.

Based on the above, it can be thought within this experiment's conditions that in addition to entering and exiting personal space by approaching within 0.5m of the test subject, interacting with the test subjects by waving a hand or other actions provides a sense of reality.

The conditions that provided a sense of reality are making eye contact and entering and exiting personal space while waving a hand, which are both actions of communicating, so it can be thought that communication plays an important role as a factor that provides a sense of reality. Also, due to the fact that even within the condition of entering and exiting personal space, the condition of waving a hand, which is a form of communication, had a higher ratio of being thought to be from reality than the condition of not waving a hand, even for factors that cannot provide a sense of reality, it can be thought that adding a form of communication can provide a sense of reality.

5. Conclusion and Future Tasks

In this research, investigations were conducted with the objective of discovering factors that make the virtual in SR made believed to be reality and evaluating whether the factors can be used practically.

Through the verification experiments regarding whether characters who closed the

psychological and social distance through concerted actions would be considered to be from reality, it became clear that closing the psychological and social distance through concerted actions has a low likelihood of providing a sense of reality.

Through the verification experiments regarding whether characters who make eye contact and characters who enter and exit personal space would be considered to be from reality, it was found that sensing eye contact has a possibility of providing a sense of reality. Also, for the entrance and exit of personal space, it was found that approaching within 0.5m while waving a hand also has a possibility of providing a sense of reality.

Concerted actions and entering and exiting personal space are not enough to provide a sense of reality, but making eye contact and simultaneously waving a hand while entering and exiting personal space were effective. Therefore, it was found that adding actions of communication can provide a sense of reality.

As the brightness had an impact on the experiments with concerted actions, there were various effects other than the factors contained in this research, such as the impact of the picture quality and sound of the experiment footage due to the environment of the experiment room and the impact of the familiarity between the character in the footage and the test subject for the personal space experiment. There is a necessity to perform the experiments after thoroughly eliminating the impact of other factors and experiments that verify which factors have an impact. In these experiments, verification was only performed for human characters, but there is a necessity to formulate new experiment methods to verify whether the findings are applicable for non-human characters and concepts that do not exist in reality (such as cartoon characters).

Reference Documents

Wakisaka, S. (2013). Substitutional reality system as an experimental platform of internal measurement. *The 27th Annual Conference of the Japanese Society for Artificial Intelligence*.

Wakisaka, S., & Fujii, N. (2012). Sense of reality and presence in substitutional reality systems. *The Institute of Image Information and Television Engineers Technical Report*, 36(44), 19-23.

Takahashi, K., & Watanabe, K. (2008). Interpersonal synchrollization in unconscious hand movement. *IEICE Technical Repot, HIP, Human Information Processing*, 108(282), 111-116.

Watanabe, K., & Takahashi, K. (2013). Cognitive Science and Emergence of Presence. *The journal of the Institute of Image Information and Television Engineers* 67(4), 289-292.

DEVELOPMENT AND APPLICATION OF ONLINE TOOLS FOR KANSEI ENGINEERING EVALUATIONS

Simon SCHÜTTE^a, Lluís Marco ALMAGRO*^b*

^a *Linköping University, Sweden, (simon.schutte@liu.se)*

^b *Universitat Politècnica de Catalunya, Spain, (Luis.marco@upc.edu)*

ABSTRACT

Kansei Engineering is a methodology seeking to grasp customers' feelings and subjective affective opinion of products as well as turning their affective needs into suitable product concepts. The procedure is rather complex and requires a fair amount of interdisciplinary expertise and experience in order to achieve reliable results. The high threshold to learn those techniques is preventing many practitioners from applying it. There are, however, software packages that have supported product designers to perform Kansei Engineering evaluations without being experts in the field of statistical mathematics. This paper will give a short overview on Kansei procedure, and the methods attached to it, and shows present and future areas of application for computerized tools in Kansei Engineering.

1. BACKGROUND AND INTRODUCTION

Kansei Engineering is a methodology seeking to grasp customers' feelings and subjective affective opinion on products as well as turning their affective needs into suitable product concepts. In comparison to other R&D tools, the methodology does not spread as fast as the success story would lead one to assume. One of the reasons might be that the procedure is rather complex and requires a fair amount of interdisciplinary expertise and experience in order to achieve reliable results. This means that the high threshold to learn affective engineering technique is preventing many practitioners from applying it. A solution was the development of software tools which automatized whole or parts of the Kansei Engineering processes. Most of those tools were Japanese, but some were developed in Europe. Among others, Linköping University developed a general software package that supported product designers to perform Kansei Engineering evaluations without being experts in the field of statistical mathematics.

2. PURPOSE OF THIS PAPER

This paper will give a short overview on Kansei procedure and methods attached to it. It also shows the validity of these tools and present experiences and future areas of development and applications for computerized tools in Kansei Engineering

3. KANSEI ENGINEERING METHODOLOGY – A PROPOSED MODEL

In 2004 Schütte, Eklund, Axelsson, and Nagamachi proposed a model on Kansei Engineering methodology. It is an aggregation of many Kansei Engineering studies and provides a structured procedure. Figure 1 depicts this proposed model.

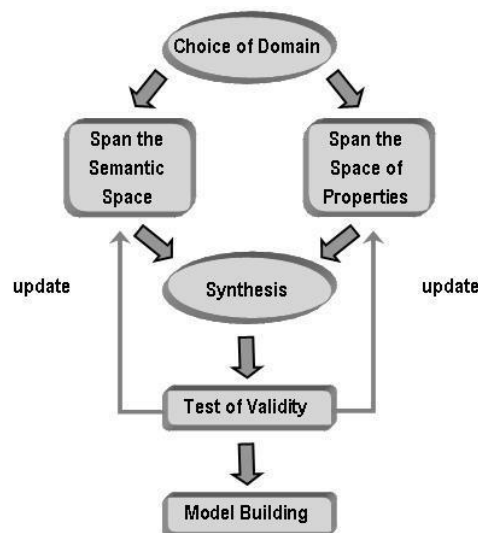


Figure 1: Kansei Engineering general procedure

As a first step, a domain is chosen. The domain definition requires customer insight information such as demographic data of the targeted user group as well as a summary of typical customer behaviour and affective customer needs. Outgoing from this, products are chosen serving this customer groups. As an inspiration, methods such as affective cards or mood boards can be used (Lee, Harada, & Stappers, 2002).

In a following step this domain, including its typical customers and products, is described from two different angles: The Semantic Space (Osgood, Suci, & Tannenbaum, 1957) and the Space of Properties (Schütte, 2005).

The Semantic Space is based on the Semantic Differential Theory of Osgood, Suci, & Tannenbaum from 1957. It is a methodology where by using Principle Component Analysis (PCA), an array of emotions are derived. This can be described as a vector representing the emotional response of

users toward a given domain. These vectors span the Semantic Space and are called Kansei Words (M Nagamachi, 2000).

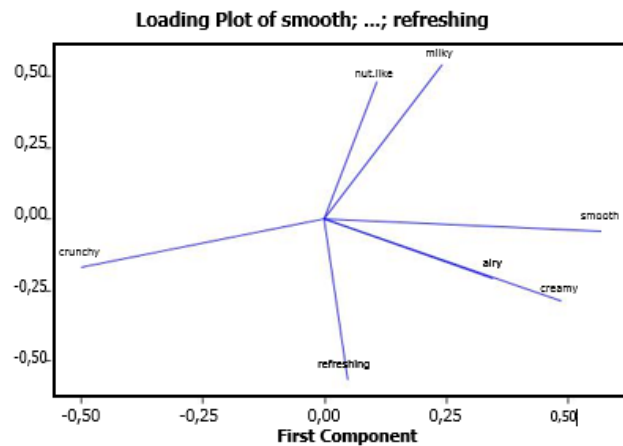


Figure 2: Example of the Semantic Space for chocolate toffee fillings (Schütte & Marco-Almagro, 2013).

The Space of Properties identifies affective physical attributes of the products in question. For this it is possible to use methods such as Card Systems or Affinity Analysis (Bergman & Klefsjö, 2002). The input to this step is a collection of products identified belonging to the earlier mentioned domain.

The output is typically a short list of product attributes that strongly affect the subjective (affective) experience of the users.

Table 1: Example of the outcome from the "Space of Application" step (Schütte & Marco-Almagro, 2013).

Sample No.	Caffeine	Flavour	Yoghurt	Spice
1	Yes	Salt	No	Chilli
2	Yes	Salt	No	None
3	No	Salt	Yes	Chilli
4	No	Salt	Yes	None
5	No	Nut	No	Chilli
6	No	Nut	No	None
7	No	Nut	Yes	Chilli
8	No	Nut	Yes	None
9	Yes	Fruit	No	Chilli
10	Yes	Fruit	No	None
11	No	Fruit	Yes	Chilli
12	No	Fruit	Yes	None

As shown in Table 1 the physical properties of the product in question are broken down into several categories. Table 1 is arranged into a so called dummy coding table. It represents 12 samples that are necessary for the following synthesis step. These 12 samples represent possible combinations of properties to be tested.

The synthesis step connects the Kansei Words (Vectors from the Semantic Space) (compare Figure 2) to the product samples representing the physical attributes of the product (from the Space of Properties). Here several methods can be used: Mathematical and non-mathematical methods. Most common methods are Linear Regression Analysis and variants of it, such as Quantification Theory Type 1 (QT1) or Ordinal Linear Regression Analysis (OLR) or even mixed effects OLR (Marco-Almagro, 2011). Other methods which are used are Rough Sets Theory (RSA) or Fuzzy logics (Nishino, Nagamachi, & Ishihara, 2001).

They all have in common that they establish a connection between the two Spaces and thereby provide a possibility for product designers to get information of how certain intended affective aspects can be represented in a product. Also, it becomes possible to choose product properties in a way that an intended feeling is supported (compare Figure 3).

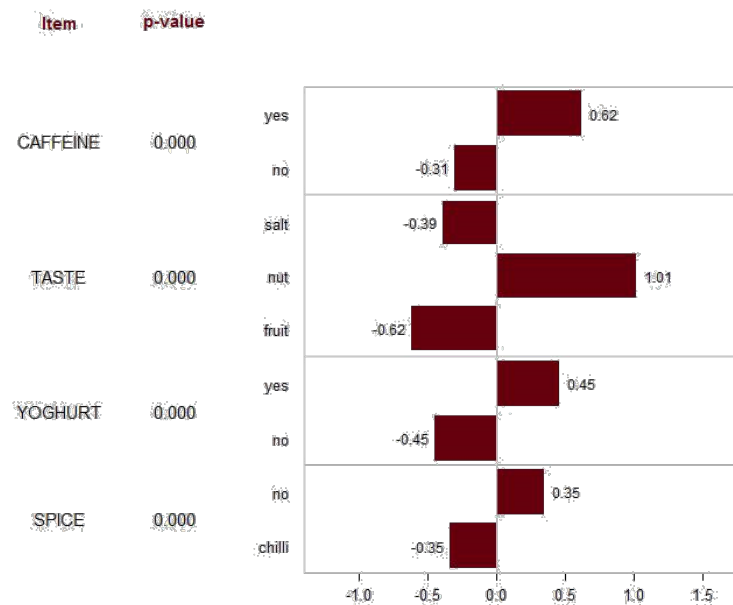


Figure 3: Example of the linking between the Semantic Space and the Space of Properties for chocolate toffee fillings for the Kansei Word "want it" (Schütte & Marco-Almagro, 2013).

Finally, a model is created, mathematical or qualitative, describing the relationship between affective aspects of customer preferences and physical properties.

This procedure is used in many Kansei Engineering studies in different variants and encourages product designers to integrate own tools and process parts from their own companies. Products which have been developed using Kansei Engineering span from cars to electronics to garments (Mitsuo Nagamachi, 1997).



Figure 4: Samples of European Products developed using Kansei Engineering method.

In Europe, it has been used since the millennium shift in vehicle industry, food industry, construction, and furniture industry (see Figure 4). Hence, Kansei Engineering methodology is presented as a rather powerful complement in product development.

4. DEVELOPMENT OF AN ONLINE TOOL

Unlike other powerful methods such as Quality Function Deployment (QFD), Kansei Engineering never spreads as fast. As mentioned earlier, one reason for that might be that it requires a fair amount of mathematic statistical expertise. Product designers are rarely trained in those methods. Hence, Japanese researchers developed specialized systems supporting design of e.g. kitchen (Matsubara & Nagamachi, 1996, Imamura, Nomura, Tamura, & Goto, 1997). Other systems focused on integration of VR and 3D visualization (Ishihara, Ishihara, & Nagamachi, 1998, Marui, 1997) but none of those systems addressed a general purpose for Kansei Engineering studies. In the beginning of 2000 a European project was launched building an academic/industrial network and was collecting and assembling tools for affective user need assessment (ENGAGE, 2005). Within that network an attempt to a more generalized software called KENSYS was also presented. The development of this tool was however discontinued.

Schütte realized after returning from a guest researcher period in Japan in 2002 that the Japanese methods could not easily be translated and applied in European industrial contexts. This led to the development of the first version of a computerized software (Schütte, Alikalfa, Schütte, & Eklund, 2006). This software could process the synthesis step, i.e. linking together emotional terms with physical product properties using the previously mentioned QT1 method. In the 15 years since then the software is today in its 5 generation and an online tool which is available for free on www.kanseiengineering.net.

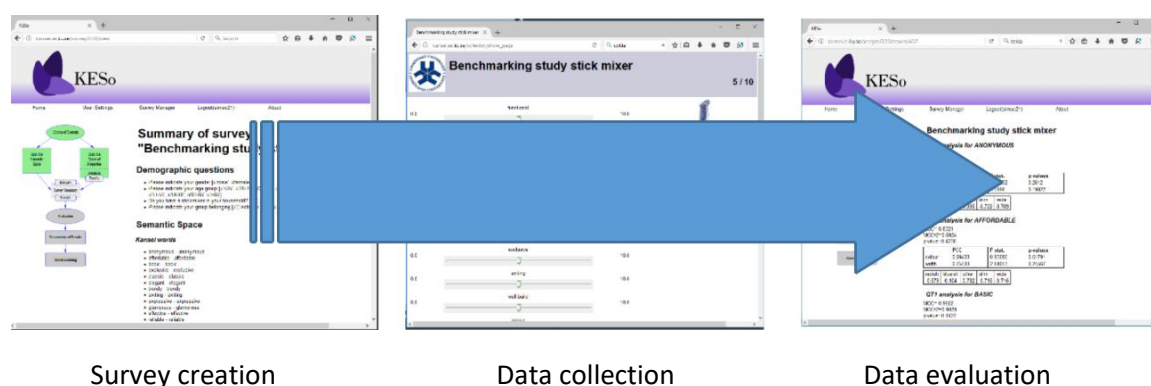


Figure 5: Typical KESo procedure. Source: www.kanseiengineering.net

KESo software is a universal tool for Kansei Engineering studies. It is built around the general Kansei Engineering model from 2004 (Figure 1) and follows its structure. After defining the domain, both

Semantic and Physical Space an online survey is created as illustrated in Figure 5 left. The created survey (middle) is then put online, and answered by suitable users. This can be done by simply posting an online questionnaire to the participants including images, videos, or sound files of the product in question. If other properties are supposed to be evaluated, the questionnaire can be carried out in a lab environment on mobile devices. If necessary, the data can even be collected manually on paper and input in the system later. When the data collection is finished (or even while collection data) the data can be analysed in the synthesis step using a different statistical tool. Today KESo can evaluate data using QT1, OLR, and RSA (compare section 3).

5. EXPERIENCES WITH ONLINE TOOLS

The evaluation of online tools in Kansei Engineering is almost solely based on the authors' experiences with KESo software and its derivatives. Hence, the authors are aware that the picture they are drawing in this paper can be somewhat biased. On the other hand, the authors tried to draw their conclusion on a meta-level without too much focus on the special functionality

Companies usually embrace tools for affective evaluation of their products. There are very few documented and tested methods and tools on the market. That does by no means mean that there is no need for such methods. Rather companies working in tough markets see their work and knowledge on affective aspects as their competitive edge. Therefore, most of them are uneager to share that knowledge. Computerized tools have always been a welcome addition to their development arsenal, either for application in their actual R&D activities or just for verification of their own work.

A great advantage of tools such as KESo (as many other tools aiming for usage in R&D) is that it can seamlessly be integrated into companies product development processes. This makes it easier for product designers to relate to the tool and reduces the mental threshold to actually applying it to real world problems. Also, as mentioned earlier, online tools are simple and intuitive to use. This reduces the necessity of gathering additional knowledge of areas not directly related to product development activities – in the case of KESo: mathematical statistical familiarity.

As reality looks like today, many bigger companies within B2C branches consider right affective appearance of their products as mandatory. Vehicle industry, furniture producers, and service providers have specialized staff for this purpose. SME:s however, do certainly see the advantage of having products affectively streamlined, but they often do not have the financial means and expertise to do so. Here a more generalized tool like KESo can make a difference for R&D process in SME:s.

From a scientific point of view the online tools have promoted the area of affective product development research. Cooperation between companies and academia in the area of Kansei Engineering could prove its strength as a methodology and the tools showed their function in real life environments. Many products (compare Figure 4) in the world demonstrate this.

However, there are also risks involved when using tools like those presented in this paper. As previously mentioned as an advantage, tools like KESo are developed to be simple and intuitive to use. The risk however, is that such tool used by unexperienced designers, can return false data (e.g. as a result of bad input data quality). Due to the lack of experience, the designer might take wrong

outputs as real and draw wrong conclusions. Also, results are statistical in nature. In other words: The data is true for only a part of the customer group. Engineers, however, sometimes tend to over-interpret the results taking them as absolute truth. In fact, the outcome from Kansei Engineering studies should be handled as a support for further product development. These tools do not automatize a designer's decision-making.

6. FUTURE DEVELOPMENTS

Despite the success affective evaluation software had in the past, there is still a lot of improvement potential. One is closely related to the previously mentioned ease of use. Of course, affective evaluation software needs to be intuitive and must require little expert knowledge on the statistical methods behind it. On the other hand, it must be ensured that everybody can determine the quality of the resulting data. One way could be an improved dashboard or colour coding of results that are statistically less reliable.

Since Kansei Engineering is expanding fast, new tools for the different steps in Figure 1 are developed. Testing them manually would be cumbersome. Therefore, the software should be designed to include new experimental tools easily. That would decrease development time and validation of new tools. Moreover, the software would become more universal.

Another aspect which would make affective evaluation software more universal would be to enhance the ability to integrate it with existing R&D systems such as SAP. Being able to display data in other system would further lower the threshold for usage of those systems.

REFERENCES

- Bergman, B., & Klefsjö, B. (2002). *Kvalitet i alla led*. Lund: Studentlitteratur.
- ENGAGE. (2005). *European project on engineering emotional design report of the state of the art-round 1*. Valencia.
- Imamura, K., Nomura, J., Tamura, H., & Goto, M. (1997). An application of virtual Kansei engineering to kitchen design. In M. Nagamachi (Ed.), *Kansei Engineering 1*, pp. 63–68. Kure: Kaibundo Publishing Co., Ltd.
- Ishihara, S., Ishihara, K., & Nagamachi, M. (1998). Kansei interface system and internet VR. In W. Karwowski & R. Gonnetilleke (Eds.), *Manufacturing Agility and Hybrid Automation – II, 1*, pp. 403–406. Hong Kong: IEA Press.

Lee, S., Harada, A., & Stappers, P. J. (2002). Pleasure with products: Design based Kansei. In W. Green & P. Jordan (Eds.), *Pleasure with products: Beyond usability*, pp. 219–229. London: Taylor & Francis.

Marco-Almagro, L. (2011). *Statistical methods in Kansei engineering studies*. UPC Barcelona Tech.

Marui, T. (1997). The development of an edutainment software based on spherical VR images. In M. Nagamachi (Ed.), *Kansei Engineering 1*, pp. 77–85. Kure: Kaibundo Publishing co., LTD.

Matsubara, Y., & Nagamachi, M. (1996). Kansei virtual reality technology and evaluation on kitchen design. In R. J. Koubek & W. Karwowski (Eds.), *Manufacturing Agility and Hybrid Automation – 1*, pp. 81–84. Louisville, Kentucky, USA: IEA Press.

Nagamachi, M. (1997). Kansei engineering: The framework and methods. In M. Nagamachi (Ed.), *Kansei Engineering 1*. Kure: Kaibundo Publishing Co., Ltd.

Nagamachi, M. (2000). *Discussion with Prof. Nagamachi about Kansei Engineering and practical applications of the methodology*. Linköping.

Nishino, T., Nagamachi, M., & Ishihara, S. (2001). Rough set analysis on Kansei evaluation of colour. In M. G. Helander, H. M. Khalid, & M. P. Tham (Eds.), *The International Conference on Affective Human Factors Design*. Singapore: Asean Academic Press.

Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning*. (C. E. Osgood & J. G. Snider, Eds.), *Semantic Differential Technique - a Source Book*. Illinois: University of Illinois Press.

Schütte, S. (2005). *Engineering emotional values in product design- Kansei Engineering in development*. Institution of Technology. Linköping University, Linköping.

Schütte, S., Alikalfa, E., Schütte, R., & Eklund, J. (2006). Developing software tools for Kansei engineering processes: Kansei Engineering Software (KESo) and a Design Support System Based on Genetic Algorithm. In *QMOD 2006*. Liverpool.

Schütte, S., Eklund, J., Axelsson, J. R. C., & Nagamachi, M. (2004). Concepts, methods and tools in Kansei Engineering. *Theoretical Issues in Ergonomics Science*, 5, 214–232.

Schütte, S., & Marco-Almagro, L. (2013). *Development of an Affective Sensorial Analysis Method for Food Industry*.

GAZE-VOTING INTERFACE FOR INTERACTIVE EVOLUTIONARY COMPUTATION CONSIDERING THE KANSEI EVALUATION OF MULTIPLE PEOPLE

Hiroki ISODA^a, Hiroshi TAKENOUCHI^b and Masataka TOKUMARU^{*c}

^a Graduate School of Kansai University, Japan, k977084@kansai-u.ac.jp

^b Fukuoka Institute of Technology, Japan, h-takenouchi@fit.ac.jp

^c Kansai University, Japan, toku@kansai-i.ac.jp

ABSTRACT

The aim is to develop an Interactive Evolutionary Computation (IEC) system that can automatically generate designs or media content based on the preferences of multiple users by capturing their gaze movements and by using this as a solution to evaluation. In the beginning, experiments conducted have revealed that stimulated images to subjects managed to catch the movements of their gaze. Consequently, it is found that the images with the longest look and the greatest preference by the subjects occurred at a rate of approximately 63%. This suggests that the subjects choose their favourite images. Furthermore, the IEC's algorithmic performance is simulated based on the results from the experiment. Consequently, it is verified that solutions using the IEC algorithm have partly evolved with a voting accuracy of 63%. From these observations, it is expected that the IEC system is built to catch the movements of the users' gaze and the evolution in solutions are preferred by multiple users by making users more conscious in advance.

Keywords: multiple user preferences, interactive evolutionary computation, gaze movements

1. INTRODUCTION

1.1. IEC Overview

The IEC method is able to assist in creating designs or media content that is based on the user preferences through the interaction between a user and a computer [2]. Several studies have examined the improvement in various application systems or interfaces [3-6]. The genetic algorithm (GAs) or Tabu Search is used as the basic technology of the IEC. Therefore, by replacing the fitness function with a user's evaluation in an IEC algorithm, the IEC can be used to

* Corresponding author.

reflect the intuitive preferences of the user to optimise the design or content. Systems using the IEC have been studied to create, for instance a pose generation system preferred by users [3] or an interior design support system [4]. The IEC system reflected the Kansei of multiple users have been studied. These include the IEC systems for fashion coordination preferred by multiple people [5] or a system that generates solutions to form a consensus among all the participants of a conference [6].

Sakai et al. developed an IEC system for multiple people by using an algorithm that accepts multiple user evaluations [5]. The system is able to obtain sufficient number of evaluations through an interface using voting buttons and digital signage to generate fashion coordination that satisfies the preferences of multiple users. It is possible to generate better solutions based on users' preferences in these multiplayer IEC systems by using evolutionary calculation.

1.2. The Interface of IEC in Consideration of the Kansei Evaluation of Multiple People and its Limitations

In an IEC system that considers the Kansei evaluation of multiple people, it is crucial to create an interface of such that each user is able to vote easily. In a conventional IEC system, for instance, users select solution candidates by pressing buttons [5]. Users need to operate the system one at a time when they vote. This method may act as an obstacle for obtaining a large number of votes in a short period of time.

Therefore, instead of utilising the conventional voting method, we consider using a user's gaze information directly as a solution for evaluation. For instance, if a user's preference can be estimated from a casual gaze movement of the user who passed in front of the system, the IEC interface can be expected to collect votes easily. In order to use the gaze information as a voting interface, it is necessary to investigate the features of the gaze movement. In addition to that, the preferences estimated from the gaze information are considered to partially contain an error compared to the conventional solution evaluation methods, which actively selects the solution candidates. Therefore, it is necessary to verify the extent of evolutionary performance that is maintained as IEC algorithm with solution evaluation including errors.

2. PREVIOUS STUDIES AND THEIR LIMITATIONS

Several previous studies have dealt with the relationship between the gaze movements and the user preferences. Shimojo et al. [7] showed a pair of facial images to subjects. The subjects were instructed to decide which image is more attractive. Simultaneously, the subject's gaze movements were analysed. Consequently, a subject's gaze was initially distributed evenly between the two stimuli, which gradually shifted towards the face that the subject eventually chose.

Several studies have reported that human gaze movements have been affected by preferences or by a stimulation that was generated by images. However, in previous studies, subjects recognised that their gazes were being analysed as part of the experiment. In this study, the aim is to estimate user's preference from a user's casual, unconscious gaze

movements so that a simple IEC interface is created. Therefore, experiments that conceal the fact that gaze information is conducted and analysed, allowing the subjects to act naturally during the experiment. In addition to that, the gaze movements after the subjects have chosen their preferred images are re-analysed.

3. EXPERIMENT ON THE RELATIONSHIP BETWEEN THE GAZE MOVEMENTS AND THE USER PREFERENCES

3.1. Outline of the Experiment

A number of stimulus images are prepared and showed to the subjects. The subjects chose the images based on their preference. At the same time, the gaze movements of the subjects before and after they chose the images were analysed. After the subjects chose their preferred images, the subjects were asked to reveal which images that has been chosen.

The method of digital signage to present the stimulus images was adopted. This methodology has a feature that contents can be displayed to a large group. The “HVC-P” that was developed by the OMRON Corporation was adopted as a tool to analyse the gaze movements. The HVC-P is an image-sensing component equipped with a camera that integrates 10 types of image analysis functions, including facial detection and gaze estimation [9]. The photograph of the experimental environment is shown in Fig. 1.

In this experiment, two digital signage were set up side by side in the same direction, and the HVC-P was positioned at the centre of these digital signage for it to be hidden from the subjects. Then, the stimulus images in the digital signage were displayed. These images were presented to the subjects at approximately 1.5 m from the digital signage. The gaze movements of the subjects using HVC-P were analysed and recorded. Considering the analytical accuracy of HVC-P, two distinct modes of stimulus image presentation were employed. As shown in Fig. 2,

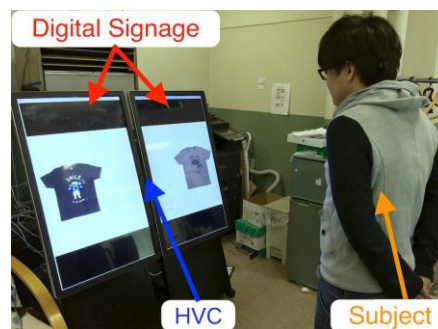


Figure 1: A photograph of the experimental setup (a two-stimulus image presentation)

the first is a two-stimulus image presentation, which displays one stimulus image on each digital signage. The second is a four-stimulus image presentation, which displays two stimulus images on each digital signage.

In addition, the subjects were encouraged to not only vaguely look at the stimulus images but were also asked to possess a kind of intention, designated by the experimenter. In general cognitive psychology, it is believed that human gaze movements are affected by their consciousness (i.e., psychological state). Therefore, it is believed that the psychological condition of a subject influences his or her gazing time for the stimulus. Accordingly, in this experiment, subjects are encouraged to have two types of consciousness and present stimulus images: 1) neutral consciousness (thinking nothing) and 2) thinking about what I prefer and choose.

Several T-shirt images are used as the stimulus images. A T-shirt is suitable for this experiment because it is an object for which a subject can decide his or her preference in a short period of time. The T-shirt image that was chosen is the "Design T-shirts Store graniph" [10]. The stimulus images used in this experiment are shown in Fig. 2.

3.2. Experimental Method

First, it is encouraged that the subjects to be in the "neutral consciousness" state and started analysing the gaze movements using the HVC-P. The experiment was performed in the following manner:

1. Presentation of stimulus images: Several sets of T-shirt images at regular intervals were consecutively presented.

In the case of the two-stimulus image presentation, 15 pairs of stimulus images were displayed for every 5 seconds. In the case of the four-stimulus image presentation, 10 sets of stimulus images were displayed every 8 seconds. At this time, all subjects just looked at the stimulus images and made no selections.

Next, the subjects were asked to choose an image from all stimulus images.



Figure 2: Presentation formats of stimulus images

2. Re-presentation of stimulus images: All sets of stimulus images that were presented in step (1) were re-presented. The order of presentation was shuffled.
3. Determining which images the subjects chose: The subjects chose their preferred image out of all the presented images.

There is no time limit set for subjects, and all subjects told us verbally when they chose their preferences. The chosen images and the response times for all of the subjects. After the subjects made their choices, the same stimulus images were presented continuously for 10 seconds. Steps (2) and (3) were repeated for all stimulus images.

3.3. Experimental Results

The focus is the duration of the gazing time for the stimulus images and on the comparison of the images that had longer gazing times with the images that were chosen by the subjects.

A total of 39 men and women aged 20-22 years have participated in the study. The two-stimulus image presentation was presented to 20 subjects, and the four-stimulus image presentation was presented to 19 subjects. The average time for all subjects from the time of presentation of images to the time of choice made by the subjects was 2.40 seconds for the two-stimulus image presentation and 4.18 seconds for the four-stimulus image presentation.

The experimental results for the two-stimulus image presentation are shown in Figs. 3-5. Each graph shows the number of accorded cases and non-accorded cases consisting of images that was gazed the longest and the images preferred by subjects. Each subject was shown 15 stimulus images, so the total number of cases were 15. Fig. 3 shows the results for the subjects with neutral consciousness, whereas Figs. 4 and 5 show the results for the subjects that were thinking about the preferences (Fig. 4 shows the results for the subjects before making a choice, whereas Fig. 5 shows the results for the subjects after making a choice). The subject's preferences were notable in accordance with the gazing time shown in Fig. 4. The average of the accorded rate (accorded cases per all cases) was 63.5%, indicating that the accuracy of estimating the preference from the gazing time is approximately 63%. On the other hand, even in the case of the four-stimulus image presentation, subjects tend to gaze at their preferred images for a long time; however, the average of the accorded percentages was only approximately 36%.

While there are large subject-to-subject variations in the ratio of the accorded cases to non-accorded cases for subjects with neutral consciousness (Fig. 3), there was no significant difference between the accorded side and the non-accorded side at the 1% level according to the Wilcoxon rank sum test ($p = 0.61$). This is in a sharp contrast to the differences apparent in Fig. 4 ($p = 0.0000023$) and Fig. 5 ($p = 0.000065$), where the number of accorded cases significantly exceeded the number of non-accorded cases recorded either before or after the choices had been made.

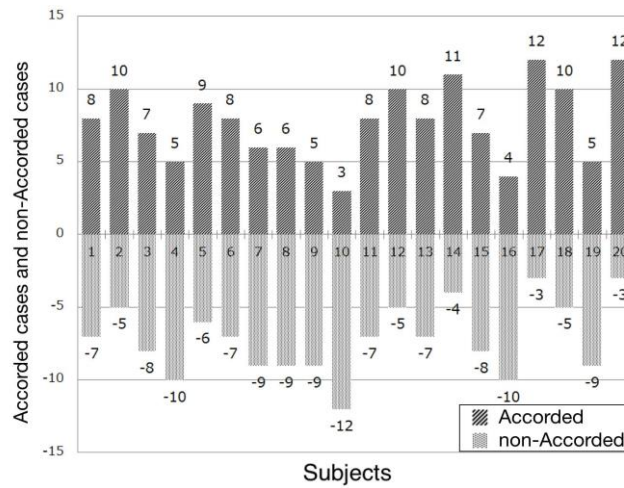


Figure 3: Results for the subjects with neutral consciousness

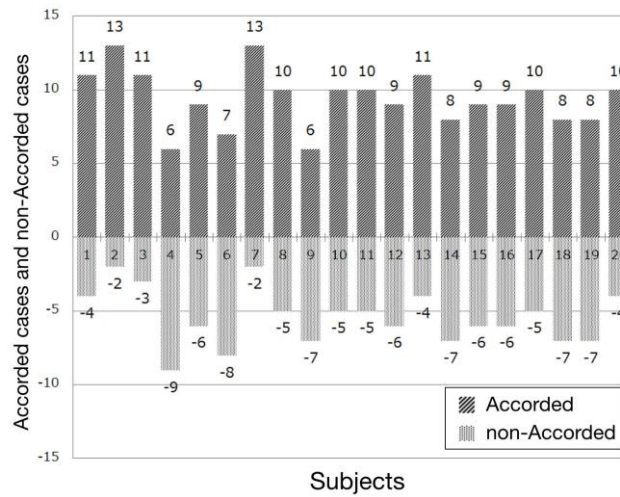


Figure 4: Results for the subjects before making a choice

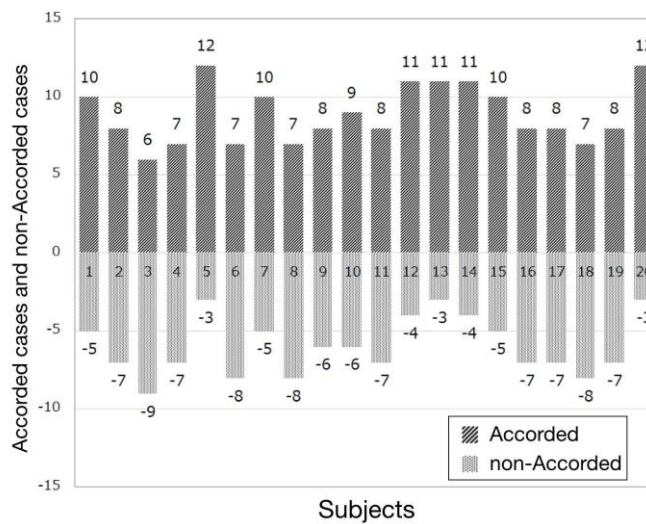


Figure 5: Results for the subjects after making a choice

3.4. Consideration

The results showed that the subjects in the neutral consciousness state do not express their preferences through gazing time. Thus, it is difficult to estimate the user preferences by using the gazing duration time from this state. However, if the subjects are encouraged to focus on the second type of consciousness, i.e., "thinking about what I prefer and choose," they tend to closely gaze at the image they like for a longer period of time in the two-stimulus image presentation. In contrast, in the four-stimulus image presentation, it is observed that there is a tendency among the subjects to gaze at their second most favourite image or at a disliked image throughout the experiment.

4. SIMULATION OF THE EVOLUTION PERFORMANCE

4.1. Simulation Method

In this simulation, the Paired Comparison Voting (PCV) method was adopted, which is an IEC algorithm that reflects the preferences of multiple people [5]. The PCV method provides only a two solution candidate to the user. Therefore, the estimated preferences from the users' gaze information can be used as a solution evaluation in the PCV method. The PCV method determines a superior solution out of two-candidates from the votes of multiple users, and it generates new solutions through the evolution calculation for each competition. Fig. 6 shows an outline of the PCV system using the example of T-shirt design. Each user chooses his or her favourite image from two solution candidates. When a plurality of users participates in voting and a certain number of votes gather, the PCV operations create a uniform crossover of the GA to two solution candidates. The PCV method creates masks according to the voting ratio for each solution candidate, generates two new solutions, and accepts the votes of the users again.

In this simulation, the evaluation agents comprising bit strings were used instead of real users. Each evaluation agent has its own favourite bit strings of solutions. They compared their own bit strings with the presented bit strings and evaluated the solution candidates. From the 1,000 generated evaluation agents, some evaluation agents that were selected randomly participated and voted for a paired comparison. Each individual solution has 30 bits of gene length. In total, 16 solution candidates were generated for each generation and child individuals were generated by using uniform crossover according to the voting ratio.

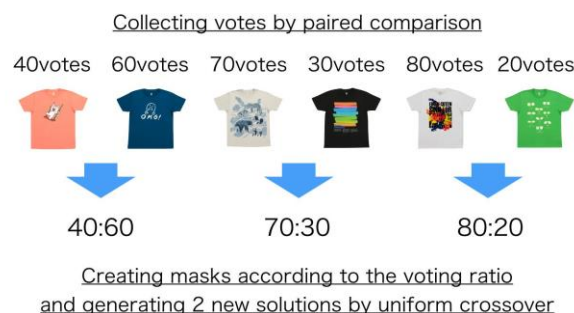


Figure 6: Outline of the paired comparison voting (PCV) method

The generation parameter was set to 1,000 to ensure that there were adequate generations to evolve sufficiently. After the pre-simulation operation, the mutation is set and rated to 1% in order to optimise the performance of the PCV method. The bits were randomly selected in the mutation rate process based on the mutation rate from all solution bits and inverted. In order to eliminate the probabilistic influence, the simulation was repeated for 100 times.

In this simulation, the evaluation agents are comprised of parameters such as the probability of voting incorrectly. Based on our experimental results, the average of the accorded rate was approximately 63%; however, there were variations from subject to subject. Fig. 7 shows the distribution of subjects in every accorded rate. From this data, the standard deviation was calculated to be 12.4357. Thus, it is assumed that the distribution of these subjects revealed a normal distribution with an average of 63.4745 and a standard deviation of 12.4357. In this simulation, all the evaluation agents comprised a value of voting accuracy that was consistent with this probability distribution.

Furthermore, every evaluation agent has a preference trend that is associated closely with collectiveness. In general, the preferences for design varies between users. However, it is unlikely that a user would have a preference that is different from those of all other users. First, an evaluation agent with random bits as a centre of preference is created. Then, a group of evaluation agents by inverting the bits of the centre of the preferred evaluation agent in the range of 6 bits or less is created.

4.2. Result and Discussion of Simulation

Fig. 8 shows the transition of the average evaluation value for each generation. It shows up to 200 generations, where the increase in the average evaluation value had stopped at any case. In this case, the average evaluation value is the average of the matching degree of each bit of all evaluation agents and the elite solution candidate in each generation.

The higher the average evaluation value becomes, the more the users prefer the solution candidate. In addition to the accorded rate obtained from the result of the experiment, several rates between 100% and 52% for comparison are set.

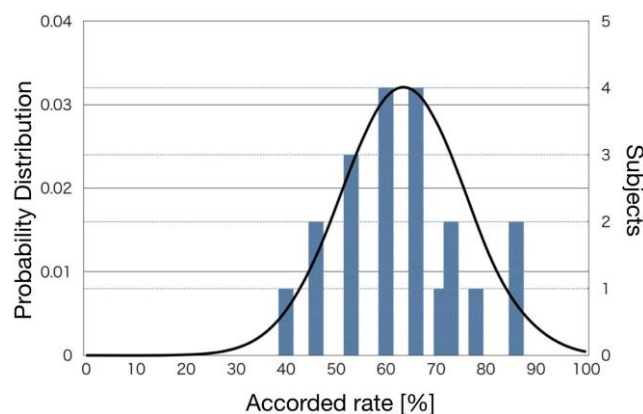


Figure 7: Distribution of subjects and probability distribution curve

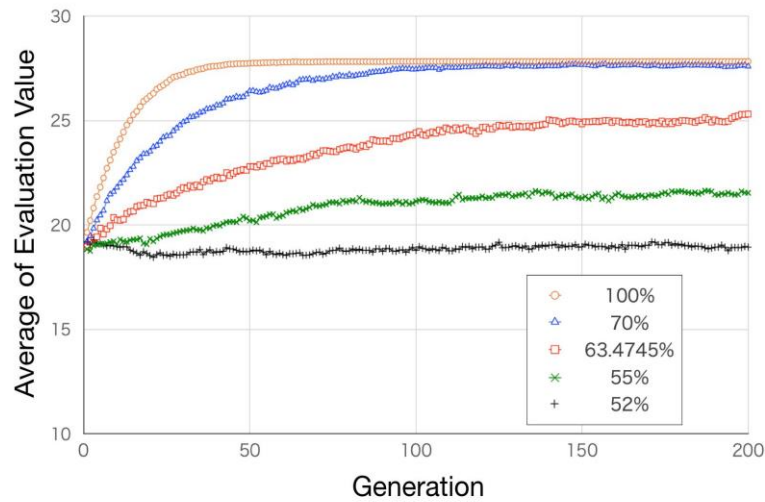


Figure 8: Transition of the average evaluation values

At a 100% accorded rate, the evaluation agents always vote for their favourite solution candidates. This reveals the performance of the original PCV method. When the accorded rate dropped to 70%, although the rise at the initial generation becomes slow, finally, the same performances as the rate of 100% were obtained. At an accorded rate of 63.4754%, the result of our experiment, the transition did not reach a performance that is similar to as that achieved at 100% accorded rate. However, the average evaluation value is increased to some extent. On the other hand, when the accorded rate dropped to 52%, the average evaluation value was nearly flat and the solution did not evolve in the desired direction.

5. CONCLUSION

The primary aim is to develop an IEC system that can automatically help in creating designs or media contents based on the user preferences by using their gaze information as a solution for evaluation. In achieving this, an experiment on the relationship between the gaze movements and the user preferences in order to verify the means to estimate the preference from the gaze information was conducted. Then, to verify the solution evolution performance of the IEC algorithm, an evolution simulation based on the experimental results was performed.

In this experiment, it is found that the images that received the longest gaze and the images preferred by the subjects were accorded at a rate of approximately 63%. As indicated in a previous study, gazing time of the subjects increased for their favourite images. The participants who did not recognized that their gazes were being analysed also had the same reaction.

In the evolution performance simulation, a simulation to verify the evolution performance of the solution using the PCV method was conducted which is an IEC algorithm that considers the Kansei evaluation of multiple users. The simulation results showed that a performance as good as that of the original algorithm could not be obtained. However, the solution evolved towards the preference of each evaluation agent when the generations progressed.

From the above results, considering the Kansei evaluation of multiple people, it is expected to develop a gaze-voting IEC system by asking the participants to be more conscious in advance. It is assumed that this system will be operated in facilities or on the street with many people. As a way to increase consciousness among the users who are walking on the streets, a list of instructions will be displayed beside the IEC system so that users unconsciously think about their preferences. Currently, an IEC system for real multiple users is planned to be developed.

ACKNOWLEDGMENT

This research was partially supported by a MEXT-supported Program for the Strategic Research Foundation at Private Universities, 2013–2017 from the Ministry of Education, Culture, Sports, Science, and Technology.

REFERENCES

Raorane, A., & Kulkarni, R. V. (2011). Data mining techniques: a source for consumer behavior analysis. *International Journal of Database Management Systems (IJDMS)*, 3(3), 45-56.

Takagi, H. (2001). Interactive evolutionary computation: fusion of the capabilities of EC optimization and human evaluation. *Proceedings of the IEEE*, 89(9), 1275-1296.

Emi, T., & Hagiwara, M. (2014). Pose generation system expressing feeling and statel. *International Journal of Affective Engineering*, 13(3), 175-184, 2014.

Huang, W., Matsushita, D., & Munemoto, J. (2006). Interactive evolutionary computation (IEC) method of interior work (IW) design for use by non- design- professional Chinese residents. *Journal of Asian Architecture and Building Engineering*, 5(1), 91-98.

Sakai M., Takenouchi, H., & Tokumaru, M. (2014). Design support system with votes from multiple people using digital signage. 2014 IEEE Symposium Series on Computational Intelligence (SSCI 2014), *ISIC2014 proceedings*, 26-31.

Sun, X., Yang, L., Gong, D., and Li, M. (2012). Interactive genetic algorithm assisted with collective intelligence from group decision making. 2012 *IEEE Congress on Evolutionary Computation (CEC)*, 1-8.

Shimojo, S., Simon, C., Shimojo, E., & Scheier, C. (2003). Gaze bias both reflects and influences preference. *Nature Neuroscience*, 6(12), pp.1317-1322.

OMRON Sensing egg project, <https://plus-sensing.omron.co.jp/egg-project/>

Design tshirts store graniph, <http://www.graniph.com>

A STUDY OF THE PERCEPTION OF CARICATURE CREATION

Wen-Ting Fang^{*ab}, Jiede, Wu^c and Rungtai, Lin^b

a Department of Art & Design, Changzhou Vocational Institute of Mechatronic Technology, Changzhou, Jiangsu, PR. C. f_wenting@163.com

b Graduate School of Creative Industry Design, National Taiwan University of Arts, New Taipei City, Taiwan, rtlin@mail.ntua.edu.tw

c Department of Animation, School of Journalism & Communication, Anhui Normal University, PR. C. 125082357@qq.com

ABSTRACT

Caricature art is the combination of line, color, skills, composition, rhythm, etc. which are created in an exaggerated way to form a unique code through its drawing skills. It is always carefully conceived by artists, and is presented based on visual senses. Imagination is the aesthetic complement to give the audience an impression. Therefore, the purpose of this research includes: to create a model to understand the process of artists' conception and inspiration; to analyze the audience's cognitive model for caricature artwork; to help artists reflect the creation and design artworks to meet the aesthetic needs of the audience. Disclosed herein is a method for creating a caricature and this research is based on caricature creation conceptual model with the method of interviewing experts, case study, and a series of practical operations. An excellent artwork needs to satisfy three levels to express its creative connotation, which are technical, semantic, and effectiveness levels. In terms of creation process, the process can be divided into four steps: set a scenario, tell a story, write a script, and create a comic. As the research results, this study verifies the rationality of caricature creation conceptual model through a case-study and provides a theoretical basis for the aesthetics of caricature creation.

Keywords: *Caricature Creation, Communication matrix, emotional design*

1. INTRODUCTION

Caricature art is the combination of line, color, skills, composition, rhythm, etc. which are created in an exaggerated way to form a unique code through its drawing skills. It is always carefully conceived by artists, and is presented based on visual senses. Imagination is the

aesthetic complement to give the audience an impression. Rhodes (1996) proposed the main features of caricature as being an exaggeration and individuation: a caricature is different from a realistic portrait by its specific deformation. On the contrary, it's from a fantastic form by its representation of a known subject.

It's important to emphasize creativity and create the figure's typical personality in order to pursue similarity in spirit in caricature. However, the caricature creation is complicated and undefined. This original art form of painting can attract people's attention and strike a chord because of its special painting techniques that can generate great visual impact, and it's widely used to adapt to the aesthetic of public entertainment standard in various fields (newspapers, magazines, commercial advertising, animation film, etc.). Caricature is presented in the form of grotesque due to exaggeration and deformation, therefore, how to create more favorable caricature works for audiences based on humorous and vivid features in this article is the key issue.

The caricature artists create artworks under the sensibility of subjects from three levels (image, impression, and idea); artworks have become a bridge of communication between artists and subjects. Audiences can be impressed by an excellent artwork that is easy to touch one's heart and achieve the same effect between works and cognition. Different artists have distinctive creative techniques, and they like creating works with various forms and styles to achieve the unity of form and spirit. As shown in figure 1, the author has tried a variety of styles in caricature. Exaggeration is an important strategy to impress humor and innovation, which form a funny, flexible, and diverse style with innovative methods. Artists can always quickly grasp the personality of characters to render the image with long-term experience, and it involves the coding of the connotation of artworks about how artists transform creativity into artworks and also involves the decoding of cognition about how audiences feel about the artists' intention (Flavell, 1992; Onisawa & Hirasawa, 2004). In essence, this article focuses on how to convert the creation process from inner emotion to perceptible creation model and audiences generate semantic cognition from experience, concept, and stereotype, to make aesthetic experience and art appreciation.

Artists apply a variety of artistic media, symbols, and metaphors to independently create and perform artwork, which expresses their own ideas and communicates their life experience. Caricature arts are the media that provide powerful and essential means of communication. Most research for caricature remains in the aspect of skill expression; ignores the process of inspirations and conceptions. Indeed, there is a rule according to the artists' subjective creation, and there is a key that artists explore on audiences' aesthetic experience after watching the caricature artwork. A successful caricature creation must allow the viewer to complete three processes of cognition through the content: 1) situational cognition, i.e. whether viewers can see; 2) artistic conception, i.e. whether viewers can understand; 3) emotional cognition, i.e. whether viewers can be touched (Micheal, 1999; Chen et al., 2014, 2015). Thinking about

* Corresponding author.

caricature art as a process of social interaction, to show how the artist's creations are conceived, developed, delivered, and received, and how the viewer is attracted, how accurately they understand the artwork, and how they are affected by the artwork must be studied. For the evaluation of caricature artworks, we need a better understanding of the communication track between artist and audience, not just for taking part in the social context, but also for developing an interactive experience between artist and audience. Then, these factors are analyzed and discussed in order to establish a caricature communication matrix to understand the perceptions of artist and audience. More precisely, this article involves caricature creation conceptual model for artists to seek how to create a deeper level of artwork and think about innovational skills and creative methods, which provides a theoretical basis for the communication and practice of caricature creation. The purpose of this research includes: firstly, the study creates a model to understand the process of artists' conception and inspiration. Secondly, it analyzes the audience's cognitive model for caricature artwork. Thirdly, it helps artists to reflect on the creation and to design artworks meeting the aesthetic needs of the audience.



Figure 1: Caricature Creation (design by Wen-ting Fang)

2. RESEARCH FRAMEWORK

This article provides an analysis of the artists' artistic creation and audience's aesthetic experience through the literature review from communication theory, mental model, and aesthetic theory. In terms of communication theory, artist's coding is how the artist expresses the creation process of artistic conception; audience's decoding is how the audience comprehends the artworks; the artist is the addresser and the audience is the addressee. This is the cognitive process where artist sends a message and audience decodes the message, thus this study develops a caricature creation conceptual model to understand the artist's creative process and the audience's aesthetic experience as shown in figure 2.

An excellent artwork needs to satisfy three levels for expressing its creative connotation, which are technical, semantic, and effectiveness levels (Fiske, 1990; Jacobson, 1987). The technical level as the first level, which concerns about composition and color, and the possibility of attraction, which makes the audience perceive the appearance of the artwork and sends the

surface information for audience. Cognition is the connection between the subject and the consciousness, that is an intangible relationship with artist and audience. Semantic level as the second level requires artists to accurately express the image characteristics. The effectiveness level as the third level is how to touch the addressee to take the right actions; that is, how effectively does the received meaning affect to conduct the expected way (Fiske, 1990).

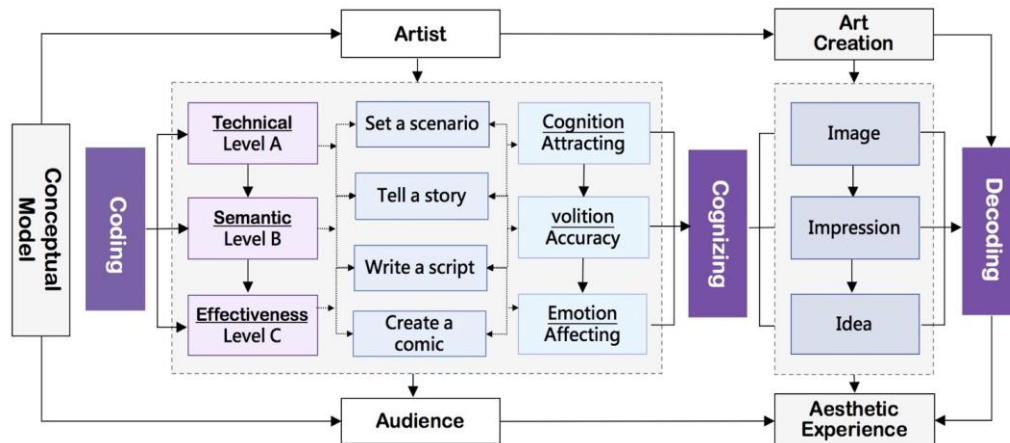


Figure 2: Caricature Creation Conceptual Model

In terms of creation process, the process can be divided into four steps: set a scenario, tell a story, write a script, and create a comic (Lin, 2007). The steps explain how to look for differences, find the character personality and organize the image. This creative process is the core factor. The audience's decoding process include: 1) do you see? 2) do you understand? 3) does it touch your heart? Specifically, there are three key steps to understanding the meaning of artwork, e.g. cognition (attracting), volition (accuracy), and emotion (affecting). The first level, which is about image, is the thought that audience is attracted by the appearance. The second level which about impression is the thought audience understands the meaning of artwork to enter into the phase of association. The third level, which is about idea, is the thought that audience can feel the mentality of the artist and audience is immersed in the unique artistic charm of artwork.

3. METHODS

Based on the previous studies, disclosed herein is a method for creating a caricature and this research is based on caricature creation conceptual model with the method of interviewing experts, case study, and make a series of practical operations as shown in figure 3. The study can be divided into three sessions. In session I, the literature review was used as a way to construct the caricature creation conceptual model and combine with mental model and communication theory. In session II, professors and students in National Taiwan University of Arts were interviewed to modify the model and analyse the creation process, and a caricature case study was operated in this phase. In session III, this research involved doing plenty of caricature creation practice with semantic analysis and cognitive model.

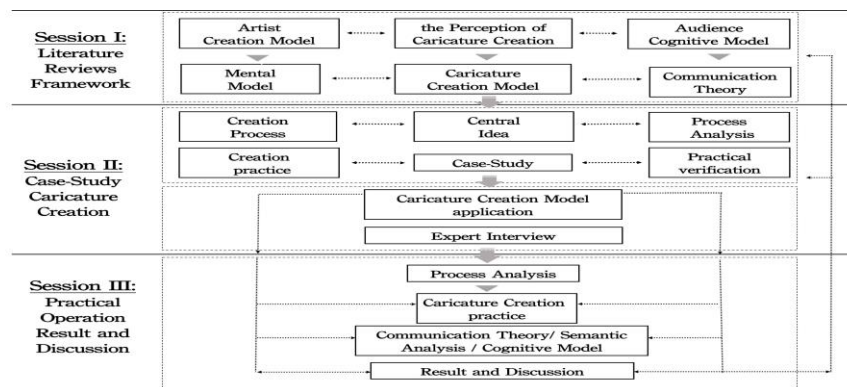


Figure 3: Procedures for Caricature Creation

4. A CASE STUDY OF CARICATURE CREATION

This study is based on Professor Lin who has authorized authors to use the portrait in the relevant research area as the object of caricature to discuss the process of creativity. It's important to explore how the artist creates artwork from the image, the impression, and the idea according to empirical rule and thinking mode and to study how the audience perceives the artist's concrete context and abstract mood in this study. Actually, four parts are identified based on certain methods and procedures: Setting a scenario means to carefully find the especial elements; Telling a story means to analyze the character features; Writing a script means to design with creativity and Designing a character means to choose the vivid images. Specific methods include: 1) identifying features and facial expression features, 2) features Composition and features proportion, 3) exaggeration and deformation and emphasis features, 4) emotional expression and Individual expression.

4.1. The Perception of Image

For the first phase, setting a scenario includes identifying features and facial expression feature in order to express the perception of image. This phase essentially discusses the problem faced on the technical level, and the artist creates in surface shape to attract the audience.

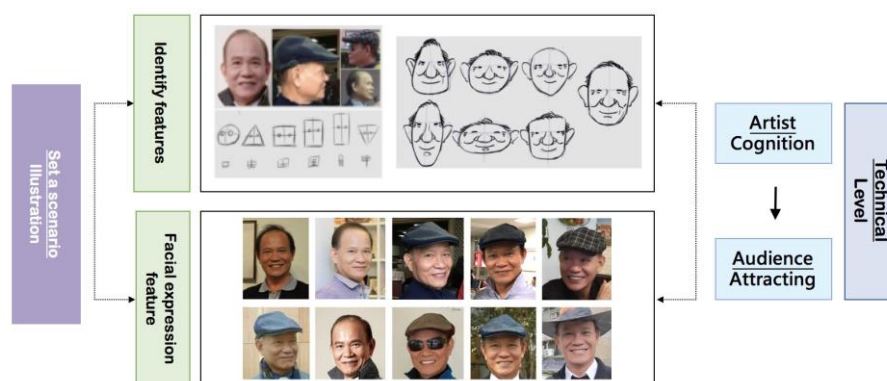


Figure 4: the First Phase of Caricature Creation (design by Jiede, Wu)

Accordingly, point, line, and plane are the basic forms of image composition, whereas the execution of the line plays a vital role. The free combination of lines (e.g., straight lines, oblique

lines or curves) can produce different aesthetic effects; lines can form a sense of volume and space with the physical structure and the perspective; as a matter of fact, the power of lines can express the rhythm. Simple geometric shapes (e.g., square, round, oval, triangle or trapezoid) can be used in creating the facial outline of characters. In fact, the author tried many times to draw the facial outline in a concise and crisper way, which has expressed with a sense of decoration as shown in figure 4. This is a general process in which artist refines, which artist extracts a pure character form with the unique expression of the character to show the subjective creation at the first level.

More precisely, the basis of caricature creation is the reality, and it requires the artist to collect plenty of material about the facial expressions. Therefore, how to grasp the facial expression can proceed from the details. For example, the artist tries to find out the change of facial muscle structure when the subject smiles as shown in figure 4. Overall, it is the main precondition that many elements have entered into the artist's mind at the beginning of the creation; these complex information elements are conducive to highlight the characteristics of the subject and the information will be presented in the subsequent creation process.

4.2. The Perception of Impression

For the second phase, telling a story includes features composition and features proportion in order to express the perception of impression. This phase is essentially to discuss the problem faced on the semantic level, and the artist consciously refines the character of the subject to achieve the first level of cognition.

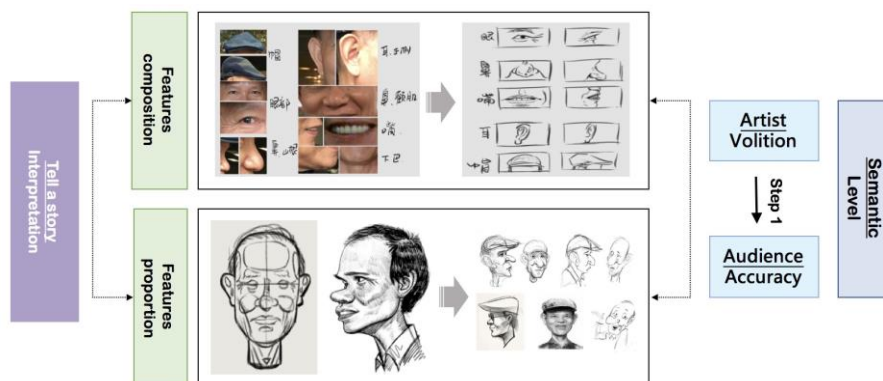


Figure 5: the Second Phase of Caricature Creation (design by Jiede, Wu)

Artists can form a unique feature database by themselves after a long training and they can also code for the concrete form when they face the subject. For instance, small eyes can be replaced by thin lines or dots; large eyes can highlight the black of the eye, ignoring the white part, or even only using long eyelashes. The shape of the eyebrows are important to portray the characters' personalities, and thick eyebrows can emphasize the painting with a black and thick shape. The nose can emphasize the shape of the tip of the nose, and elongate or shorten the length of bridge of the nose. The shape of the ears is also different such as semi-circular, triangle, or rhombus. Accordingly, each person has their own modeling features such as the hair, the beard or the accessories, which can enhance the performance of the characters with careful description of these elements. But ultimately, this study conducts deep analysis of the

subject's facial features as shown in figure 5, and make a large number of sketches of the character in order to look for the facial features such as big nose, thin lips, neat teeth, or crescent-shaped eyes.

General comics often break the normal proportion of the human body to pursuit the creativity, similar to caricature. The proportion of facial features is important in the performance of personality. The proportion of forehead and chin, can highlight the characteristics of the subject, by increasing or decreasing, lengthening or shortening it to enhance the expression characteristics of caricature. For example, some people's facial features are more gathered in the centre of the face, while others' facial features are scattered with the overall trend of expansion. Consequently, this study conducts an in-depth analysis of the proportional relation of the subject on the front and side face, which has found that the subject's forehead is relatively large and the proportion of nose and cheekbones have a high percentage and the distance of nose and mouth is closer. The author has tried to draw many drafts to find out the difference of the change in the proportion in order to prepare for the follow-up study.

4.3. The Perception of Idea

For the third phase, writing a script includes exaggeration and deformation and emphasis features in order to express the perception of idea. This phase is also to discuss the problem of sematic level, and artists create a fantastic atmosphere to achieve the correct understanding for audiences, i.e., the second level of cognition.

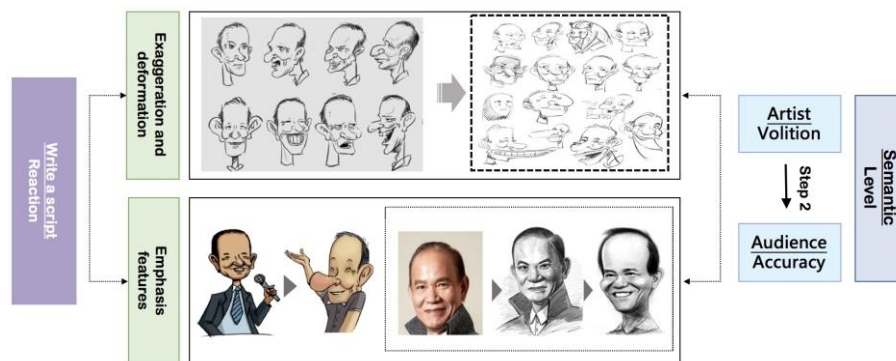


Figure 6: the Third Phase of Caricature Creation (design by Jiede, Wu)

Creative idea is an important means of caricature that expresses with absurd plot to help audience experience the true feeling from the fictional art world. Essentially, exaggeration and deformation is the basis of caricature to create the sense of cartoon. Exaggeration includes modeling and conceptual aspects, which emphasizes features to make the caricature impressive and highlight the overall creative imagination rather than the surface level of expression. Facial features were exaggerated and deformed to realize non-life scenes as shown in figure 6. For example, the ears are designed bigger to show the humor and the teeth are designed exaggerated to express eloquent feature as shown in the left figure. To express the overall conception of the subject with exaggeration method, the mouth is designed like a boat to express the plausible image and the lion is designed for the subject so as to express divine

image in his field. Actually, a humorous and relaxed aesthetic environment is created by exaggerated painting way, which accords with aesthetic taste and create a distinction between the reality and the cartoon.

How to highlight features of the subject based on exaggeration has been studied through deforming the character as shown in figure 6. Appropriate deformation will not only influence the similarity with the subject, but also can increase the entertainment, which has made the creation original and achieve the unity of form and spirit.

4.4. The Aesthetic Experience

For the fourth phase, creating a character includes emotional expression and Individual expression in order to express the perception of idea. This phase is to discuss the problem of effectiveness level, and artists create with emotion to transform the real characters into illusory artworks thus audiences can be touched to achieve the emotional interaction.

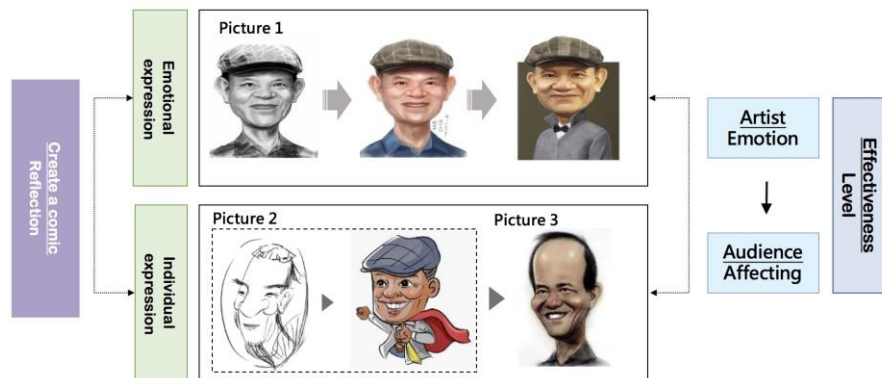


Figure 7: the Forth Phase of Caricature Creation (design by Jiede, Wu and Wen-ting Fang)

This phase of caricature integrates the deepest thinking into creation, which combines the experience, the technique and the perception to achieve the aesthetic experience of humor and creativity. Therefore, the artists hope to create artwork to achieve more vivid and fun effect combining the analysis of the subject and the attempt of the creation. The first picture records the morphological changes in the creation as shown in figure 7, and the artist captures the expression of the smiling moment of the subject to create the attractive artwork with the reasonable exaggeration, which also highlights the main features such as the position of cheekbones, the sharp of the nose and the curvature of eyes. The second picture expresses the humour scenario with the creative way, for instance, the image of the old master to convey the knowledgeable personality traits and the image of the superman which combines with the fictional character to express the sensual fantasy of the subject. The third picture, which exaggerates with big forehead, has produced unexpected artistic effects and expressed the amiable character. In general, the artists are good at using the absurd plot to express the real world in caricature creation thus audiences, who are moved, can achieve visual shock and spiritual touch.

5. CONCLUSIONS

This study verifies the rationality of caricature creation conceptual model through a case-study and provides a theoretical basis for the aesthetics of caricature creation. Setting a scenario is the process of finding the characteristic; telling a story is the process of generalizing the form; writing a script is the process of emphasizing the cartoon; creating a character is the process of in-depth artistic processing. The following is the creation practice for caricature with author through the analysis of artist conception as shown in figure 8.

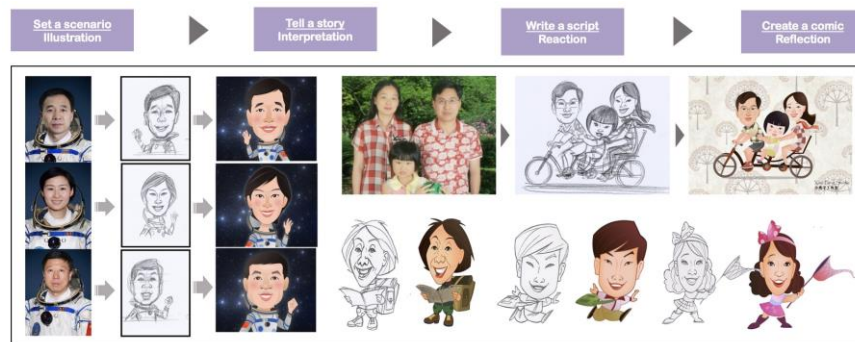


Figure 8: Caricature Creation practice (design by Wen-ting Fang and Yuan-han Jiang)

This caricature communication matrix finally analyzes the process of the artist's inspiration and the audience's cognitive pattern of artwork so as to design the work according to the audience's aesthetics as shown in figure 9. Artists collect the exquisite elements that are weaved with inspiration and imagination so that it is the process of artistic interpretation. The art congeals artists' emotion or idea; thus, it must have the function of conveying beauty and it is the key to opening the aesthetic door. Essentially, caricature artists create artwork through technical level, semantic level, and effectiveness level to communicate the aesthetic experience. Artists who study how to visualize the inspiration have the rational model in creation and they code for the audience; audiences as the followers of artists' mind decode with aesthetic experience and they understand the artists' original intention through image, impression, and idea.

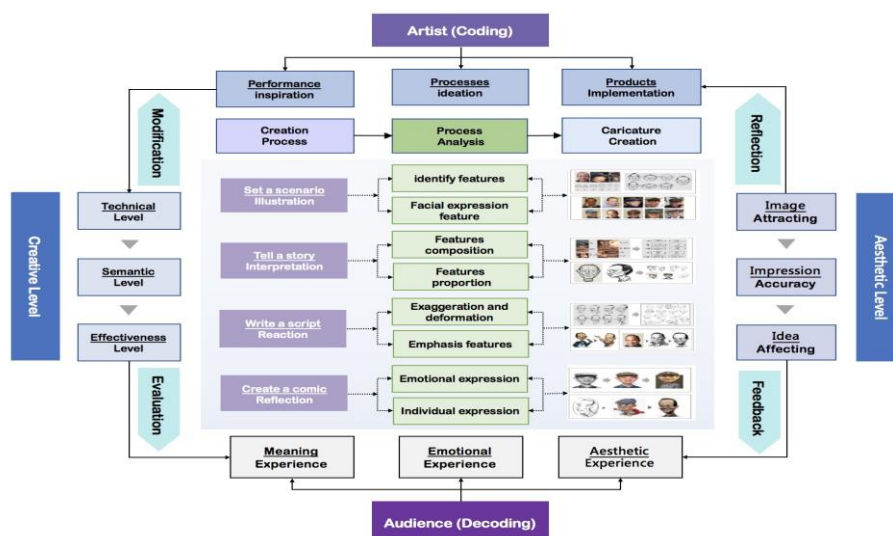


Figure 9: Caricature Communication Matrix

Acknowledgments

The authors wish to thank those who contributed to the research, especially, the faculty of National Taiwan University of Arts, Graduate School of Creative Industry Design. This is a series of caricature studies and the follow-up studies will be more in-depth.

REFERENCES

Chen, S. J., Lin, C. L. & Lin, R. (2014). The Study of Match Degree Evaluation between Poetry and Paint. Proceedings of the 5th Asian Conference on the Arts and Humanities (ACAH2014), Osaka, Japan, April, 2014.

Chen, S. J., Lin, C. L. & Lin, R. (2015). A Cognition Study of Turning Poetry into Abstract Painting, The 5th Asian Conference on Cultural Studies (ACCS 2015), Kobe, Japan.

Fiske, J. (1990). Introduction to communication studies. London: Routledge.

Flavell, J. (1992). Cognitive development: Past, present, and future, Developmental psychology.

Jakobson, R. (1987). Language in literature. Cambridge, MA: The Belknap Press of Harvard U. P.

Lin, R. (2007). Transforming Taiwan Aboriginal Cultural Features into Modern Product Design: A Case Study of a Cross-cultural Product Design Model. *International Journal of Design*, 1(2), 45-53.

Michel, K. F. (1999). Turning Poetry into Paintings: An Experiment in Visualization. *Art Education*, 52(3), The Practice of Art Education, pp. 6-12.

Onisawa, T., & Hirasawa, Y. (2004, July). Facial caricature drawing using subjective image of a face obtained by words. In Fuzzy Systems, 2004. Proceedings. 2004 IEEE International Conference on IEEE, 1, pp. 45-50.

Rhodes, G. (1996). Superportraits: Caricatures and recognition. Psychology Press.

MALAYSIAN PERCEPTIONS TOWARDS BEMBAN PRODUCT DESIGN

Ain Syafiqa ABU BAKAR ^a, Abdul Muta'ali OTHMAN ^b

^a Universiti Teknologi Malaysia, Malaysia, heyainsyafiqa@gmail.com

^b Universiti Teknologi Malaysia, Malaysia, mutaali@utm.my

ABSTRACT

This research represents an initial study of *bemban* product designs during the *Hari Kraf Kebangsaan* (National Craft Day) in Kuala Lumpur. The practitioners of *bemban* products have tried to create innovative designs with the help of the Kraftangan Sarawak and the Sarawak Craft Council to derive good relevant designs that meet the market. Therefore, the objective of this study is to investigate Malaysian perceptions towards *bemban* product designs to identify how Malaysians perceive current *bemban* products in the market. In order to achieve research objectives, the Kansei engineering attitude and behaviour, user's experience research and a 5 level semantic differential scale were used to construct questionnaires. According to the survey analysis, it is highly important to understand user's desire in the *bemban* product development.

Keywords: *Perceptions, Bemban, User Research, SD scale, Kansei Engineering*

1. BACKGROUND RESEARCH

Bemban is a plant that can be found mostly in Southeast Asia. In Malaysia, the Ibans from Sarawak are highly known for using *bemban* plants to produce *bemban* products for lifestyle activities and ritual ceremonies.



Figure 1: *Bemban Air* (*Donax Arundastrum*)

There are various traditional motifs found in the *bemban* products produced by the Ibans of Sarawak. The product design, shape, form and patterns normally follow the functions of the products, which carries significant semantic reference towards the lifestyle, demography and behaviour its users.



Figure 2: *Bemban* Product (Traditional)

Recently, *bemban* products have started to take on a new turn in terms of design due to its failure to meet the current change of design preference in the Malaysian market that were brought about by lifestyle, material and religious revolutions. Therefore, its complexity and unprofitability has also resulted to the refusal of many *bemban* practitioners and Iban youngsters to participate in the creation of *bemban* products. With the help of the Kraftangan Sarawak and the Sarawak Craft Council, *bemban* product practitioners started to create innovative and relevant designs that would meet the demands of the Malaysian market. Product functionality, decorations, and other materials are presently being added in the development of *bemban* products.



Figure 3: Bemban Product (Current)

In order to assist *bemban* product development in moving forward and meeting the demands of the Malaysian market, this research recognises different Malaysian perceptions towards current *bemban* products.

2. RESEARCH METHOD

2.1. Kansei Engineering (Attitude and Behaviour) Approach

Based on the working *bemban* product development, the criteria of selection for an instrument would require its ability to measure Malaysian perceptions towards Malaysian craft products. The researcher used Malaysian products as the benchmark due to their similarities in product situations and characteristics with *bemban* products.

The Kansei Engineering psychological measurement focusing on attitude and behaviour is the method used in this research. This distinction can be summed up by contrasting "what people say" versus "what people do" (very often the two subjects are quite different). The purpose of attitudinal research is usually to understand or measure people's stated beliefs. (Christian Rohrer, 2014)

Attitudes Components

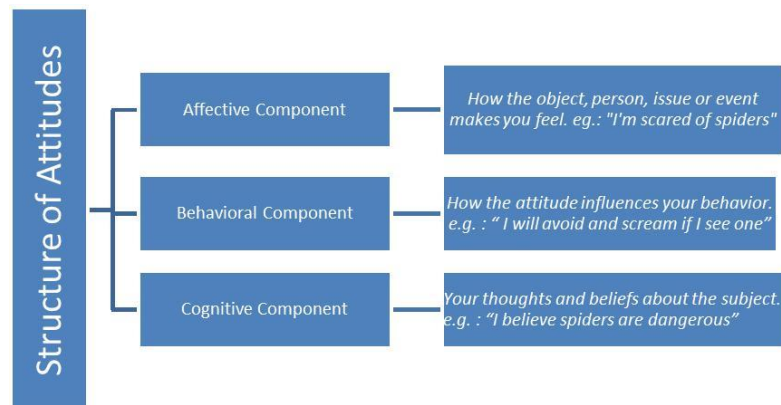


Figure 4: ABC Model Attitudes

Structure of Survey

- a. Attitude (Thinking):
 - i. What are the preference of Malaysians in terms of style pertaining to craft products?
- b. Behaviour (Actions - from the past):
 - i. What are the preference in terms of style based on their previous purchases?
 - ii. What are the characteristics of products that were purchased?

2.2. Semantic Differential Approach

The following analyses the use of the Semantic Differential (SD) type 5-point of rating scale designed to measure the feelings of Malaysians towards the craft.

Question structure: The respondent is asked to choose his or her feelings towards crafts, based on a 5-point scale between two polar adjectives (for example: "Future-Ancient", "Alive-Gone" or "Remembered-Forgotten").

Score meaning: 1-2 points mean that the product is still acceptable by Malaysian consumers, 3 points mean natural, 4-5 points mean the product is obsolete and 6 points mean that the consumer doesn't recognise the product.

2.3. Study Sampling

A pilot test of questionnaires is distributed to a total of 160 various age groups and are divided into 5 age groups: below 20, 21-30, 31-40, 41-50, and above 51 years old. These questionnaires were distributed at the *Hari Kraf Kebangsaan* / National Craft Day, Kuala Lumpur, Malaysia.

3. RESULT & ANALYSIS

3.1. Initial Results

3.1.1. Product Style

The visual styling for craft products was divided into 6 categories: Traditional, Contemporary, Futuristic, Minimalist, Industrial, and others. The Malaysian consumers' score for the type of craft visual style were compared between attitude and behaviour questions and are reported as follows:

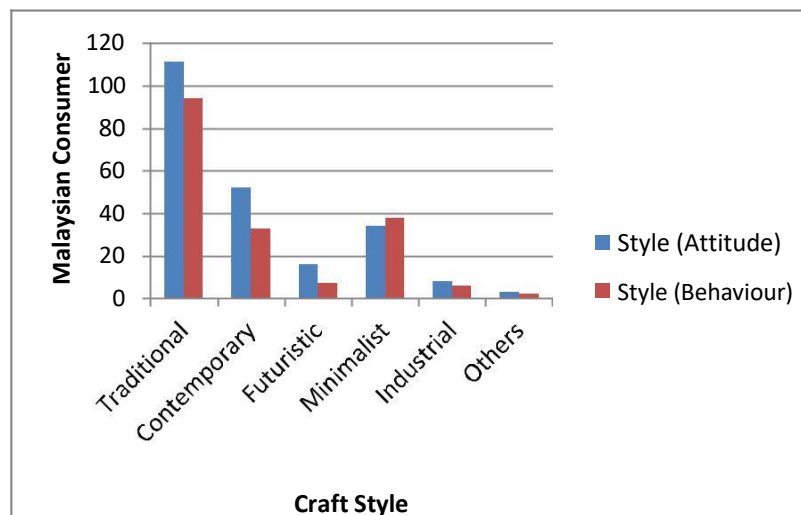


Figure 5: Malaysian scores on craft style preferences according to attitude and behaviour

Figure 5 shows craft styles from attitude and behaviour point of views. Attitude in this questionnaire means the visual style of craft product that they will purchase in *Hari Kraf Kebangsaan* (HKK), while behaviour is the visual style of craft product that they have already purchased. The data in figure 5 clearly revealed that the Traditional style is the highest preferred craft style product that is realised from attitude and behaviour questions. However, several styles that followed suit in terms of attitude were Contemporary, Minimalist, Futuristic, Industrial and others. In addition to that, a slight difference in terms of behavioural data showed that following the traditional style were Minimalist, Contemporary, Futuristic, Industrial and others.

3.1.2. Product Functions

Product functions for craft products are divided into 5 categories: Decorations, Gifts and Corporate Souvenirs, Fashion and Accessories, Tools and Home Appliances, and

others. The Malaysian consumer scores for the type of product functions based on behaviour questions and are reported as follows:

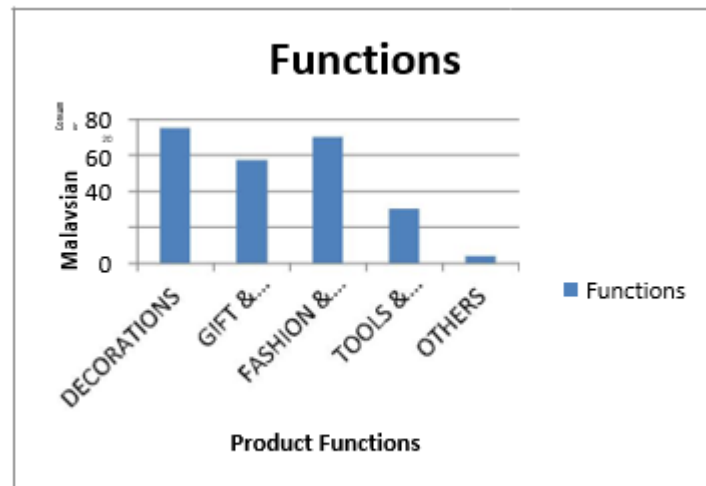


Figure 6: Malaysian scores on Preferences Product Functions according to behaviour

The Malaysian consumer scores for the type of product functions based on stated product that has been purchased are tabled in Table 1 which states the functions of Top 10 Craft Product that Malaysians have purchased.

Table 1 Functions of Top 10 Craft Product that Malaysian has purchased

No	Item	Product Functions			Total Purchasing
		Fashion	Decorations	Tools	
1	Batik (<i>Batik</i>)	•			77
2	Plaited Product (<i>Anyaman</i>)		•	•	26
3	Songket (<i>Songket</i>)	•			19
4	Woodcraft (<i>Ukiran Kayu</i>)		•		12
5	Cloth (<i>Baju</i>)	•			11
6	Labu Sayong (<i>Labu Sayong</i>)		•	•	10
7	Congkak (<i>Congkak</i>)		•	•	9
8	Dagger (<i>Keris, Parang, Pisau, Kerambit</i>)		•	•	8
9	Ring, Bracelet (<i>Gelang, Cincin</i>)	•			6
10	Shoes (<i>Kasut</i>)	•			5
	Total	123	65	53	188

From table 1, the highest functions from craft products that Malaysians have purchased are Fashion, followed by Decorations and Tools. However, Gift functions cannot be measured using this table since every product can be as a gift and it depends on consumer.

3.1.3. Obsolete Parameters

Initial findings are reported as follows.

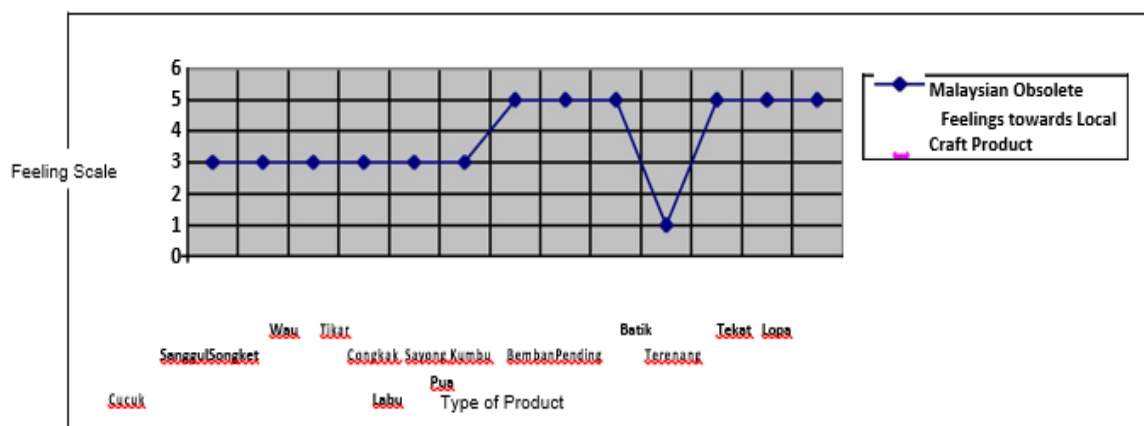


Figure 7: Malaysian Obsolete Feelings towards Craft Product

3.1.4. Consumer Recognition towards *Bemban* Product

The Malaysian consumer scores for the *bemban* recognition are reported as follows:

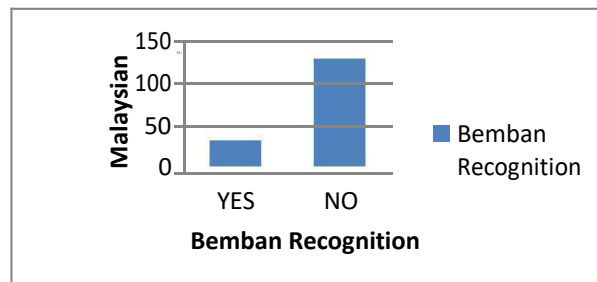


Figure 8: Malaysian Recognition towards *Bemban* Product

3.2. Preliminary Findings

Preliminary trends can be identified based on the questionnaire analysis conducted. The following are some main conclusions that can be made:

1. Product style and functions criteria preferred by Malaysians –

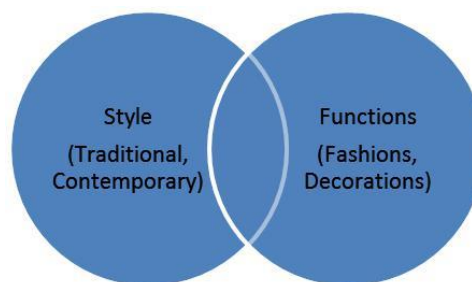


Figure 9: Craft Criteria according to Malaysian Preferences

Based on Figure 9, the darkest side that merges between style and function is the product criteria that are accepted by Malaysians. This explains that a product that retains a style and function that are favourable to Malaysian consumers will attract Malaysians to buy as well as accept the product design. There's a need to majorly develop craft product functions based on tools and home appliances that can meet the Malaysian lifestyle.

2. What do Malaysians mean by traditional style?
 - a) Based on Questionnaire

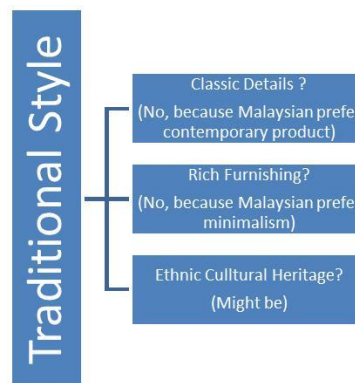


Figure 10: Traditional Style words meaning

3. Which tools & home appliances should be developed?

For tools & home appliances craft products, they should be developed into something that Malaysians can use in this era. This is supported by tools & home appliances that Malaysians still purchase are *anyaman*, *labu sayong*, *parang & pisau*, and *congkak*.

4. CONCLUSION

Based on the survey, current *bemban* products are unable to meet Malaysian preferences. A majority of Malaysians fail to recognise *bemban* products whereas a minority of Malaysians who recognise the product, felt that the designs are obsolete. Based on the differences between traditional *bemban* products with current *bemban* products, its development has been in stagnant motions due to the lack of empathy towards user preferences, behaviour and lifestyle. Therefore, *Bemban* product development has been designed by functions following the form. This means that there is a decline in the current *bemban* product functions that fails to meet the Malaysian lifestyle as compared to traditional products that have always put functions and semantic reference with user's lifestyle as an aesthetic value. *Bemban* products have been developed by increasing their aesthetic view of various material decorations and fancy functions that doesn't meet Malaysian preferences. This perspective of aesthetic point of view prevents the design development from moving forward and meeting the market's expectations.

5. ACKNOWLEDGEMENTS

The researcher would like to express gratitude to her research supervisor, associate professor Abdul Muta'ali bin Othman, whose contributions in stimulating suggestions and encouragement, greatly helped coordinate her study. She also would like to acknowledge with much appreciation all the staff of Perbadanan Kemajuan Kraftangan Malaysia, who gave their permission to use Hari Kraf Kebangsaan 2017 for collecting data, and provided all the facilities to complete the questionnaire "Malaysian Perceptions towards Craft Product". Special thanks goes to her team mates, Jaron Sim Yu Chong, Mohd Assyakirin Ariffin, and Nurul Atiqah Razali, who invested their full effort in achieving the questionnaires' goal.

REFERENCES

Axelsson, J, Eklund, J, Nagamachi, M, Ishihara, S, Rydman, K, & Sandin, J. (no date). *Suspension and damping a lowlifter platform (An application of Kansei Engineering)*. Division of Quality and Human-Systems and CMTO. Linkoping Universitet, SE-581 83, Linkoping, Sweden. Hiroshima International University.

Durin, A. (2014). *Tikar Bemban*. Universiti Malaysia Sarawak.

Demirbilek, O & Sener, B (2003) *Product design, semantics and emotional respons*. *Ergonomics*, 46:13-14, 1346-1360, DOI: 10.1080/00140130310001610874

Lokman, A. (2010). *Design & Emotion: The Kansei Engineering methodology*. Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Malaysia. Vol 1, Issue 1, 2010.

Lévy, P. (2013). *Beyond kansei engineering: The emancipation of kansei design*. *International Journal of Design*, 7(2), 83-94.

Lockton, D (2012), '*Attitudes, meaning, emotion and motivation in design for behaviour change*', working paper, available at <http://danlockton.co.uk>

McLeod, S. (2014). *Attitude and Behavior*. Retrieved from <https://www.simplypsychology.org/attitudes.html>

Nagamachi, M. (2008). *Perspectives and new trend of Kansei/Affective Engineering*. User Science Institute, Kyushu University. Conceptual Paper.

Nagamachi, M, Tachikawa, M, Imanishi, N, Ishizawa, T, Yano, S. (2008). *A Successful Statiscal Procedure on Kansei Engineering Products*. 11th QMOD Conference.

Simon T. W. Schütte , Jörgen Eklund , Jan R. C. Axelsson & Mitsuo Nagamachi (2004) *Concepts, methods and tools in Kansei engineering*. *Theoretical Issues in Ergonomics Science*, 5:3, 214-231, DOI: 10.1080/1463922021000049980

Sharon, T (2014). *Tools for Entrepreneurs: Flying Cars, UX Research, Attitude and Behavior*. Retrieved from <https://www.youtube.com/watch?v=KISgWT2Nbak>

A STUDY ON THE PERCEPTION OF LOCAL TAIWANESE AND IMMIGRANTS IN TAIWAN TOWARDS THE COLOUR IMAGERY APPLIED ON CALICO OF THE “FORTUNE CHICKEN”

Shi-Mei, HUANG^a, Ming-Chyuan, HO^a and Yuan Hua, LU^b

^aProfessor, Graduate Institute of Design, NYUST, Taiwan (R.O.C.), homc@yuntech.edu.tw

^bProfessor, College of Design, STU, Taiwan (R.O.C.), yhlu@stu.edu.tw

ABSTRACT

In Taiwan, the issue of sub-replacement fertility has deteriorated in recent years, the government has focused on the ethnic fusion and the marriage diversity. The study probes the innovative spherical design of the “Fortune Chicken” which symbolizes consummation along with variety of calico so that the deviation in colour imagery can be tested and a consensus among different ethnicities in term of the imagery delivered by the innovative product can be reached. In this study, the colour of the “Fortune Chicken” was applied according to the concept of “Communicating Across Cultures”. A total of 60 subjects from both Taiwanese and immigrants in Taiwan, with 30 subjects in each group, participated in the Field Survey conducted by the study. Among the 30 subjects of the immigrants in Taiwan, 23 of them expressed the need for the Taiwanese wedding gift, the “Fortune Chicken”. The element for the preferred colour among the diverse ethnicities was analysed through the calicos obtained from three different countries; the United States, Japan, and Taiwan. As a result, the preferred colour was the pattern knitted with Brocade and Satin Weave.

Keywords: *Wedding gift, the “Fortune Chicken”, Colour imagery*

1. PREFACE

Due to the worsening of sub-replacement fertility in Taiwan, the wedding gift, the “Fortune Chicken”, with the connotation of consummation and blessing has played an important role in the modern society where the form of marriage has been diversified. Since Zhou Dynasty of China, the groom has been preparing gifts for proposing to the bride at the bride’s home, and in the past, anser was used as the gift for making proposal since the animal represents loyalty in relationship, hence this proposal is also known as “Betrothal”. Until Song Dynasty, the use of

anser was replaced with chicken, duck, and goose since the anser was difficult to be spotted in the wild. Today, the traditional wedding custom practiced in Korea is still being preserved and utilized, but the live duck and goose which needs to be prepared by the groom have now been replaced with painted duck and goose made of wood. In Ho-Lo district of China, chicken is used in the wedding instead of goose and duck, and the chicken is named as the “Fortune Chicken”. In Taiwan, there is even a song sang in Taiwanese dialect called “Fortune Chicken” which can be found on YouTube, meanwhile, there was a news reported by Chinatime.com on the Internet on March 6th, 2012 stated that a dispute between the customer and the online vendor was taken to the court because the colour on the wooden painted chicken which ordered by the customer had already faded when the customer unboxed the parcel and this had made the customer feel a sense of bad luck. Since dyed fabric transmits a direct sense of security to people (L. J. Huang, 1997), the usage of dyed fabric can be diversified and transformed into an ornament in a house and even a toy in order to proliferate the function of dyed fabric after the wedding reception. The main objective for the study is to probe the colour imagery appearing on the calicos when applying on the “Fortune Chicken” and to fulfil the care on “Diverse” marriage in Taiwan which includes not only the marriage of Taiwanese, but also the marriage of the second generation from spouse of cross-national marriage and immigrants. According to the observation conducted by the researcher on daily basis for the study of the commonality of colour in cross-culture, the preferred colour for Taiwanese and immigrants possesses a powerful influence compared with other elements, such as style and quality (Q. F. Lu, 1993). In addition, it also possesses cultural connotation, for instance, the colour red represents luck in Chinese culture, and therefore, it is often used in the wedding. Adversely, colour white in the West symbolizes purity, which is why colour white often appears on the wedding in most of the Western countries (J. H. Lin, 2002). So, what is the preferred colour of the “Fortune Chicken” for Taiwanese and immigrants? And, what is the meaning behind the colour imagery? These are the questions that needs to be explored.

Furthermore, after searching the past literature, there is no research done based on the perception of Taiwanese and immigrants in Taiwan on colour imagery of the calico used on the “Fortune Chicken”. Because of that, the study has conducted an in-depth research on the perception of Taiwanese and immigrants in Taiwan on colour imagery represented by the “Fortune Chicken”, and the result of the study can be used as a reference for designing the wedding gift, “Fortune Chicken” as well as understanding the colour preference for the people in the Southeast Asia region.

2. LITERATURE REVIEW

Colour is relatively essential in a diverse society, it not only involves in the wedding custom, but also borderlines the relationship and the respect among different ethnicities for avoiding conflict. Psychologically speaking, the influence of colour is much more apparent than it of shape on human emotion (Q. F. Lu, 1993; S.Y. Lin, 1989). Only when people are given with a certain mission via the use of colour in marriage will they truly comprehend the connection between life and colour and understand the true meaning of colour (S.Y. Lin, 1989). Wedding culture is a type of cultural learning and it derives uniquely from human, there are symbols

which possess certain ability and they can be verbal or non-verbal which represents a different form of matter (G.Q. Zhu, 1982). The “Fortune Chicken” is an object which magnifies the power of nuptial connotation through colour and provides us with the strength to prolong our life in the critical moment as man and woman are getting married and accomplishing the psychological needs of auspiciousness and consummation.

2.1. Paper title and subtitle

The Rites of Zhou is the most comprehensive etiquette for bureaucracy in ancient China, many of its customs are still being practiced in modern era, especially the use of colours for celebration and funeral. In Zhou Dynasty, colour red was the most popular one in term of its usage, colours used in every ritual must be in accordance with the rule, and colours could not be used at will. There is a special relationship between religion and wedding custom, for example, in Hinduism, colours yellow and black are often used by the gods, in Buddhism, colours yellow, gold and silver have their uniqueness. These colours inflow into the countries in Southeast Asia, China, Japan and more due to the outflow of Buddhism. From this, we know that there is a trace for the influence of religion on colour of wedding in the society, besides, it encompasses affection of colour from ethnic and custom (S.Y. Lin, 1989).

2.2. The association between semantic meaning and color

Colour brings prosperity, security, and felicity to people’s life, there are two proverbs which originated from Tang Dynasty that can best depict the association between colour and life and they are “Full of Gold” and “Colourful” which are often used to describe affluence and are often used to describe affluence. Colour gold delivers a sense of grandeur and can be associated with the connotation of wealth and abundance. With a representation of various colours, it often offers a resemblance of auspiciousness and vivacity. In Japan, the colour will change to glamour as a peaceful period of time approaches, and this obvious change of colours is influenced by Buddhism and Chinese architecture. In terms of the system of colour, it is the era of warm colour and religion has played a major role in affecting the use of colour in our life. Colours which can bring warmth to people are often preferred by Asian (S.Y. Lin, 1989). For every ethnicity, there are colours which represent the affection for wedding and these colours are the unique colours used in the wedding. There is a strong connection between human behaviour and colour reminiscence. And the prime factor for the effect of this colour reminiscence is associated with our living environment (W. C. Lin, 1989).

2.3. The novel sensual imagery of color from the “Fortune Chicken”

According to the study, among all the sensual receptions of human, visual reception takes 87%. Visual reception is sensitive to the shape and colour of an object (L. Yeh, 1993). From the subjective philosophy of practice or anthropology point of view, the so called “Establishment of Novel Sensuality” is to build up the psychological ontology of human, especially the emotional body of it. Nietzsche stressed that in order to study aesthetic, people must examine it from the view of the creator, and the creation of an art can be studied through strong will (Z. H. Li, 2001). In the book of Chromatics (1989), it mentions that in the colour matching experiment, it starts

from the association of semantic colour following by the experiment of texture and physical samples, the collection of physical samples is particularly difficult, but the beauty of art is its creation (S.Y. Lin, 1989). From Experimental Aesthetic, some rules are being summed up, such as sphericity and ellipse represent the characteristics of consummation and tender, for example, an object with the shape of ellipse is more popular than the one with the shape of sphericity. Aesthetic comprises two key points, one is its sensuality, instinct, and skill-less and the other is its hyper-sensuality, rationality, and skilfulness (G.Q. Zhu, 1982; Z. H. Li, 2001). Therefore, the making of the “Fortune Chicken” must start from the design, the pattern and the stitching in order to come up with an experimental sample and understand consumers’ feelings toward the sensual semanteme of colour so that the “Fortune Chicken” can be created according to the need of consumer and market.

3. METHOD OF STUDY

In order to establish the corresponding relationship between the “Fortune Chicken” and the colour imagery of the cultural code from the calicos, the researcher collected the calicos with strong representation of national colour from the United States, Japan, and Taiwan. The 35 spherical “Fortune Chicken” sample were created.

The professors of design and art related field were invited, also the Art Association chairman or former director of the Kaohsiung Museum of Art, academic qualifications are master's or above related departments who have engaged in related work for at least 19 years, with only one scholar who did not live abroad for a long time were invited. (As seen in Table 1)

Table 1: The basic information of the scholars
















NO	Scholar	Gender	Age	Degree	Occupation	Seniority	Former Residence
1	Huang 00	F	40~50	PhD	Scholar	19	USA
2	Garden00	F	50~60	PhD	Scholar	22	Japan
3	Lee 00	M	40~50	PhD	Scholar	23	Britain
4	Che 00	F	50~60	Master	Artist/Scholar	30	Japan
5	Wu 00	F	50~60	Master	Artist/Scholar	23	Canada
6	Yu 00	F	40~50	Master	Artist/Scholar	26	Taiwan

After consulting with 6 scholars, the Field Trial was conducted along with 35 samples of “Fortune Chicken”, and 15 out of 47 pieces of rhetoric with strong connotation of cultural code was selected and 5 samples were picked respectively from which scored the highest in representing Taiwan, Japan, and the U.S. so a total of 15 samples with powerful cultural code were finalized as the samples for the test result of $\alpha = .98$

Finally, the method of semantic differential, abbreviated as SD, was conducted on those 15 samples of “Fortune Chicken” along with 15 different pieces of rhetoric in order to make imagery scale. Then the method of field setting was used in the way that 15 samples of

“Fortune Chicken” were displayed along with the questionnaires on the table which allowed the subjects to actually feel and grade them. (As seen in Table 2)

Table 2: The summary of the 15 selected “Fortune Chicken” samples after the consultation with the scholars

USA				Japan				Taiwan			
No	Picture	Element	Fabric	No	Picture	Element	Fabric	No	Picture	Element	Fabric
1 A		AU Architecture Tiger - AUBURN UNIVERSITY	American cotton	6 F		Cherry	Japanese Brocade	11 K		Butterfly	Taiwanese Brocade
2 B		AU Tiger AUBURN TIGER	American cotton	7 G		Plum	Japanese Brocade	12 L		Dragon - Longevity in Chinese character - Bat	Taiwanese Brocade
3 C		AU - Tiger Paramecium Flowers	American cotton	8 H		Plum Camellia	Japanese cotton	13 M		Cauligraphy	Taiwanese Brocade
4 D		A ALABAMA	American cotton	9 I		Cherry	Taiwanese cotton	14 N		Longevity in Chinese character Flower	Taiwanese Brocade
5 E		Santa Claus Christmas Tree Crutch Cub	Taiwanese cotton	10 J		Plum	Taiwanese cotton	15 O		Chrysanthemum	Taiwanese Brocade

15 samples of “Fortune Chicken” representing Taiwan, Japan, and the U.S. were selected from 35 original samples after the interview with the scholars, and those samples were renumbered and presented by using English alphabet.

Second, the 15 pieces of rhetoric used in this study were selected through the discussion and interview with the scholars, the completed set of 15 pieces of rhetoric are; “festive, blissful, joyful, elegant, blessing, longevial, playful, gorgeous, brave, folkish, scholarly, healing, wealthy, consummated, and orthodox”, and the Visual Analogue Scale was conducted and used as a standard on the set of the “Fortune Chicken” samples for the Image Scale experiment for the Numerical Rating Scale to rate the samples from 1 as the lowest to 10 as the highest, the larger the number the stronger the feeling towards rhetoric.

Finally, 60 subjects were selected randomly, mostly female, for the study and among the subjects, 6 of them were local Taiwanese male and 24 of them were female so there was a total of 30 subjects participating in this study. As the nationality for the immigrant subjects, they are as follows: one from Philippine, one from Cambodia, two from Indonesia, 26 from Vietnam. Their age range is as follows: 9 out of 30 fall in the range between 20 to 30 years old, 14 out of 30 fall in the range of 31 to 40 years old, and 7 out of 30 fall in the range of 41 to 50 years old.

4. RESULT AND DISCUSSION

4.1. Result

- 1.) After the survey, the result is shown on Table 3.
- 2.) The average obtained from 15 pieces of rhetoric of the 15 “Fortune Chicken” samples were represented in figure in order to compare the level of standard. (As shown in Figure 1)

Table 3: The result of the experiment conducted by 60 subjects along with the use of 15 pieces of rhetoric incorporating with 15 “Fortune Chicken” samples

Average Rhetoric	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Festive	4.2	4.48	4.92	5.87	8.13	7.58	7.33	6.97	7.43	5.22	8.33	8.52	6.87	8.6	8.68
Blissful	4.68	5.42	5.35	7.47	8.02	8.27	7.6	7.53	7.18	5.75	8.32	8.4	6.67	8.4	8.62
Joyful	5.45	5.85	5.03	7.08	7.68	7.93	7.1	6.97	7.25	5.38	8.03	8.27	6.45	8.3	8.6
Elegant	4.3	5.43	5.17	6.03	6.18	7.67	6.92	7.22	7.02	6	7.58	7.83	7	7.8	8.3
Blessing	5.12	5.2	5.17	6.42	7.8	7.82	7.42	7.43	7.62	5.5	8.4	8.75	7.45	8.8	8.83
Longevial	5.03	5.22	5.13	5.85	6.85	7.43	7.22	7.22	7.05	5.42	8.18	8.65	7.43	8.6	8.58
Playful	6.28	6.5	5.60	6.82	6.45	6.67	6.13	6.63	5.9	5.22	6.9	6.63	5.67	7.2	7.15
Gorgeous	5.02	5.28	5.7	5.98	7.12	7.87	7.62	7.37	7.27	5.13	7.78	8.35	6.87	8.8	8.6
Brave	6.75	6.25	5.98	5.53	5.97	6.17	5.92	6.4	6.03	5.87	7.08	7.57	6.2	7.2	7.6
Folkish	4.52	4.48	5.35	4.63	6.35	7.12	7.05	6.9	6.8	5.43	7.77	8.13	7.17	8.1	8.1
Scholarly	5.7	5.65	5.87	5.65	6.05	7.02	6.93	6.62	6.6	5.85	7.07	7.28	6.93	7.2	7.7
Healing	5.15	5.77	5.22	6.82	6.72	7.02	6.27	6.6	6.35	5.33	6.7	7.2	6.17	7	7.45
Wealthy	5.15	4.58	5.55	5.92	7.15	7.75	7.58	7.3	7.47	5.17	8.28	8.67	7.2	8.5	8.63
Consummated	5.82	5.65	5.73	6.92	7.67	7.72	7.63	7.7	7.67	5.67	8.47	8.7	7.48	8.6	8.93
Orthodox	4.97	4.6	5.4	5.22	7.52	7.53	7.42	7.33	7.73	5.95	8.15	8.72	8.1	8.6	8.72
Total average	5.21	5.36	5.41	6.15	7.04	7.44	7.08	7.08	7.02	5.53	7.80	8.11	6.91	8.10	8.30

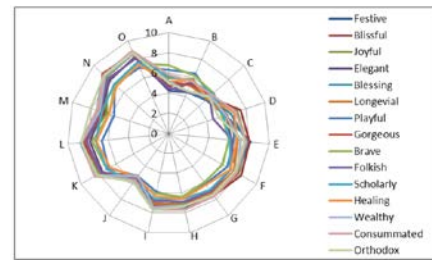


Figure 1: The average of rhetoric on “Fortune Chicken” derived from the comprehensive ethnic groups

Proceed on, the analysis for the deviation in colours between local Taiwanese and immigrants was conducted by using t-test analysis and the result is shown in Table 4:

Table 4: The deviation between local Taiwanese and immigrants in rhetoric representing on the 15 “Fortune Chicken” samples

	Rhetoric	Average	Standard Deviation	t	Rhetoric	Average	Standard Deviation	t
A	Festive	3.37	2.341	-2.556*	Gorgeous	4.30	2.706	-2.048*
		5.03	2.697			5.73	2.716	
	Blissful	3.73	2.149	-3.286**	Wealthy	4.00	2.600	-3.656***
		5.63	2.327			6.30	2.261	
B	Blessing	4.07	2.392	-3.473***	Consummated	5.13	2.515	-2.286*
		6.17	2.291			6.50	2.097	
	Longevial	3.97	2.356	-3.466***				
		6.10	2.412					
C	Festive	3.87	2.161	-2.027*	Gorgeous	4.10	2.264	-3.951***
		5.10	2.537			6.47	2.374	
	Blissful	4.43	2.239	-3.292**	Wealthy	3.50	2.047	-4.057***
		6.40	2.387			5.67	2.090	
D	Blessing	4.40	2.111	-2.785**	Consummated	5.00	2.477	-2.386*
		6.00	2.334			6.30	1.664	
	Longevial	4.27	2.377	-3.314**	Orthodox	3.37	2.189	-3.951***
		6.17	2.052			5.83	2.627	
E	Festive	4.23	1.942	-2.951*	Scholarly	5.20	2.565	-2.300**
		5.60	1.632			6.53	1.871	
	Blessing	4.17	2.198	-3.699***	Wealthy	4.80	2.631	-2.469*
		6.17	1.984			6.30	2.037	
F	Longevial	4.13	2.417	-3.447***	Consummated	5.10	2.482	-2.144*
		6.13	2.063			6.37	2.076	
	Gorgeous	5.00	2.573	-2.371**	Orthodox	4.53	2.446	-2.826**
		6.40	1.958			6.27	2.303	
G	Festive	5.13	2.432	-2.537*	Brave	4.40	2.268	-3.798***
		6.60	2.027			6.67	2.354	
	Elegant	5.30	2.277	-2.842**	Folkish	3.53	2.145	-3.666***
		6.77	1.675			5.73	2.490	
H	Blessing	5.43	2.542	-3.427***	Scholarly	4.47	2.097	-4.174***
		7.40	1.850			6.83	2.291	
	Longevial	4.60	2.500	-4.230***	Wealthy	4.67	2.695	-4.030***
		7.10	2.057			7.17	2.069	
I	Gorgeous	4.77	2.750	-3.974***	Orthodox	4.07	2.677	-3.495***
		7.20	1.919			6.37	2.414	
J	Festive	8.80	1.789	2.626*	Brave	5.00	2.505	-3.169**
		7.47	2.129			6.93	2.212	
	Joyful	8.17	1.821	2.042*	Scholarly	5.43	2.344	-2.159*
		7.20	1.846			6.67	2.073	

G	Festive	8.23 6.43	1.357 2.096	3.949***	Folkish	7.93 6.17	1.437 1.931	4.020***
	Elegant	7.60 6.23	1.653 1.695	1.261**				
I	Festive	8.33 6.53	1.605 2.389	3.426***	Brave	5.33 6.73	2.202 2.067	-2.539*
	Elegant	7.77 6.27	1.775 1.964	3.104**	Wealthy	8.00 6.93	1.742 2.149	2.112*
	Longevial	7.73 6.37	2.180 2.205	2.414*				
J	Longevial	4.70 6.13	2.466 2.417	-2.274*	Wealthy	4.40 5.93	2.094 2.164	-2.788**
	Gorgeous	4.27 6.00	1.874 2.477	-3.056**				
K	Playful	5.93 7.87	2.463 1.655	-3.569***	Scholarly	6.50 7.63	2.374 1.829	-2.071*
	Brave	6.17 8.00	2.493 1.438	-3.489***	Healing	5.90 7.50	2.564 1.697	-2.850**
L	Festive	9.13 7.90	1.167 2.057	2.857**	Folkish	8.70 7.57	1.466 2.079	2.440*
	Playful	5.93 7.33	2.532 1.788	-2.474*	Healing	6.43 7.97	2.445 1.810	-2.761**
	Brave	6.80 8.33	2.552 1.516	-2.830**				
M	Festive	7.57 6.17	1.977 1.663	2.968**	Folkish	7.80 6.53	2.469 2.129	2.128*
	Longevial	8.10 6.77	2.203 2.315	2.286*	Wealthy	7.73 6.67	2.258 1.729	2.054*
	Playful	4.70 6.63	2.521 1.474	-3.626***	Orthodox	8.90 7.30	1.971 1.664	3.397***
N	Festive	9.27 7.90	1.311 2.155	2.967**	Healing	6.30 7.60	2.575 2.253	-2.081*
	Blessing	9.17 8.33	1.147 1.626	2.294*	Wealthy	9.03 7.93	1.129 2.016	2.607*
	Longevial	9.00 8.13	1.232 1.548	2.400*	Orthodox	9.17 8.10	1.206 2.074	2.436*
	Brave	6.43 7.97	2.359 1.810	-2.825**				
O	Playful	6.30 8.00	2.507 1.800	-3.017**	Healing	6.73 8.17	2.463 1.840	-2.554*
	Brave	6.60 8.60	2.343 1.522	-3.921***				

Note: ■ Local Taiwanese □ Immigrant * $p < .05$. ** $p < .01$. *** $p < .001$.

Through the use of the SPSS22 analysis, the maximum and the minimum of the value for the rhetoric are shown on Table 5, Table 6, and Figure 1. The result of the test on each of the cultural code imagery is analysed as follows: Examining the different perception of the consumers towards the various colour imageries presented by the “Fortune Chicken” with distinct cultural codes. This study uses the identical design of the “Fortune Chicken” with the calicos of different countries even with the application of the same colour the surface of nature for the colour will be dissimilar. Not only the brightness or saturation will be different, but also the hue can somehow be altered (S.Y. Lin, 1989). It is to probe the unique feeling which the colour used in the wedding can bring to people.

- 1) Sample “Fortune Chicken” O owns the highest average in the following rhetoric; “festive 8.53, blissful 8.93, joyful 8.57, elegant 8.43, blessing 8.73, longevial 8.63, playful 8.0, gorgeous 8.73, brave 8.6, folkish 7.9, scholarly 8.0, healing 8.17, wealthy 8.43, consummated 8.9, the total average is 8.46 which shows that there is a strong imagery perception for sample O. From the result of t-test conducted independently, there is an apparent difference in rhetoric between local Taiwanese and immigrants in Taiwan and the result is as follows: brave (-3.921***), playful (-3.017**), and healing (-2.554*). The result with negative sign shows that the acceptance rate of the immigrants in Taiwan is higher than that of local Taiwanese. In other words, brocade and satin weave are more popular among the immigrants in Taiwan. An unexpected result has been discovered during the interview by the researcher in which

the use of the pattern and colour in the Vietnamese wedding is similar to the one used on sample O since the majority of the immigrant subjects are Vietnamese.

- 2) Sample "Fortune Chicken" N obtains the highest average in rhetoric are longevial (8.6), playful (7.2), and gorgeous (8.8), the feeling of imagery is relative strong. The sample N is made of Brocade and Satin Weave with a little green pattern and its patterns are intense.
- 3) Sample "Fortune Chicken" L obtains the highest average in rhetoric are folkish (8.13), wealthy (8.67), and orthodox (8.72). The calico used on sample L is a common one for the traditional wedding gown of the bride in Taiwan. According to the information provided by the Vietnamese immigrants, they have used the identical calico when they got married in Taiwan. Sample L is made of Brocade with Satin Weave on top which scores the highest average in orthodox as sample O, they both are considered the colour for the traditional wedding.
- 4) From the independent t-test, among sample O, N, and L, the immigrants in Taiwan have a more obvious feeling than local Taiwanese towards the two pieces of rhetoric, healing, and brave. Therefore, these three samples hold a powerful sense of healing and bravery to the immigrants in Taiwan.
- 5) Sample "Fortune Chicken" A has obtained the least average in festive (4.2), blissful (4.68), elegant (4.3), blessing (5.12), longevial (5.03), gorgeous (5.02), and healing (5.15).
- 6) The samples with the least average are sample A, B, C, and D, but in terms of calico, American calico is more acceptable by the immigrants in Taiwan than local Taiwanese.
- 7) Sample "Fortune Chicken" H does not have any significant presentation regarding rhetoric on the t-test, this has proved that a similarity exists between local Taiwanese and the immigrants in Taiwan. Cotton and Plain weave made in Japan are popular for both local Taiwanese and the immigrants in Taiwan, and the average of rhetoric is 7.08, also the sample F and G which were made with calico used in the Japanese wedding have high acceptance rate of 7.44 and 7.08 respectively.

4.2. Discussion

In 1985, Rook had once mentioned that ritual indicates a presentation of a series of symbolic behaviour which it symbolizes (J. H. Lin, 2002). Wedding is a type of ritual and the "Fortune Chicken" is the symbol of marriage. Through the use of the implication hidden inside the colour, the imagery which delivers to people is purposeful as if the "Meaning" and "Image" being transformed and refocused onto an object which leads to a "Mood Swing"-like behaviour (M. M. Chen, 2006). In accordance to the memory and association, the impact of colour on the immigrants in Taiwan is deeply affected by their biological families, therefore, the immigrants in Taiwan have their preference for colour and they also have what Cahill had stated, the "Metaphorical Thinking". Besides, with the same colour, the change in quality will bring out a difference in brightness or saturation even the hue will be different (S. Y. Lin, 1989). While conducting the study, the researcher has discovered that among the 13 "Fortune Chicken" samples, 5 of those which were selected by the scholars are made of Taiwanese calico of

Brocade, however, the “Fortune Chicken” samples made of deep red colour cotton calico were not chosen. From this we can tell that the preferred material for the wedding is Brocade with shiny and gorgeous colour.

In this study, the largest average in rhetoric falls on sample O, N, and L after conducting the imagery scale test on the immigrants in Taiwan, it clearly shows that Brocade is the most favourable colour for local Taiwanese and the possible reasons are as follow: R. Faulkner had once said that colour can stir emotion, association, and memory (Q. F. Lu, 1993), in this study, the Vietnamese immigrants were invited as the subject outnumbered the rest of the nationalities even under random selection. A profound impact of Chinese culture has taken place in the Southeast Asia region, accompanying with the colonization of the West, language, written words and politics have been transformed, but with only one exception which is the wedding culture, it is still celebrating for the purpose of longing for auspiciousness and this derived from ancient Chinese culture. Particularly, the design of the “Fortune Chicken” is spherical with colour red and a little bit of yellowish red, it represents vivacity and can be associated with the Sun (S. Y. Lin, 1989). It brings out the warm feeling towards people and it is the best wedding gift. For the average of rhetoric, sample A, B, C, and D obtain the least average in all rhetoric except playful in which sample J obtains the least average, this clearly shows that the calico, made of cotton and Plain weave, from the United States is unfavourable for the wedding, especially the colours, white, and light blue, deliver a sense of coldness to people, furthermore, colour white can only be seen in a funeral in Taiwan. However, from the t-test, these colours are more acceptable among the immigrants in Taiwan. Perhaps, the concept of colour will change if the Western education influences the people in Taiwan for a little longer.

5. CONCLUSIONS AND SUGGESTIONS

With the application of identical design of the “Fortune Chicken”, the study targeted at probing the relationship of sensual rhetoric between local Taiwanese and the immigrants in Taiwan through the cultural presentation of calico pattern collected from the United States, Japan, and Taiwan. Meanwhile, the scholars were invited to select the samples for conducting the experiment of colour imagery tested on the subject of local Taiwanese and the immigrants in Taiwan so that the correlation of colour and sensual rhetoric can be established. And why did the study conduct the test on the deviation of colours? After conducting the survey and analysis for colour imagery, the result is assorted as follows:

- 1) Most of the immigrants participated in the experiment were Vietnamese and their acceptance towards sample “Fortune Chicken” F, G, and H which were made of calicos from Japan was relatively high from 7.08 to 7.44. Those samples were all in a presentation of warm colour and golden pattern, and there isn’t much deviation between the perception of local Taiwanese and the immigrants in Taiwan based on those samples, perhaps, it is because both Taiwan and Vietnam had once been colonized by Japan before.
- 2) Rhetoric with large average all fell on the calicos collected from Taiwan, the subjects of the study preferred chroma which is often used in the traditional wedding of Taiwan, along with

the use of brocade and satin weave, samples represented sense of joy and prosperity. However, sample “Fortune Chicken” M obtained the average of 6.91, although, it used red brocade, the black satin weave pattern presented low saturation which was unfavourable among the subjects.

- 3) Rhetoric with the least average fell on the calicos collected from the United States and sample J of Japanese calico, and the overall average was 5.53 which was close to sample M’s rhetoric average 6.91. This proved that colour white, blue, and black were not popular among the subjects and those colours could be easily associated with funerals.

In short, the preference of colour is profoundly influenced by tradition and custom. The wedding gift is an important present to the daughter. Its function is to deliver affection so items made with high saturation of chroma and with the use of brocade and satin weave are the most favourable in a wedding.

The suggestion for further study, the application of the wedding gift, “Fortune Chicken”, in other festivities can be further discussed, for instance, in Taiwan, when moving in to a new house, the word “Chicken” will also be used since it is homophonic to “Settle Down” in Chinese language, and the “Fortune Chicken” can be used as a mascot, so its usage is varied. The immigrant subject for the study is difficult to find and due to the language barrier, it is also difficult to communicate with them when conducting the survey, hence, the selection of immigrant subject from Southeast Asia is determined by the ethnicity with the highest proportion of the population in Taiwan. In the future, the researcher hopes to interview people countries other than those in Southeast Asia in order to probe the difference in preference. Also, the researcher hopes to collect more calicos with strong cultural code so as to increase the selection.

REFERENCES

- Huang L. J. (1997). *Contemporary Fiber Art Exploration*. Taipei: artist
- Lu Q. F. (1993). *Modelling Principle*. Taipei City: Lion Book
- Lin J. H. (2002). *Consumer Behaviour*. Taipei City: Zhisheng culture
- Lin S.Y. (1989). *Chromatics*. Taipei: Sanmin Bookstore
- Kottak C. P. (2011). *Cultural Anthropology* (13th ed). (Y.C. Xu & J. C. Xie Trans). Taipei City: Giant Streaming Book Company. (Original work published 2009)
- Zhu G.Q. (1982). *Western Aesthetics History*. Taipei County: Han Jing Culture
- Lin W. C. (1989). *Colour Scheme*. Taipei: Art Books

Yeh L. (1993). *Modern Aesthetics System*. Taipei: Shu Lin, p427.

Li Z. H. (2001). *Four Aesthetics*. Taipei: Sanmin, p84.

Chen M. M. (2006). *Broad Discussion of Imagery*. Taipei: Wanlou Lou Publishing House, p25-27.

A STUDY ON CULTURAL AND CREATIVE PRODUCT DESIGN MODEL FROM THE PERSPECTIVE OF PAPER CUTTING

Chiang Chang, TZU ^{*a}, Hui Huang, SHU ^b

^{ab} Graduate School of Creative Industry Design, National Taiwan University of Arts,
Banciao District, New Taipei City 22058, Taiwan

^achang.tc0214@msa.hinet.net, ^bshhuang@textiles.org.tw

ABSTRACT

Culture is a valuable asset of mankind, while innovation ensures the extension of culture. Chinese traditional paper cutting is unique in terms of art style, and its art creation and auspicious semantics differ from other pattern systems. This is because a cultural core based paper cutting design model should be the focus of the entire product design application in which the value of a complete design lies. The scope of research is limited to the outcome of the traditional paper-cut word “fu” (福, blessing) converted into cultural products, with literature analysis adopted as the main method. The three levels of conversion product attributes in three levels, namely, exterior, function, and interior, shall serve as references. The purpose is to construct a complete and logical design model through the paper-cut word “fu” (福) and three conversion attributes, which shall be provided for future designers to reflect on and apply. In terms of the steps of the design model, first the individual attributes of the word “fu” (福) are employed as references. Then, “the individual conversion attributes in three levels” are adopted as the method. Finally, the cultural content is used to complete the value-added paper-cutting design, thereby constructing the model system diagram of traditional paper-cut conversion cultural products and specifically converting traditional paper cutting into cultural product designs.

* Corresponding author.

E-mail address: chang.tc0214@msa.hinet.net (T. C. Chang).

Keywords: *traditional paper cutting, paper-cutting the "fu" (福) character, cultural and creative products, design model*

1. Introduction

The content in traditional Chinese paper-cutting is unique and extraordinarily significant. Unlike the realism in Western patterns and the spontaneity in Chinese paintings, the creator expresses his or her personal intuition and impression into a simple and lively piece of creation that specifically applies cultural aesthetics into everyday life. The word "fu" (福 , blessing) is one such example. Although traditional paper-cutting itself is desirable, including other cultural features by using modern designs can uncover its trendiness and enhance its appeal. With passing time, even if human psychology were to remain consistent, tools, objects, and cultures around the world are constantly changing. Technology will keep advancing, and while design principles continues to remain unchanged, their methods of application must adjust to new human activities, new technologies and new forms of communication and interaction (Norman, 1988). Therefore, the source of creativity for cultural products is the culture of daily life. Design is a creative behaviour that involves the reinterpretation of cultural meaning, followed by the extraction of inspiring cultural elements, and the use of design techniques to creatively transform these cultural elements into new forms that are meaningful to modern life, thereby integrating with modern lifestyle and satisfying the spiritual needs of consumers. Hence, through the cultural meaning of collective memories, designers can express their creative ideas to inspire consumers, and give purpose to their creative activity (Lin, 2014). To this end, the model for adding value to the character "fu" (福) paper-cutting involves 3 levels of attribute transfers, namely external transfer, functional transit, and internal transformation. Through such cultural value-added methods, cultural aesthetics can be specifically applied into everyday applications and meet the needs of modern living.

2. "Fu" Paper-cutting and Combination Rules

Traditional Chinese paper-cutting is a form of auspicious representation. Its implied cultural significance is not only expressed in the spoken language, but also in the propitious combination of "word" (言) and "image" (象) where "the image must be meaningful, and the meaning must be auspicious" (言必有意, 意必吉祥). Paper-cutting is built upon a profound cultural foundation that reveals a cultural connotation and philosophy that consummate the artistic creation. The character "fu" (福) is classic in paper-cutting. In the book *Shuowen Jiezi* (说文解字), Hsu pointed out that the character "fu" (福) means "bei yeh" (祓禊 , sacrificial ritual), and refers to "ji tong yue" (吉同月), a sacrificial litany. In the Offerings of the Sage, the virtuous will be protected and their sacrifices blessed by the gods. Therefore the significance of making sacrifices is to receive protection and blessing from the gods. The Chinese forefathers believed that happiness is granted by Heaven and their ancestors, and therefore they should offer sacrifices to their ancestors. Such a concept is visible in the construction of the character "fu" (福), where the

"Shih"(尸) radical on the left represents the shrine, altar, and other sacrificial concepts while the early form of "fu"(𠂔) on the right represents respect and ladle type wine vessels. The act of offering up the "fu"(𠂔) with a pair of hands and pouring wine into the altar represents "chi fu" (𠂔, praying for blessing). To this end, when virtuous or accomplished individuals are protected through sacrificial worship, they are blessed with manifestations of happiness and the common people are in turn protected. Hence the expression "wu fu" (𠂔, five blessings), namely longevity, wealth, health, love of virtue, and natural death describes the five greatest blessings of living a long and successful life of wealth, health and well-being, good deeds, and dying a natural death. The character "fu" (𠂔) is also similar in pronunciation to "fu" (𠂔, wealth), and hence symbolizes riches and honour, good fortune, and happiness. Evidently, in addition to the original meaning of wealth and longevity, it defines the meaning and hope of supplication, warding off evil, happiness, and bliss.

The paper-cutting culture is particularly significant in that collective rules are formed through cultural heritage. Tao (2003) believes that the rules generated from mascots are derived from (1) Homophonization (同音): Homophonic Chinese characters are primarily used as paper cutting themes by utilizing the Chinese characters feature of having the same sound but different meaning to illustrate unique themes in a pattern. For example, the character "fu" (𠂔, blessing) has the same pronunciation as the character "fu"(𠂔) in the "bian fu"(𠂔, bat) pattern. The "fu" (𠂔) in the centre surrounded by 5 bats implies "wu fu lin men" (𠂔, May fortune descend on your household) and blessings; (2) Representation (象形): Meanings are drawn from animal and plant attributes and object shapes. For example, the continuity and incessancy of seawater represents peace and eternity; (3) Demonstration (指事): Images and artistic manifestation are derived from familiar and specific logic. For example, ancient "qian" (𠂔, money) represents wealth and honour, and assonates with "qian" (𠂔, front) while "fu"(𠂔) represents "fu qi" (𠂔, blessings); hence "fu zai yan qian"(𠂔, Blessings before the eyes) represents an abundant wellspring of wealth; (4) Association (借代): The meaning in a pattern is borrowed from inspiring tales told by storytellers. For example, the "Si fu" (𠂔, blessing) held in the hands of the heavenly "Caishenyeh" (𠂔, the god of wealth) is a metaphor for "tian gong si fu" (𠂔, blessings from heaven and good fortune); (5) Integration (综合): Formed by a combination of multiple auspicious elements, the pattern becomes even richer in meaning. For example, as shown in Fig. 1, the pattern combination of the rooster, sun, and bamboo is a metaphor for "yi ming jing ren" (𠂔, amazing the world with a single brilliant feat), indicating dazzling career and academic success.



Figure. 1: Paper-cutting rules

2.1 Transfer of Cultural Attributes in Paper-cutting

Culture is a common form of life among humans while history is their common memory. In terms of cultural and creative thinking, creativity is the pursuit of consumer inspiration and recognition through transfer of cultural meaning. Therefore, cultural creativity that can reflect common life experiences and common historical memories is most likely to inspire consumers. Hence, a redefinition of design must include a return to cultural thinking. Early design development emphasized the principle of randomness in form, but the contemporary contention of hundreds of schools of thought is that product design is no longer about function and shape, but should be committed to cultural heritage and preservation. Moreover, innovation has always been the driving force of economic growth, and the threshold for technical opportunities has become increasingly low. The challenge of innovation is not the discovery or development of technologies, but the adding of value to these technologies, which is, finding the most meaningful application. Design-driven innovation is precisely a method for adding value and meaning to technology. It emphasizes the creation of more meaningful products and services, and such a pursuit is facilitated by new technologies (Verganti, 2009). As such, in the creation of cultural products, cultural elements inherent in cultural objects must be re-examined and reconsidered, and through design, transferred into new forms that are consistent with the modern era. Moreover, how the use of such objects can facilitate psychological satisfaction should also be explored (Lin, 2004).

Leong and Clark (2003) proposed a three-level design framework for a comprehensive theory of value-added cultural design, namely the external level, intermediate level and inner level. Hsu (2004) delineated three attributes of cultural design, which Lin (2007) summarized as (1) External or appearance level, including colour, texture, shape, surface motifs, lines, detailed treatment, and other structural relationship; (2) Intermediate or behavioural level, including function, operability, ease of use, safety, and associations; and (3) Internal or psychological level, including special product meaning, product story, product sentiment, and product cultural features. Norman (2004) believes that design must include the following three levels: visceral level, behavioural level, and reflective level, and corresponding product attributes are: (1) Instinctive design: appearance, which includes product appearance, touch and feel; (2) Behavioural design: the use of fun and utility, including functionality, performance, and ease of use; and (3) Reflective design: self-image, personal satisfaction and memory, including feelings, emotions and cognition.

In summary, contemporary product designs must not only meet the functional needs of consumers, but must also predict user mood when using the product. By creating possible scenarios based on product meaning, designers can quickly deduce the information actually needed by users and add value to the product design. In addition to aesthetic appearance, product function must also satisfy behavioural needs in order to create an innovative product that is rich in content, convincing, and fascinating. Through such innovation, culture can be deeply embedded into a product to create meaning and depth in its basic application, and a comprehensive method and framework for cultural product design can be constructed.

3. Transferring the "Fu" Character into Cultural Product Design

Through literature review, this study examined combination rules in traditional paper-cutting, and analysed the significance of the shape and meaning of the character "fu" (福). By using attribute transfer to add value to a cultural product design, a model is constructed for the cultural transfer of "fu" (福) in paper-cutting. The design process comprises two major steps: analysing the combination rules and character meaning in the paper-cutting, followed by adding value according to attributes to complete the cultural product. First, paper-cutting rules are analysed and the cultural level clarified. Second, the meaning of the character "fu" (福) is analysed. Here, product cultural level is analysed according to appearance and philosophical meaning. Third, individual attributes are transferred to the products. In this process, after the character "fu" (福) is analysed and the individual attributes transferred, product characteristics are distinguished and value added through design, and finally the cultural products are constructed. All the components of the design framework serve to establish the benchmarks for paper-cutting rules, determine the features and cultural characteristics of the character, and through transferring the characteristics to product attributes, complete the design cycle of value-added cultural products. In other words, the cultural product is created within a cognitive product design framework that comprises methods and order, as shown in Fig. 2.

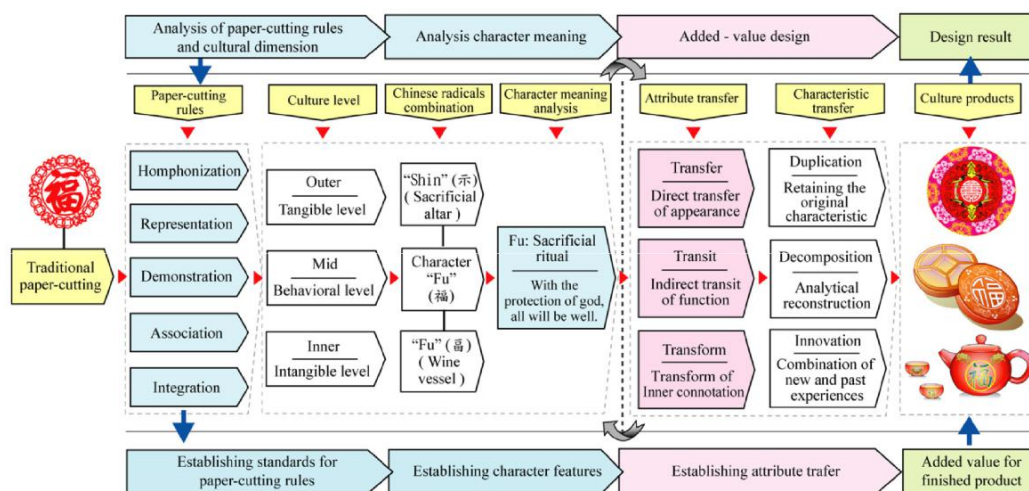


Figure. 2: Product design model for the cultural transfer of the character "fu" (福).

3.1. Tangible Level Transfer

Tangible level transfer is an application of outer shape. Creators select or reorganize their thinking based on attributes such as shape characteristics, colour meaning or lines, and then create value-added design that reveals a new dimension. Zuo (1998) points out that in Chinese folk art, the circle is an important feature representing perfection, that is, successful conclusion, completeness and happiness. Objectively, it reflects the perfection of the universe. This concept has become the psychological ideal of completeness, and hence folk art emphasizes successful

conclusion and completeness in its pattern features, and paper cutting is one such example. Therefore, transferring the circle into product characteristic to fulfil human hope for perfection is likely the most symbolically meaningful form of expression.

The appearance combination of the character "fu"(福) can be divided into two parts: First, in terms of shape, the character is a symmetrical. The radical on the left, "shih"(示), is associated with the altar or celestial sacrifices while the "fu"(畐) on the right is related to wine vessels and people. Second, in terms of righteousness, using two hands to offer up wine to the altar signifies praying to the heaven for success and protection from disaster. To this end, conceptualizing design transfer to products at the tangible level is divided into four parts:

- (1) External features: Commanding the circular dish shape to manifest the feature of perfection;
- (2) Colour and space: Alternating red and yellow to deliver a visual sense of auspicious feature;
- (3) Design presentation: Centrally positioned and balanced form illustrates harmony and complement; and
- (4) Connotation: Using "liang" (兩, two) and patterns to connote the merging of two into one. In the dish, the "fu"(蝠) as in the two bats, "bian fu"(蝙蝠), and the "fu"(福) as in the character for blessing, are homophonic. Their circular and symmetrical arrangement with the character "shou" (壽, happiness and longevity) in the middle is derived from the expression "fu shou shuang chuan" (福壽雙全, blessed with both happiness and longevity). It is a contemporary sacrificial dish showing a design that expresses complete perfection, as shown in Fig. 3.

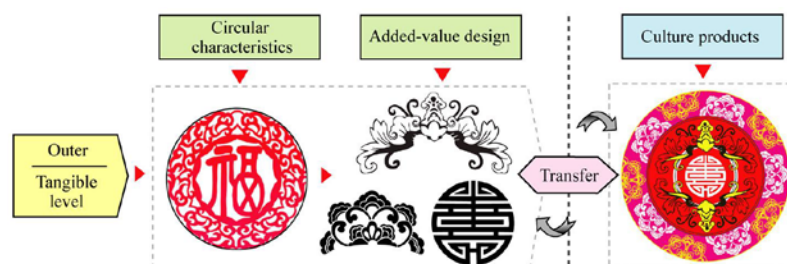


Figure. 3: External transfer of perfection into product design.

3.2. Behavioural Level Transit

In behavioural level transit, user behaviour becomes the indirect mid-level application. The creator analyses or re-deconstruct product function, convenience, and safety to achieve product transformation. Hollows are the most important feature in paper-cut silhouettes. Hollows are cut or carved out of paper to create connected and unbroken positive lines and connected and unbroken negative lines. Such rule is foundational in paper-cutting because a fragmented, incomplete pattern is imperfect. In paper-cutting, the pattern structure must be compact and neither disjointed nor messy, and the components must be simple and evenly laid out. Uniformity must be found in variation; rhythm in balance, and accord in symmetry so that the pattern is not fragmented and remains complete and beautiful (Bao, 1999). To this end, in the structure design of paper-cutting, the centre of the pattern must first be found, then aligned with the centre of the paper to achieve the best and most representative result. Then through folding and cutting, a complete hollow pattern is obtained, thereby achieving the

design goal. Hence, in paper-cutting, centrality, smoothness, and stability are important in the structure design, and its basic structure must remain intact and unbroken regardless of the number of cuts. Therefore, in transferring paper-cutting to a product design, hollow but connected patterns and balanced negative and positive lines are the most important characteristics that should be manifested.

In the product function level, design transfer can be divided into four parts: (1) First, external features: Understanding the circular shape of the candy box to show the integrity of the product; (2) Colour and space: using rich colours and openwork lid to display product features; (3) Component display: Configuring the character "fu"(福) in the middle of the hollow and coordinating with the 5 bats to create a balanced pattern that demonstrates a balance between the negative and positive; and (4) Connotation: Manifesting meaning using a candy dish with five "fu" (幅, pieces) of compartments, which is the homophonic of "fu" (富, wealth), arranged in a circular fashion. In addition to signifying "wu fu" (五福, five blessings), with the character "fu" (福) on the openwork lid, the act of taking snacks or sacrificial objects from the dish means receiving the five blessings, and is a contemporary design on a candy to symbolizes success and good fortune, as shown in Fig. 4.

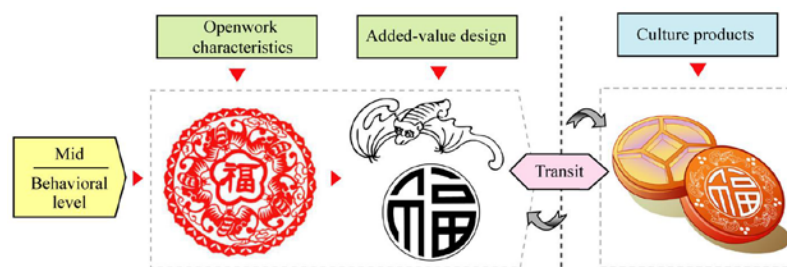


Figure. 4: Functional transit of openwork into product design.

3.3. Intangible Level Transform

Intangible level transformation is the application of inner spiritual meaning, and the focus is on the resulting combination of new and old significance, story, or cultural features. The concept of auspicious is central to paper-cutting, and the implied culture is deeply influenced by traditional Chinese culture thoughts, which affect artistic connotation and manifestation. In addition to perfect form, the pursuit of techniques for creating images is even more important, and methods that demonstrate "zhong he" (中和, compromise and harmony) are used to convey aesthetic consciousness. Peng (2007) points out that in Chinese art, "zhong" (中, compromise) is a principle for correctly dealing with contradictions, and is both a standard and method; "he" (和, harmony) refers to uniting diversities or oppositions, and is both a state of form and mechanism for achieving complete harmony and unity. In ancient wisdom, everything comes in two, such as yin (阴) and yang (阳), false and true, hard and soft, and inverse and converse. In fact, everything is characterized by opposite and complementary attributes that

are both connected and mutually dependant, where "one becomes two" (一分为二), and "two becomes one" (合二为一). An overall aesthetic sense of fullness, wholeness, completeness, and brilliance is pursued, while in pattern structures, uniformity, symmetry, perfection and completeness are emphasized, and irregularity and brokenness are taboo. Most pictures are in pairs because symmetry and even numbers engender peace and perfection. In terms of colours, red, gold, and yellow are commonly used by the people while lines used are clean, simple, vibrant, rhythmic, and regular (Tong, 1996). Therefore, to connote auspiciousness, designs should focus on transferring spiritual harmony and health to product design.

Our forefathers had absolute imagination and awe for the infinite universe, and so respectfully offer supplications to the heaven and unknowns using articles or food. "Zun" (尊, wine vessels) were receptacles used by the ancients in their worship and supplication, and corresponding product used in modern sacrifice is the "hu" (壶, pot), where the integration of external and functional features becomes foundational to overall transfer. The transfer in product design can be divided into four parts: (1) External features: Understanding the round shape of the pot to construct the external appearance, and using openwork in the body of the pot to manifest perfect auspicious characteristics; (2) Colour and space: The configuration of red, yellow, and white portrays a visual perception of auspiciousness; (3) Component display: The character "fu" (福) in the middle configured with ancient money produces a symmetrical and smooth pattern; and (4) Connotation: The combining of "hu" (壶, pot) and "bei" (杯, cup) represents the uniting of two objects into one. At the same time, "hu" (壶, pot), "fu" (福, blessing) and "fu" (富, wealth) are homophonic, and imply wealth. The addition of the character "fu" (blessing) and ancient money further connotes "fu zai yan qian" (福在眼前, fortune or happiness before one's eyes, implying blessing), and also transforms the pattern into a contemporary pot for practical and sacrificial use, with a design that symbolizes auspiciousness, bliss, and plentiful sources of wealth, as shown in Fig. 5.

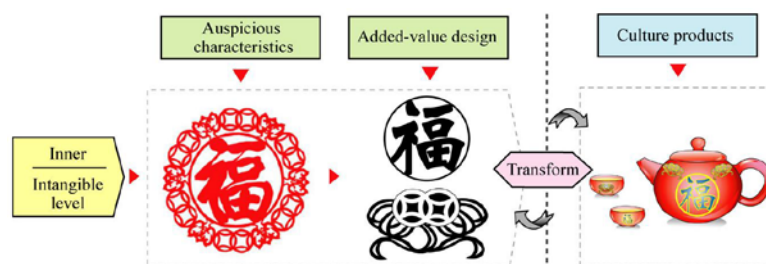


Figure. 5: Intangible level transfer of auspiciousness into product design.

4. Conclusion

In this paper, the traditional paper-cutting of the character "fu" (福, blessing) is used as a framework for conceptualizing design. A design model with the transfer of three levels of

attributes to products is also used to demonstrate the meaning and characteristics of cultural products, and the following conclusions are made:

(1) External Transfer: A circular shape represents completeness and no defect, and symbolizes perfection and absolute auspiciousness. To this end, transfer is based on the perfection of external features. The shape and meaning of the character "fu" (福) in paper-cutting are closely tied to human supplication for success. Hence, using the circular shape of a dish, the two bats evenly configured around the circularly shaped character "shou" (寿, longevity) constitute the basic external thematic pattern for product transfer. In addition, the primary use of red colour emphasizes the auspicious symbol, and the merging of two into one in the pattern configuration manifests the absolute "fu shou shuan chuan" (福寿双全, complete in both blessing and longevity) symbol of perfection in the cultural product design.

(2) Functional Transit: The hollow feature with unbroken and connected lines is the greatest characteristic of paper-cutting while the character "fu" (福) is closely associated with the utensils used in sacrifices and worship. Hence, the design is applied to the candy dish which have both sacrificial and practical uses. The five "fu" (幅, pieces, homophone with "fu" 富, wealth) are the compartments in the candy dish, and are arranged in a circular pattern to imply "wu fu" (五福, five blessings). In addition, the auspicious colour, the main use of the character "fu" (福) on the lid, which is laid in openwork characterized by hollows and complements of negative and positive, are smoothly and symmetrically integrated. In addition to using the dish for snacks or sacrifice and the connotation of receiving the "wu fu" (五福), the specific application of the silhouette cutting of human philosophy into the design allows for better appreciation of the cultural imagination and fun in a culturally meaningful contemporary candy dish design that exhibits success and good luck.

(3) Internal Transform: Traditional thinking in Chinese culture is characterized by the common psychological phenomenon of auspiciousness. Our ancient forefathers had absolute imagination and awe for natural phenomena and celestial bodies that affect everyday life, and "chi fu" (祈福, praying for blessings) became a psychological assurance for their hope of success and protection from bad luck. Therefore in the transfer of designs to auspicious pots for sacrificial or practical uses, the external shapes are round to symbolize perfection and auspicious colours are also used to create a sense of visual psychology. In the pattern design, the character "fu" (福, blessing) in the middle configured with ancient money produced a symmetrical, smooth, and solid structure. On the body of the pots, the openwork negatives and positives characterizing paper-cutting are used to demonstrate the ultimate brilliance of the product. The product combines "hu" (壶, pot) and "bei" (杯, cup) to convey the uniting of two objects into one. At the same time, "hu" (壶), "fu" (福), and "fu" (福) are homophonic, and thus not only imply wealth and honour, but with the pattern combination of the character "fu" (福) and ancient money, also creates the vision of "fu zai yan qian" (福在眼前, fortune or happiness before one's eyes).

Overall, the form and content in paper-cutting are dominated by Chinese philosophy and transmit cultural aesthetics into everyday application. However, the circle represents the psychological hope for perfection, and hence the birth of the character "fu" (福). Whether divided into two parts or merged as one, the font remains aesthetically balanced in its symmetry or complements of negatives and positives. The seemingly complex paper-cut patterns nevertheless conform to the rule of seeking similarities among differences. Such conceptualization simplifies the complex, and allows for ease of completing the creation. The invariable dual relationship of yin (阴) and yang (阳) or complement and opposition is the most concrete demonstration of the principle of compromise and harmony. Its absolute wisdom also made it the highest rule and thought pursued in traditional Chinese culture and art.

Reference

- Bao, J.H. (1999). *The Art of Paper-cutting*. Shandong, Shandong Education Press, p49.
- Han-Xu, S.Z. & Qing-Duan, Y.C. (1985). *Shuowen Jiezi*. New Taipei City: Hanjing.
- Hsu, C. H. (2004). *An application and case studies of Taiwan aboriginal material civilization conferred to cultural product design (Unpublished master's thesis)*. Department of industrial design, Chang gung university, Taoyuan Taiwan.
- Leong, D., & Clark, H. (2003). Culture-based knowledge towards new design thinking and practice-A dialogue. *Design Issues*, 19 (3), 48-58.
- Lin, R. T. (2004). Cultural creativity, Value-added design. *Art Appreciation*, 1 (7), 26 -32.
- Lin, R. T. (2007). Transforming Taiwan aboriginal cultural feature into modern product design: A case study of cross cultural product design model. *International Journal of Design*, 1(2), 48.
- Lin, R. T., & Kreifeldt, G. J (2014). *Do not touch! Design technology & the art of conversation*. New Taipei city: Yu Chen enterprise co., ltd.
- Norman, D. A. (2004). *Emotional design: Why we love (or hate) everyday things*. New York: Basic books.
- Norman, D. A. (1988). *The design of everyday things: Revised and expanded edition*. Basic books.
- Peng, J.X. (2007). *The History of Chinese Art*. Beijing, Peking University Press, p564; pp569-571.
- Tong, W. E. (1996). Auspicious patterns of children play. *The national palace museum monthly of Chinese art*, 1(157), 4-17.
- Tao, S. Y. (2003). *Chinese mascots*. Taiwan: Dong Da.
- Verganti, R. (2009). *Design-driven innovation: Changing the rules of competition by radically Innovating what things mean*. Boston: Harvard Business.
- Zuo, H. Z. (1998). *Chinese folk art modelling*. Chinese: Hu Nan.

A STUDY OF SERVICE DESIGN APPLIED ON TRADITIONAL MARTIAL ARTS

Ming-Chw, WEI^{*a}, Yung-Cheng, HSIEH^a, Shu-Hui, HUANG^b and Liang-Yu, CHEN^c

^{*a} National Taiwan University of Arts, Taiwan, E-Mail:ntua10070801@gmail.com

^a National Taiwan University of Arts, Taiwan, E-Mail: ych@ntua.edu.tw

^b National Taiwan University of Arts, Taiwan, E-Mail:shhuang@textiles.org.tw

^c National Taiwan University of Arts, Taiwan, E-Mail:aries951753@gmail.com

ABSTRACT

Traditional Chinese martial arts is one of the index items for the recognition of the Western world towards the Oriental culture. However, among the modern young generations, traditional martial arts are strongly marginalized and become a part of the temple fair culture. Even if the government has started to take such traditional folk sport seriously, the number of inheritors is gradually reduced, and talents are in shortage in the realistic situation. This study discussed traditional martial arts protected by intangible cultural heritage by means of data analysis, integrated the knowledge hierarchy of service design into the inheritance and protection of traditional protection. Whether a new heritage strategy can be built is the purpose of this study. To sum up the heritage mode of traditional Chinese martial arts, the following three suggestions are proposed in the study finding as the directions of thinking on the planning of traditional martial arts inheritance by firstly improving the recognition on traditional martial arts, excellent traditional culture becomes a part of our lives, which can last for long. Secondly, enhancing the capacity of traditional martial arts and combining the features of generations to absorb the input of more young groups is innovative and creative. Thirdly, building a platform and strategic alliances and gathering resources can increase the effect of heritage.

Keywords: service design, traditional martial arts, intangible cultural heritage.

* Corresponding author.

1. INTRODUCTION

Martial arts is a body building method and a cultural symbol which is nourished and developed in Chinese civilization. It is a combination of techniques and arts, as well as a part of entertainment and the lives of common people. Cultivating virtues before learning martial arts, while studying etiquette before learning skills. Chinese martial art is one of the earlier Chinese cultural icons known to the world. The rich connotation of martial arts gives them product creativity meeting spiritual and cultural needs in modern society. For instance, the movie "Yip Man" is a perfect example. Nevertheless, traditional martial arts gradually decline in modern society. It is an issue worthy of exploration on how to convert numerous figures famous for traditional martial arts and materials formed by accumulation of cultural relics into a cultural industry chain through the way of service design to enable propagation and promotion in the scale effect and make them easier to be accepted by young groups.

1.1. Study Background

With its unique charm, traditional martial arts absorb the essence of different genres and integrate traditional cultural cores such as martial arts culture, national spirit, and morality education of martial arts, forming the cultural product with national characteristics. Nonetheless, with the changing times, traditional martial arts have generated an essential value divergence which is the main reason for the contradiction between "criticism and praise" and "inheritance and development" in the inheritance process of traditional martial arts. Functionalism proposed: the existence of a specific cultural trait is due to its performance of a certain important social function. The development of martial arts shall seek a new integrated value to establish a good environment for the evolution of traditional martial arts. In the trend of globalization, cross-border communication have become normal, and Taiwan is no exception. "Local is global". In the key time of global evolution of traditional martial arts, coexistence, and integration are important transition thinking for the modernization of traditional martial arts.

Modern society has entered the age of experience economy. Based on the theoretical process of service design, this study sets up the knowledge hierarchy of traditional martial arts, as well as discuss and analyse the feasibility of utilizing the service design process to inherit and develop traditional Chinese martial arts, which was the motivation of this study.

1.2. Purpose of Study

Traditional martial arts experienced three great social changes in modern China. Growing commercialization had changed people's lifestyle and the cultural spirit of traditional martial arts had been replaced by various leisure and entertainment (Niu Aijun, 2008) since the reform and opening-up in the China mainland. During the civil war in 1949, many martial arts inheritors carried corresponding classics and retreated to Taiwan with Kuomintang. These people gradually decayed in Taiwan, and their classics scattered among the public. "Culture is of non-productivity, and it is impossible to be reconstructed once it is lost" (Hu Liping, Xie Qianmei

and Gao Chengqiang, 2011). Traditional martial arts culture is confronting such dilemma. Whether integrating modern service design knowledge and theory into the management of traditional martial arts is helpful for the inheritance and development of traditional martial arts is the purpose of this study.

2. LITERATURE REVIEW

The Three Character Classic says "and the genealogical connections should be examined, so that the end of one dynasty, and the beginning of the next may be known". It means that the past must be known first in order to know the future. This study conducted literature review on three orientations, namely traditional martial arts, service design, and intangible cultural heritage to sum up and reorganize the data analysis of the study.

2.1. Traditional Martial Arts

Chinese martial art is the product under Chinese traditional civilization featured by extensive contents. In the China mainland, it is often known as "Wushu", manifesting the connotation of Chinese culture and the background of the revolution of the Communist party of China; while it is called "Kuoshu" by the government of the Republic of China", manifesting the background of the government of Taiwan. Since the end of the Qing Dynasty, "martial skill" had been used together with "martial art" (Sports Commission, Executive Yuan, 2011). Adam Chi Hsu, the famous martial artist interpreted in this way: "In my opinion, Chinese martial arts need to be modernized at both domestic and international stages. However, modernization does not equal to westernization. It must not be westernized, because we would automatically turn into Westerners and lose our oriental traditions if martial arts are westernized. It is absolutely not a racist comment. What I mean is that you would fundamentally change such thing. I heard China mainland often said martial art belonged to people of the world. Therefore, we should reserve it as our gift and enable people of the world to enjoy it. If it is westernized, it means that we discard this gift. We might have the heart to dedicate, but it is void, so we strongly advocate the modernization of martial arts; but I absolutely object to its westernization". (Adam Chi Hsu, 2002)

Since the retrocession of Taiwan, martial arts have developed roughly in several orientations:

1. Famous martial artists have emerged in a large number since they retreated to Taiwan from China mainland, spreading plenty of traditional martial arts genres to Taiwan. The temporal and spatial barriers enabled traditional martial arts in Taiwan to preserve many original varieties, sub-varieties, and even new derived varieties, which was of great significance to the inheritance of Chinese culture.
2. All kinds of organizations related to traditional martial arts were successively founded. Among these organizations, "Chinese Martial Arts Training Institution" founded by Chen

Pan-Ling in 1950 was the earliest one. A good many people with lofty ideals participated in such organizations. The government not only regarded traditional martial arts as sports and culture, but also a part of public security and political mobilization.

3. The spread of martial arts at school could be divided into the promotion conducted by official Ministry of Education and student societies. Particularly Chinese martial arts clubs established in universities and colleges cultivated countless senior elite martial arts inheritors whose passion for martial arts lasted a lifetime. They were truly the mainstay in the development of Taiwan's traditional martial arts.
4. Martial art in the troop was founded by Lee Won-Chi, the former teacher of Central Kuoshu Institution and the son-in-law of a martial art master named Tung Chung-Yi in modern times. After that, Chiang Ching-Kuo who acted as the vice president of the Executive Yuan at that time visited South Korea and saw the strong power of its fighting skill, so he introduced Taekwondo and otherwise set up Chikwondo for popularization.
5. One of the academic developments of martial arts was the Wu Tan Magazine established by a civil group named Wu Tan Magazine. The key man of this magazine was Adam Chi Hsu, the veteran of Wu Tan Magazine. Moreover, with the support of Kuoshu Wushu Federation of the Republic of China, Chinese Culture University created the Kuoshu Group of the physical education department, which was the only academic department cultivating Kuoshu talents in Taiwan.

The main reasons were the essence of traditional Chinese culture and the prosperity of temple fair cultural activities. Being impacted by the ideological trend of leisure and health, the public increasingly pay attention to regimen by martial arts, thus the development of martial arts is integrated into enterprise-oriented operation, which is an inevitable tendency. (Sports Commission, Executive Yuan, 2011)

2.2. Service Design

Nowadays, "design" specialty is rapidly developing and changing. In addition to its inseparability with economic activities, the correlation between design, value and service is more important. In *The Experience Economy, Updated Edition*, Pine II and Gilmore presented "The evolution of human economic activities has changed from pure product sales to experience of emotional life" (Pine II & James H. Gilmore, 2013). In the recommendation preface of this book, Sun Jui-Sui presented "experience economy is a kind of creative market, driving the new NOHAS movement". In the experience economic times, people want to buy a feeling, a story or even a sense of identity, and new experience economy changes the service process and enables the element of culture to act as an unprecedented key role, restructuring opportunities of emerging culture."

Dansk Design Centre defined "service design" as a design of systems and process around the idea of rendering a service to the user (Bedford & Lee, 2008); Copenhagen Institute of Interaction Design defined service design as (Design, 2008):

- It is an emerging academic sector, aiming at setting up complete and deliberate service experience through integrating tangible or intangible media.
- Its purpose is to provide users with full service and plan a system and process design.
- It is interdisciplinary knowledge that must combine many design skills, management, and working procedure.
- Service is the thing that has already existed in different forms since ancient times, but the truly designed service must be brought into the new business model that knows the demands of users and creates new social values in society.
- It is an indispensable element in knowledge economy.

Therefore, the main purpose of service design is to make the service you deliver useful, usable, efficient, effective, and desirable so as to meet the expectation of customers (Design Council, 2010). The output of service design might be tangible or intangible, including product, communication, environment, or behaviour. As a whole, the outcome of service design can be manifested in multiple forms. In this is Service Design Thinking: Basics, Tools, Cases, Stickdorn, Marc Schneider & Jakob (2012) proposed five principles for thinking on service design:

1. User-centred
2. Co-creative
3. Sequencing
4. Evidencing
5. Holistic

Service design is of diverse functions, which not only emphasizes the connection between customer feeling and service, but highlights their personal involvement in servicescape. Here, servicescape refers to the sum of service delivery and physical environment for interaction between enterprise and customer. Service design is a more macroscopic design activity planning and procedure. If service brings customers an experience, service design shall stress its capability of delivering customers a series of desirable unique experience designs.

2.3. Intangible Cultural Heritage

Intangible cultural heritage (ICH) is also known as non-material cultural heritage. According to the definition in Convention for the Safeguarding of Intangible Cultural Heritage drafted by UNESCO, it refers to "the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognize as part of their cultural heritage". Intangible cultural heritage is the crystal of people's living culture and the accumulation of wisdom from past generations. Mr. Feng Jicai, the chairman of Chinese Folk Literature and Art Association commented intangible cultural heritage like this, "Like human material heritage, human

intangible cultural heritage is the crystal of human civilization and common precious wealth, which is the cultural lifeline for continuity of human society. Intangible culture is often more important than tangible culture. Intangible cultural heritage contains unlimited human emotion as well as profound significance and value" (Feng Jicai, 2002).

Xiang Zhaolun, the deputy minister of culture of China proposed five orientations to correctly understand intangible cultural heritage.

1. Intangible cultural heritage passes on from generation to generation, which is of cultural significance and social function to provide related communities and groups with sense of identity and continuity. Such cultural heritage is vivid instead of static. Intangible cultural heritage is inherited in practice which is dynamic and creative, hence the inheritance of intangible cultural heritage is dynamic rather than negative. Intangible cultural heritage is not cultural relic or living cultural relic that could not be recreated. Recreated cultural relics can be deemed as "counterfeits".
2. The owner of intangible cultural heritage is a community or group or even an individual. Typical inheritors at different levels are the representatives of extensive groups of inheritors and practitioners. Most intangible cultural heritage items are heritages shared among group members, which can survive and develop by means of collective inheritance and continuous recreation. The maintenance and expansion of inheriting groups is the foundation for extending historical context, preserving ethnic characteristics, and flourishing in contemporary life.
3. The communities, groups or individuals holding intangible cultural heritage are inheritors, practitioners, and creators who shall enjoy and acquire rights for benefits, creative expressions as well as learning and training. Respecting the dominant status and rights of inheriting groups is an important principle in the work about intangible cultural heritage.
4. Effective protection measures are those that can guarantee the vitality of intangible cultural heritage, including explicit affirmation, record, filing, preservation, research, and inheritance of intangible cultural heritage law and convention, particularly the concrete measures that ensure the inheritance of representative works of intangible cultural heritage by means of formal and informal education, namely social education and school education.
5. Due to the changes in production and life style, young people are unwilling to learn or inherit, which is the reality that must be taken seriously. The significant goals in the works about intangible cultural heritage is to constantly enhance the vitality and aftereffect of inheritance of intangible cultural heritage as well as spread outstanding Chinese traditional culture by inheriting intangible cultural heritage to improve related people's lives and promoting the young generation's

understanding about intangible cultural heritage and their enthusiasm for participation (Xinhua News Agency, 2016).

Wang Wenzhang, the director of China Intangible Cultural Heritage Protection Centre pointed out "As a living culture, intangible cultural heritage has been affected by human society structure and environmental changes as well as restricted by its own existence pattern, so its social existence foundation will inevitably narrowed down. It is the influence of social development necessity. In consequence, such influence will accelerate the extinction of traditional culture and weak culture. The Cultural spirit and the human feeling of a specific nation or group embodied by those cultures will be decomposed or replaced by unstable cultural concepts generated in modern industrial society. The decomposition of those cultural expression forms in which cultural traditions are condense among the groups is difficult to be measured by any external scales, which will certainly bring confused values" (Wang Wenzhang, 2009). To sum up, rescuing and protecting those intangible cultural heritages in living predicament have become a very urgent historic task given by the era.

3. STUDY METHOD

This study applied data analysis to discuss the theoretical connotation of service design as well as inheritance and development of traditional martial arts. It utilized the five service design processes to analyse the feasibility of service design in the construction of inheritance and development process of traditional martial arts among intangible culture heritages.

4. STUDY & ANALYSIS

Cultural form is in a close relationship with social development. In 2003, UNESCO announced the Convention for the Safeguarding of Intangible Cultural Heritage, which explicitly pointed out "intangible cultural heritage passes on from generation to generation. It is continuously recreated in the adaption of communities and groups towards surroundings and the interaction between human and nature and history, which provides senses of identity and continuity to enhance the respect for cultural diversity and human creativity". Under the five thinking principles for service design, service design is a process in which four stages, namely exploration, creation, reflection, and implementation are continuously repeated. (Design Council, 2007).

Service design refers to that a service enterprise makes planning and design for its service and operational management based on its characteristics and operative goals. Its core significance is the integral design of service package and service delivery system. Traditional martial art exists in specific groups, which is unable to blend into the daily lives of the social mass. Fei Hsiao-tung, the famous ethnologist said, "culture is so fragile that it will decline once it breaks away from its dependent cultural circle; but culture is so strong that it can go out and

come back, which need collective reflection and awareness of an ethnic group. In the end, it will turn into a collective exodus or collective regression" (Han, 2007).

The inheritance of martial arts has their rites and identification. Regarding the process of martial arts inheritance, this study constructed and analysed a flow chart, shown in Figure 1:

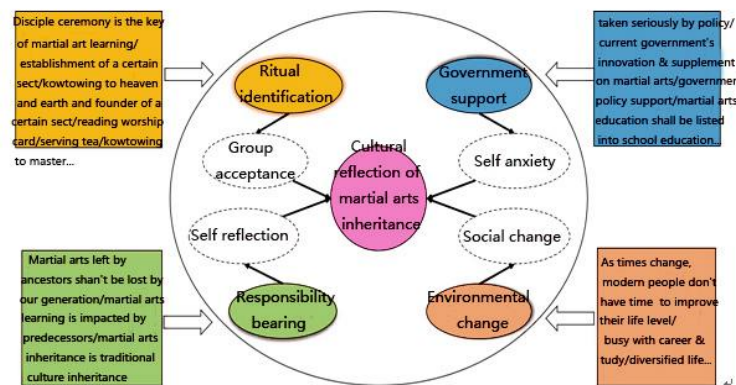


Figure 1: Reflection Process of Traditional Martial Arts Inheritance
Data source: drawn in this study

As shown in the above figure, in the process of inheritance and reflective learning, traditional martial arts has its own specific ritual process. It can be seen from the process that the orientation of inheritance is so limited that not all people can easily access, which makes its inheritance scope smaller and smaller. Intangible cultural heritage such as traditional martial arts must be safeguarded and rescued, but its rational use and inheritance and developments should not be denied. In consequence, current management knowledge is introduced to assist the utilization and inheritance and development of traditional martial arts, which is worth thinking deeply. This study converted the five service design processes into the traditional martial arts inheritance and development strategy, as shown in Figure 2:

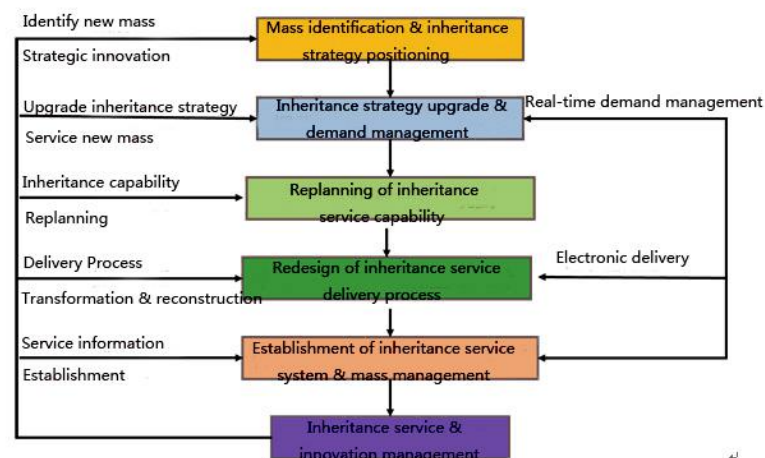


Figure 2: Application of Service Design to Traditional Martial Arts Inheritance Process Setting
Data source: drawn in this study

The theory of service design is applied to the traditional martial arts inheritance process transformation. Promoting martial arts is not equal to denying traditional martial arts by using "development", "transformation", or "innovation". The mental culture of martial arts was the long-established concept of value and aesthetics and the thinking manner by Chinese people in their social practice and conscious activities, which was the core of martial arts culture. However, social need determines social existence, so martial arts must be developed in society. We shall reflect how to continue the traditions by introducing new concepts.

5. CONCLUSION AND SUGGESTION

Oriental Culture has a long history. Intangible cultural heritage items have become buzzwords, e.g. "intangible cultural heritage + cultural creativity", "intangible cultural heritage + tourism", and so forth. Intangible cultural heritage was given an important mission. Qiu Zhijie, the dean of CAFA School of Experimental Art made public statements for several times: "Intangible cultural heritage is not an intact solid preservation, and it must be integrated into our lives. Innovative development shall be understood, consumed, and appreciated by the public. The reconstruction of Chinese aesthetic consciousness is the best way for dynamic inheritance of intangible cultural heritage". With its historic, artistic, medical, and scientific values, Chinese martial arts are the concrete contents dynamically presented by excellent traditional culture in modern days. Rapidly developing cultural and creative industries have integrated intangible cultural heritage into modern designs. Unlike cultural relics, martial arts shall be blended into contemporary lives to meet contemporary aesthetics and rhythm, without losing its foundation. In this way, Chinese martial arts can be inherited in daily lives of common people. The inheritance of traditional Chinese martial arts is not only the inheritance of skills, but more importantly, a shaping path and method representing contemporary Chinese culture shall be found to mould and guide the strategy and orientation which can promote traditional martial arts inheritance through the service design process.

To sum up the heritage mode of traditional Chinese martial arts, the following three suggestions are proposed as the directions of thinking on planning:

1. By improving the recognition on traditional martial arts, excellent traditional culture becomes a part of our lives, which can last for long.
2. Enhancing the capacity of traditional martial arts and combining the features of generations to absorb the input of more young groups is innovative and creative.
3. Building a platform and strategic alliances and gathering resources can increase the effect of heritage.

REFERENCES

- Feng, J. C. (2002). *Watching the Folk: Chinese Folk Cultural Heritage Rescue Project*. Beijing: Xiyuan Publishing House.
- Hsu, C. (2002). *The Second Anthology of Chinese Wushu Symposium*. Taipei: China Intercontinental Press.
- Han, H. (2007). Expectation on Original Regression. *New Humanity Journal of National Forum*, 19-20.
- Niu, A. J. (2008). Exploration on the Issue about Protecting "Traditional Martial Arts Inheritors" from the Perspective of Intangible Cultural Heritage. *Journal of Wuhan Institution of Physical Education*, 42(10), 52-55.
- Wang, W. Z. (2009). Intangible Cultural Heritage Protection Moves towards Cultural Awareness. *Civilization Forum*, 12, 8-9.
- Ho, S. H., & Sung, T. C. (2014). Review on Academic Research & Development of Service Design. *Journal of Design*, 19(2), 45-65.
- Hu, L. P., Xie, Q. M., & GAO, C. Q. (2011). Cultural Appeal of Traditional Martial Arts under Cultural Communication. *Journal of Nanjing Sport Institute*, 25(3), 47-50.
- Pine II, B. J., & Gilmore, J. H. (2013). *The Experience Economy, Updated Edition*. Taipei: EcoTrend Publications.
- Stickdorn, M., & Schneider, J. (2012). *This Is Service Design Thinking: Basics, Tools, Cases*. John Wiley & Sons Inc.
- Cultural Property Exchange of Sina Collection. (2016). *Xiang Zhaolun, the deputy minister of culture of China: Correct Understanding about Intangible Cultural Heritage from Five Aspects*. China.
<http://collectional.sina.com.cn/wjs/jj/2016-11-01/doc-iffxfysn8340979.shtml>
- Design Council. (2007). *Eleven lessons-Managing design in eleven global brands: A study of the design process*. London.
http://www.capitalsynthesis.com/wp-content/uploads/2011/07/Design_Process_Report1.pdf
- Sports Commission of Executive Yuan. (2011). *Sports Album for 100th Anniversary of the Republic of China - Traditional Sports*. Taipei.
- The Copenhagen Institute of Interaction Design. (2008). *What is Service Design?* Denmark.
<http://ciid.dk/research/>

EXPLORATION ON THE EMOTIONAL FACTORS OF INHERITANCE OF THE INDIGENOUS TRADITIONAL SKILLS

A CASE STUDY OF THE WEAVING OF THE SEEDIQ

Huang, HSIU-MEI ^{*a}, Hwang, SHYH-HUEI ^b

^a National Yunlin University of Science & Technology, Graduate School of Design Doctoral Program, Graduate Student, TAIWAN, ROC, may490506@gmail.com

^b National Yunlin University of Science & Technology, Professor TAIWAN, ROC, hwangsh@gmail.yuntech.edu.tw

ABSTRACT

The Seediq is one of Taiwan's 16 indigenous peoples, Weaving is an extremely tradition for the Seediq. Women are good at weaving will climb to the Rainbow Bridge and reunion with ancestors when they die. Thus, the women of the Seediq spend their whole life in weaving and probe into the highest technology of weaving. However, due to the changes in social pattern, the above-mentioned demand is gradually disappearing. According to surveys, only seven women know how to use the traditional ground loom to weave with the highest skill. This study considered non-Seediq who attended courses to learn the traditional weaving skills of the Seediq as its subjects and, for five years, analyzed the emotional factors influencing the learning of such skill against the trend of the times, including learning motivation, operating feeling of weaving patterns, physical load, and loom, instructions by the initiators, and perception and effect after learning, and raised the awareness of the Seediq to the inheritance of the traditional skill.

This study reached the following preliminary conclusions:1. The learning motivations of non-Seediq include cultural factors like interest in weaving, curiosity of different cultures, and

* Corresponding author. Huang, Hsiu-Mei

childhood memory without no ethnic identity.2. Students were attracted by the ground loom which could produce complicated patterns via simple operations. It challenges the perseverance of students. Students need to operate it by themselves. When they finish their work, they are pleasant and cherish it like a piece of artwork.3. Indigenous teachings of traditional skills are usually physical language teachings ,so ,It takes time to bridge the gap between teaching via body language and perception of students.4. The study of non-Seediq causes the social effect of learning motivation of the Seediq

Keywords: *Seediq, Weaving, Emotion factor, Inheritance of traditional skill*

1. RESEARCH MOTIVES

In the past, women of the Seediq wove due to practical needs in life, honor, and discipline of belief. With the changes in social patter, such needs and discipline gradually disappear. So do traditional skills. When the government offers subsidy for the teaching of such traditional skills, it has not met the dilemma of the Seediq. Such courses are conducted in urban area and open for non-Seediq. This study regarded 10 students where were non-Seediq and attending such courses for a long time as research subjects. It aimed to explore why non-Seediq were willing to spend five years to learn such skill against the trend of the times and understand their feelings.

2. RESEARCH PURPOSES

In general, the traditional weaving skills of the indigenous are mainly passed down to clansmen. In this study, such courses are conducted in urban areas and attended by non-Seediq. This study probed into the emotional factors influencing the study of Seediq weaving, and understood the feelings of learners at different stages, which can serve as a reference for the teachers to inspire clansmen's willingness to learn and improve teaching methods.

3. RESEARCH METHOD

This researcher participated in the learning of ground loom and Seediq weaving, and interviewed other students one by one to learn their feelings (perceptual factors). Then, this study referred to service design and service travel map, classified the learning process of the learners into three stages, that is, before, during, and after study. Based on the audio recordings, it analyzed the learning contents and feelings (emotional factors) of the students at different stages. Lastly, it summarized the emotional factors into a table.

4. SEEDIQ'S TRADITIONAL WEAVING AND INHERITANCE PLAN

4.1. Seediq traditional weaving

The Seediq is one of Taiwan's 16 indigenous peoples, Population was approximately 9,771, mainly distributed in Ren'ai Township, Nantou County. As they respect for Utux[†], they have developed rigorous Gaya[‡] life and law systems and unique and rich cultures, such as tattooed face, hunting, weaving, music, language, songs, and dance. Weaving is a vital tradition for the Seediq. Women of the Seediq use r ground loom to weave clothes and quilts for their families. According to tradition, women must plan, harvest, and scrap ramie, expose ramie under the blazing sun, sort ramie, twist ramie into thread, and dye ramie. Thus, women of the Seediq are always busy. Even when they walking to work in the field, they will twist ramie into thread. They weave in the evening and early morning. In terms of division of labor between male and female in the traditional Seediq society, Gaya restricts men from touching tools like loom, while women are not allowed to touch hunting tools. The women of the Seediq also weave clothes to make their own wedding dress and send to brides as gifts.

The traditional Seediq weaving skills include plain weave, float weave, weft pick, diamond weave, and twill weave. Especially, doriq Puniri is the most difficult skill. If one can master this skill, basically, she can weave with all the other sills. Puniri is featured in picking warps and multiple float diamond patterns. As all the patterns of doriq puniri are completed by picking warps, all the wefts are completely covered by float warps. Weavers need to accurately remember the pattern structure, and use cross-stitch work tools in order patiently and concentratedly. And they shall make no mistake so as to produce correct patterns. Doriq puniri demonstrates excellent skills and diligence and requires good eyesight. The clansmen consider it as the top weaving skill. Senior clansmen said that, clothes with the pattern by doriq puniri were used to make shawl for men. Only the leader of a hunting team could wear such shawl. Women used such clothes to tie their legs to show elegance. A woman who can weave puniri will be considered as a real woman. When she dies, her soul can climb to the Rainbow Bridge and reunion with ancestors. Thus, the women of the Seediq practice the rules of Gaya all the time. On one hand, women of the Seediq weave due to practical needs in life, honor, and discipline of belief. On the other hand, as Mei-hsia Wang pointed out that, the Seediq advocates excellent performance of individuals. The women of the Seediq spend their whole life in weaving and probe into the highest technology of weaving.

[†] The Seediq deeply believe that soul is immortal. When one dies, he/she will become Utux to care the offspring always. They practice Gaya in their rituals and behaviors and maintain a harmonious relationship with Utux. (Tseng,2013)

[‡] Gaya, literally, means "the words of ancestors". It can be understood as the disciple, habit, laws, precept, standard of behavior, social responsibility, and moral rules. (Wang,2003)



Figure1:The ground loom Figure2:Plain weave ,Diamond Figure3: Doriq puniri
weave

At present, most of the women who can weave puniri in the tribe learn it from Seta Iban (Zhang, 1919-2008). Since the age of 10, she had started to learn traditional weaving skills, and had woven for over seven decades till she died. According to an investigation in 2013, only seven women could weave with puniri, wherein, six learned it from Seta Iban, including her daughter Bakan Nawi and grand-daughter Seta Bakan. Over half of the seven women are nearly or over 70 years old. Now, There are no demands for traditional weaving in life. The rules of Gaya gradually disappear. Thus, the traditional weaving skills face the risk of failing to be handed down from past generations, especially, the most difficult skill, puniri. Even though Seta Iban endeavored to teach puniri during her later years, many clansmen failed to learn such skill, because it is not as simple as other weaving skills.

4.2. Source of the case: Inheritance plan of the Seediq weaving skills supported by Cultural Assets Law

The government registered Bakan Nawi and Seta Bakan as the inheritors of the intangible cultural asset of puniri of Seediq weaving in 2012. Since 2013, the government has offered subsidy to the Zhang's to open inheritance courses. During the first year, the Seediq in Nantou were regarded as target students. However, they failed to enroll any student. In contrast, another weaving program in Taichung Metropolitan organized by Bureau of Cultural Heritage quickly fulfilled the quota of enrollment. And the students were all active to learn. Therefore, during the subsequent four years, the inheritance plan was held in Taichung. The course was taught for 80-100 hours a year.



Figure4:Seta Iban (1919-2008) Figure5:Bakan Nawi (1936-) Figure6:Seta Bakan (1957-)

This study focused on the five-year inheritance plan from 2013 to 2017, and analyzed 10 students who continuously attended the plan. In terms of occupation, four of them were retired (three were retired teachers). Three were housewives (one Japanese and one Bunun people). Two students were working and attended the plan by asking for leave. One was a postgraduate student. In terms of region, seven were from Taichung, while one from Yunlin; one, Chiayi; and one, Taipei (This student had the furthest distance from Taichung and spent five hours back and forth to attend the course every day.). All the 10 students were not Seediq people. In 2016, one Seediq people came and was inspired by the course, and attends the course since this year.

In the first year, the content is plain weave. Cause of simple, students are proud of the quantity of work that they can finish. In the second year, the speed of weft pick suddenly becomes slow. But the skills are not difficult. This stage challenges the patience of students. In the third year, the contents are diamond weave and twill weave. Neatening warps at this stage becomes challenging. Students need to slowly twine threads according to rules slowly and patiently. It takes approximately five hours to neat a portion of thread ready to be woven. However, it is common that students make mistakes in neatening. As long as one thread is wrongly twined, one needs to start all over again.

In the fourth and the fifth years, students began to learn the most difficulty skill, doriq puniri. Puniri requires 25 different ways of lifting heald and replacement layer by layer so as to complete the circulation of four wefts. Cross-stitch work is even more difficult. Therefore, a student needs to weave extremely carefully and prudently. Once they make a mistake, they need to spend a long time to correct it. Different cross-stitch work patterns of puniri have different cultural connotations. Students must learn slowly step by step. During the course of two years, the teacher was busy instructing each student. For two years, they had learned for 170 hours. Even so, the longest clothes woven by the students was only 70cm.

5. EMOTIONAL FACTORS DURING LEARNING

The subjects in this study are not Seediq people. Their learning purposes are not cultural needs of Seediq. The motivation and psychological preparation before learning, problems and challenges during learning, and feelings and effect after learning are analyzed below.

5.1. Before learning

5.1.1. Students' learning motivation

All the students attended the course because of interest. It is extremely slow to weave clothes with the ground loom, which is not favorable for economic benefits. Thus, the students did not attend the course for profit or livelihood.

5.1.2. Why did you want to learn the ground loom? Why is it attractive to you?

According to the interviews, most of the students thought it rare and unique with aboriginal cultural characteristics. Most students started with the easiest ribbon loom. Then, they learned high loom which was easy and fast to complete a piece of work after threading. However, high loom allows them to have little autonomous control. They feel that, "The better the machine is, the more dependent and sillier they become." When they saw that the simple ground loom can weave complicated patterns, they became curious and interested.

5.1.3. Psychological preparation before learning

At the beginning, most of the students were purely curious about weaving with the ground loom. They were concerned of sitting for a long time to weave and longtime input to the course. In addition to tuition, some students far away from the site needed to spend more time and transportation costs.

5.2. During learning

The contents of the five-year course changed from simple (plain weave, weft pick, diamond weave, and twill weave at the beginning) to difficult (puniri in the 4th and the 5th years). The teacher taught the students in the same way her grand-mother taught her, that is, body language.

5.2.1. Students' feelings of using the ground loom

- a. Tired and not free: As the name, ground loom, indicates, a weaver must sit on the ground while weaving for a long time. She must use a belt to fix herself to the loom and cannot move freely. While weaving, she needs to push the weaving box with her feet. While weaving with doriq puniri, she needs to concentrate. It challenges eyesight and physical strength. As the students made special visits to attend the course, they had psychological preparation. No matter how hard, they were willing to learn.
- b. Charm of autonomous manipulation: It is easy to use the ground loom. However, the coordination between hands and feet affect the density and uniformity of patterns. They are interested because the simple machine can have multiple weaving skills and produce various patterns. The sounds produced by the weaving boxes sound as sweet as a song

5.2.2. Feelings of students about the instruction of the teacher: For the students who are accustomed to the instruction by words and teaching materials, teaching by body language is a challenge.

Weaving is a part of "life" for the teacher, while it is a type of "study" for the students. Since childhood, Seta Bakan had watched her grandmother weaving and learned from her. She has experience and background closely related to weaving which becomes a part of her life and memory. For the teacher, weaving is a type of "lifestyle". She was influenced by what one constantly saw and heard since childhood. She has the relevant cultural background. As the

students are non-Seediq, they do not have such childhood experience. Weaving is a type of "deliberate" learning process. Some students were retired teachers, so they adopted their teaching experience to explore, discuss, interpret, and even re-draw the patterns taught by the teacher via body language to make them easier to understand and accelerate understanding and learning.

5.2.3. Adjustment of mentality during learning:.

From the first to the third year, the skills learned changed from simple to complicated, like plain and diamond weave. The students competed that who could weave the most. During the fourth and the fifth years, they started to learn puniri which is extremely difficult. They must concentrate on each move and each cross-stitch. Once they make a mistake, they have to start all over again. Hence, during this stage, they competed who could better understand the logic. And they shifted their attention to physical and mental cultivation.

5.2.4. Determination and perseverance to complete. Expectation to meet at each class. Mutual growth during interaction.

5.2.5. Natural transmission of the traditional culture of the Seediq during teaching interaction.

Weaving is life experience for the teacher since childhood. While teaching, she naturally recalled her childhood and told stories about weaving, and the living habits and values of her tribe. For instance, when she was young, she helped to twist thread. Her grandfather adopted natural materials to make dye. In the past, when beam-warping was completed, it took two people to cooperate to take the threads off the shelf so as to keep them neat. Thus, the clansmen believe that "a girl who does not know how to weave has no friends. And she will be looked down upon by others.". In addition, three decades ago, when she got married, many senior members of her family sent her gifts of clothes woven by themselves. Thus, though clothes woven in this way are not used to make clothes, they can serve as precious gifts. The students learned the stories on the culture of the Seediq during the interaction at class. And they are pleasant to understand different cultures.



Figure7: Ground loom to weave needs to fix her body with the loom.



Figure8: Demonstration by the teacher



Figure9: Students draw organizational structures

5.3. After learning

5.3.1. Personal effects

For the students, they had an extremely high sense of accomplishment: They had the sense of accomplishment from the instruction of the teacher, discussion, interpretation, understanding, and completion of work. Especially, when they learned that only seven people in the Seediq tribe could do puniri, they feel that this is a precious and rare opportunity to learn the traditional skills. The learning of weaving is a way for non-Seediq people to understand aboriginal cultures. Especially, when they learned puniri, they better understood the importance of Gaya to traditional Seediq women and the reason why they spend their whole life in weaving and probe into the highest technology of weaving.

The active learning attitude makes the teacher feel the senses of accomplishment and mission and improve her confidence: The teacher, Seta Bakan, learned weaving from her grandmother since childhood. She was a housewife previously without much teaching experience. Several years ago, she was invited to teach the ground loom in her tribe. However, her clansmen had low interest in learning weaving, which made her disappointed. However, in this course, the students were eager to learn and had frequent interaction with her, which made her feel the sense of accomplishment. She said that, during teaching, she had been recalling the time that she spent with her grandmother. She feels that she is the continuation of the life of her grandmother. Hence, she hopes that more clansmen can have the sense of mission.

5.3.2. Social effects

Previously, no clansmen wanted to attend the weaving course held in their hometown. Later, non-Seediq people started to learn weaving by attending a weaving course held in a metropolitan area. Such news spreads to the tribe. Plus report by media, the clansmen begin to stress the important skills belonging to themselves. However, they were puzzled why Seta Bakan would rather teach non-Seediq rather than Seediq. Hence, Seta Bakan is invited to teach weaving at another tribe of the Seediq since October this year. Next year, she will return to her own tribe to teach the weaving culture from planting of ramie in a systematic manner.

Table1: Summary of Emotional factors influencing the learning of traditional Seediq weaving skills.

	Emotional Scope	Emotional Factors
Before learning	Motivation	Interest, particularity, curiosity
	Charm	Being rare and unique with aboriginal cultural characteristics. Handling complexity by simplicity. Compensation to life.

	Preparation	Physical strength, long-time and concentrated participation
During learning	Feelings of using the machine	Being tired and not free. Autonomous manipulation
	Instruction by the teacher	Challenge, inadaptability, exploration, interpretation, slow speed
	Mentality during the learning process	From the satisfaction to quantity to physical and mental cultivation, perseverance of completion, grow via interaction, expectation to meet at each class
	Cultural communication	Being pleasant to understand different cultures
After learning	Personal effects	Students: Sense of accomplishment, confidence, rare opportunity. The teachers: Senses of accomplishment and mission, confidence
	Social effects	The clansmen begin to stress weaving

6. CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCHES

6.1. Conclusion

6.1.1 The subjects in this study are non-Seediq students who learned weaving because of interest without cultural factors like traditional ethnic identity. They learned the culture of the Seediq during learning and recognize the preciousness of the skills and importance to preserve them .

6.1.2. The ground loom can handle complicity by simplicity, attract the students, and challenge their perseverance. The simple ground loom can produce complicated patterns. It is difficult to learn the rudiments, but the students have a high degree of autonomous manipulation, which stimulates them to persist to complete the course. Each work is cherished as a piece of artwork by the students.

6.1.3. Indigenous teachings of traditional skills are usually physical language teachings ,so ,It takes time to bridge the gap between teaching via body language and perception of students. For the teacher, weaving is a type of "lifestyle". She was influenced by what one constantly saw and heard since childhood. She has the relevant cultural background. As the students are non-

Seediq, they do not have such childhood experience. Weaving is a type of "deliberate" learning process.

6.1.4. Social effect that the enthusiasm of non-Seediq in learning weaving arouses the motivation of the clansmen: The learning of the ground loom is tired with low economic benefits. Thus, the clansmen show low willingness to learn it. However, as non-Seediq shows great enthusiasm in learning the skills, the clansmen raise the awareness that their own culture shall be passed down to the people of their tribe.

6.2. Suggestions for future researches

6.2.1 At the present stage, this study adopts qualitative research method and obtains the table of emotional factors of the students. In future studies, the investigation and analysis on attractiveness factors can be adopted. And researchers can classify emotional factors into primitive reasons, abstract reasons, and concrete reasons.

6.2.2 The subjects in this study are not Seediq people living in metropolitan areas and completed the five-year course. Next year, the teacher will return to her own tribe to teach her clansmen. The learning motivation of the clansmen and the differences in feelings between the Seediq and the non-Seediq can be further studied.

REFERENCES

Pelin, I. (2014). Investigation on the traditional weaving skills and cultural asset of Puniri of the Seediq. *Cultural Asset Bureau, the Ministry of Culture*.

Tseng, L. F. (2013). A pilot study on transmission of the Seediq weaving tradition and handicraft Puniri in Nantou County: The three generations of Seta Iban (Zhang Yu-Ying) as research subject. *Journal of Cultural Property Conservation*, 24, 33-57.

Wang, M. H. (2003). Exploration on the social nature of the Atayal from the perspective of multiple meanings of Gaya, *Taiwan Journal of Anthropology*, 1 (1), 77-104.

Wang, M. H. (2014). Exploring the transformation of capitalism from perspectives of Waya: economic changes in a Seediq Vommunity. *Journal of Archaeology and Anthropology*, 80, 53-102.

Wang, M. H., & Pelin, I. (2012). Activating the Seediq culture: A study of cultural industry in a Seediq community. *Traditional Opera*, 176, 233-286

Wu, M.R., & Yeh, H.Y. (2011). Tribe skills/Memory and cultural industry: (Re)production of the culture of female weavers of the Tailuge, Xiulin Township, Hualian County. *2011 Annual Meeting of Association for Cultural Studies*.

Toyu, Y. (2012). Inheritance variation and rupture: Changes in identity of modern Tailuge female and Weaving practice. Donghua University Press.

COMMUNICATION DURING DESIGN INFORMATION PHASE: A REFLECTION ON CROSS-CULTURAL TOOLS

Alejandra VILAPLANA^{*a}, Alexandre GENTNER^b and Carole FAVART^c

^a Toyota Motor Europe, Belgium, Alejandra.vilaplana@external.toyota-europe.com

^b Toyota Motor Europe, Belgium, alexandre.gentner@toyota-europe.com

^c Toyota Motor Europe, Belgium, carole.favart@toyota-europe.com

ABSTRACT

In our globalized environment, and particularly in the context of industrial design activities in international companies or research institutions, it is increasingly frequent to take part in diverse scenarios involving at least two different cultural contexts. Therefore, it becomes an essential point during the initiation of the design process to achieve an optimal transmission of *design information* in order to increase the added value of the project through the implementation of accurate cultural layers. However, issues pertaining to communication may arise throughout the process if there is an inadequacy in cultural understanding. Hence, it is crucial to address the significance of cross-cultural tools to be used in communication of the design information in its initial phase. Two case studies are referred to openly discuss the matter. Both cases correspond to research projects that were conducted at the Kansei Design division, Toyota Motor Europe (KD-TME). Both projects generated specific tools as a practical output for strategists and designers to use as a way to produce inspirational materials or define a target user, with a more grounded and sensible cultural base.

Keywords: *design information, communication, cross-cultural, values, early-phase*

^{*} Corresponding author.

1. INTRODUCTION

At Toyota Motor Europe (TME), the awareness of cross-cultural scenarios is taken seriously, not only due to the fact of being a European branch of a Japanese company, but also because of the company's Kansei Design (KD) team has steadily increased its diversity in having multiple nationalities among members. In this sense, the company is continuously striving for the improvement of its communication tools both internally and externally. The purpose of this paper is to reflect on the necessity of cross-cultural tools that accurately communicate several levels of design information between working teams or between designers and users; with two clear objectives: 1. To increase the quality of the conveyed information with the added value of experience-based layers and 2. Avoiding the potential misunderstandings due to cultural differences in both ends either designers or users.

2. LITERATURE REVIEW

In this section we cover three topics: diverse levels of design information, notions of culture and values from the point of view of existing models or frameworks as well as different positions concerning cultural and functional diversity in work teams.

2.1. Design Information

According to Bouchard et al., (2009) design is seen as a problem in which the initial problem space is transformed gradually into the solution space, through diverse iterative stages of information, generation, evaluation and materialisation (fig.1). The initial stage of information is essential: it has a strong impact on creativity (Bouchard et al., 2009), which enables a greater level of problem solving. It is at this initial point of the process that sources of inspiration acts as a role as an essential base for idea generation (Eckert et al., 1999); and because inspirational materials are intrinsically related to personal life and context, culture and values that have a solid effect in subsequent parts of the design process. According to their position along a scale of abstraction/concreteness, we can classify design information in three different categories (Bouchard et al., 2009) namely, Low level (colour, shapes, and textures), Middle level (sector names, patterns) and High level (values, semantic descriptors, styles).

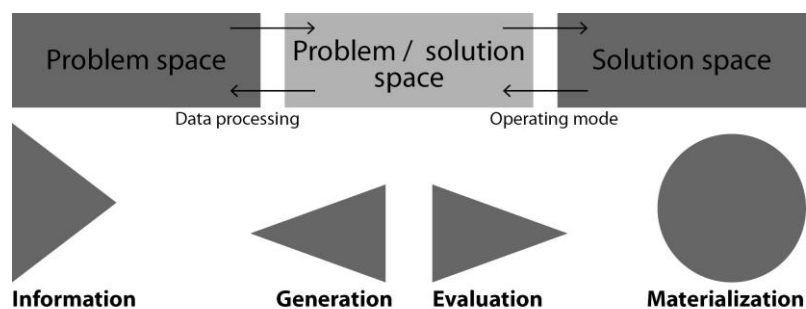


Figure 1: Early design process (adapted from Bouchard, 2009)

2.2. Culture

The effort of reaching for a single definition of culture is challenging. Spencer (2012) compiles several definitions of culture and three specific definitions is referred to:

“[Culture] is the collective programming of the mind which distinguishes the members of one group or category of people from another” (Hofstede, 1994). “...The set of attitudes, values, beliefs, and behaviours shared by a group of people, but different for each individual, communicated from one generation to the next” (Matsumoto, 1996). “Culture is a fuzzy set of basic assumptions and values, orientations to life, beliefs, policies, procedures and behavioural conventions that are shared by a group of people, and that influence; although may not determine a member’s behaviour and his/her personal interpretations of the ‘meaning’ of other people’s behaviour” (Spencer, 2008).

These definitions bring essential points when cross-cultural information is analysed where the *sense of differentiation* amongst groups, the role of *individuality* as part of a collective concept, which is strongly related to *experience* as well as the generational aspect of *transferring* the elements, which reinforces a notion of *intuitiveness* in culture. The *interpretation of behaviours*, a relevant factor that might be related to *stereotypes* and *biasness* when referring to other cultures or even to our own is also a duly important point.

2.3. Expression of culture through values

As pointed by Gentner et al. (2016), even if there are diverse definitions of culture that is based on different theoretical backgrounds, multiple models were identified and grounded in values for the description and comparison of cultural dimensions. Cross-cultural literature includes several conceptual frameworks conducted by Kluckhohn and Strodtbeck, Hall, Hofstede, Trompenaars and Schwartz. In this section, an emphasis on the models proposed by Hofstede and Schwartz is made since these models have been used globally in cross-cultural studies.

2.3.1. Hofstede’s Cultural Dimensions

Hofstede studied work-related values, mostly through an extensive study conducted with participants from 40 countries who worked at IBM (Hofstede, 1980). A theory featuring several dimensions along which cultures that revealed differences was developed. Four initial dimensions were extracted: Individualism-Collectivism, Power distance, Uncertainty avoidance and Masculinity-Femininity. Later, two additional dimensions were added to the list which are Long term orientation and Indulgence.

2.3.2. Schwartz Value Survey

As a contribution to enrich cultural dimensions proposed by Hofstede, Schwartz conducted a large-scale survey (Schwartz et al., 1990). The survey consists of value grouping according to ten dimensions: *universalism*, *benevolence*, *tradition*, *conformity*, *security*, *power*, *achievement*, *hedonism*, *stimulation* and *self-direction*. However, it is significant to highlight that even though

in a globalised world where it seems to portray that everyone is playing in the same field, although in real terms 'culture is incredibly reluctant to merge' (Braun, 2009). Moreover, as pointed out by Braun, using value based frameworks in concept development does not exempt generalisation issues.

2.4. Multicultural & Multifunctional teams

Nowadays, having multi-cultural members with multi-functional backgrounds in industrial design oriented teams is a norm (Dahlin, 2015) rather than a homogeneous culture with individuals sharing the same nationality as well as organisational affiliation (Gentner, 2014). Focusing on national or cultural diversity, Haas and Nüesch (2013) investigated the effects of national diversity in teams and outlined two contrasting theories on the subject:

- From a positive perspective (task oriented), the built up on the information and decision-making theory (Gruenfeld et al., 1996), it is argued that having cultural diversity increases team performance because teams have more access to greater varieties of task relevant knowledge and expertise.
- On a less positive view (relations oriented), based on social identity theory (Tajfel and Turner, 1979), scholars argue that higher national diversity and cultural identification can lead to social differentiations and in-group/out-group distinctions (Gibsons and Gibbs, 2006), which could be the source of conflict and therefore decrease of team performance due to poor communication.

These perspectives represent a *diversity paradox*, where diversity can lead to either attaining higher quality decisions and greater creative innovation or trigger tensions and conflicts simultaneously (Garcia-Prieto et al., 2002). Since a person's dominant function influences thought patterns and behaviours, it was noted also that differences in terms of functional points of view amongst team members can generate "*functional walls*" (Bunderson & Sutcliffe, 2002); in that sense perhaps we could even talk about "*cultural walls*". Nonetheless, this situation seems to be unavoidable to some extent, given the fact that growing cultural diversity continues to be the current status quo of many companies and academic institutions.

3. PROBLEM AND RESEARCH QUESTION

Cultural diversity and values have an impact in the information phase in the initial stage of the design processes. The problem is limited into two axes: communication problems in multicultural teams due to in/out group differentiation or presence of conflicts; and perception problems in cross-cultural users due to reliance on stereotype based information. Given the fact that values continue to be the most accurate markers to analyse and discuss a culture (Schein, 1984), the question would be *how to increase the value of design information while minimising communication problems through the use of cross-cultural tools during the initial phase?*

Since this paper intends to be a qualitative reflection rather than a quantitative analysis, the following hypothesis is suggested to be discussed with the two selected case studies. The hypothesis is: *The addition of context and experience based information layers to value based cross-cultural tools will improve the communication of a design information during the initial stage of the design process.*

4. CASE STUDY

4.1. Value Perception Research

This study was conducted to better understand elements such as the perception of cultural values in order to intentionally use them as tools to define a strategic identity (Gentner et al., 2016). The first part of this research (Gentner et al., presented at KEER 2016) consisted of the analysis of East Asian values perceived from a European stand point. The second part is introduced in this paper which covers the Japanese perception of European values in three different countries, based upon the methodology used during the first part.

4.1.1. Participants

The study succeeded to recruit participants from Germany, France and England as well as Japanese residents in those countries; these countries were selected because they concentrate the largest Japanese communities amongst Europe. Ten participants per category were selected from each country. In the case of Japanese citizens, the requirement was for them to be living in the country for at least a year and to have a specific level of cultural knowledge.

4.1.2. Stimuli and protocol

Individual interviews were conducted with all participants in the three countries. Interviews and the stimuli were conducted and presented in the participant's language. Two types of cards were used during the stimuli which are category cards that are printed in A6 format as well as value cards that are printed individually in small sizes (fig.2).

- Category cards: represents various aspects of culture of each country, extracted from literature and feedback from a previous pilot study. A total of 18 cards were created, covering the following categories which are *architectural landmarks, cultural landmarks, natural landscapes, arts, movies, work life, housing, social life, nature, food, fashion, brands, objects, celebrities, sports, traditions, politics and streets.*
- Values cards: generated by combining dimensions from different authors, selected according to the following criteria with no duplicated values in terms of meaning, values should be self-explanatory and easy to understand and finally, values should be suitable to describe the countries' culture.

Sessions have lasted around one hour per person, recorded with participants' consent. Each interview consisted of the following parts:

- Introduction: Greetings and introduction of the purpose and process of the study. Presentation of category cards with a discussion about related memories or personal experiences. During this part cards remain visible.
- Part 1: Country Culture Description: value cards were divided in three sets and are presented individually. The interviewer asked the participant to use them to evaluate the country's culture through a 5-point scale arranged on the table. Once all cards are placed along the scale the participant was asked to explain their evaluation.
- Part 2: Country Culture Comparison: in this section, the participant is asked to assess if some of the values fit particularly any of the four countries, arranged in individual boards – the country investigated, the two other countries of the study and own country.



Figure 2: Category and Value cards during interviews with Japanese participants

The data is analysed along with the results from the previous study in order to compare value perception across countries from both European and Asian perspective.

4.2. The Ethnographic Cards

This project was developed as a continuation of a previous project covering the transposition of European Experience Framework Boards (EFB) into a Japanese context (Vilaplana, 2016), as a tool for brand identity definition. The EFB consist of several boards with mainly visual and semantic stimuli where each board depicts experiences selected based on the 5 Factor Personality Model (Esquivel et al., 2016)

4.2.1. Background and purpose

The investigation was conducted as part of a collaborative PhD project between the University of Tsukuba and KD-TME. Its main objective was to analyse the level of understanding towards EFB in Japanese context. The study consisted of semantic analysis, quantitative comparison between EU and JP participants in terms of content coherence and deep semi-structured interviews (conducted in Japan). The results showed not only common differences and similitudes between EU and JP perception of the boards, but gave us some insights on which experience notions could be perceived as Universal, and which ones could be either European or Japanese.

As the data from all interviews were analysed further, it was clear that context and daily-life individual elements elicited stronger associations than preconceived cultural notions. This is found when participants were asked what ‘harmony’ means in Japan, for example, participants were inclined to relate it with simpler experiences (e.g., *people strolling in the park during autumn surrounded by colourful leaves*) rather than just stereotypical ones (e.g., *monks in a temple in Kyoto*).

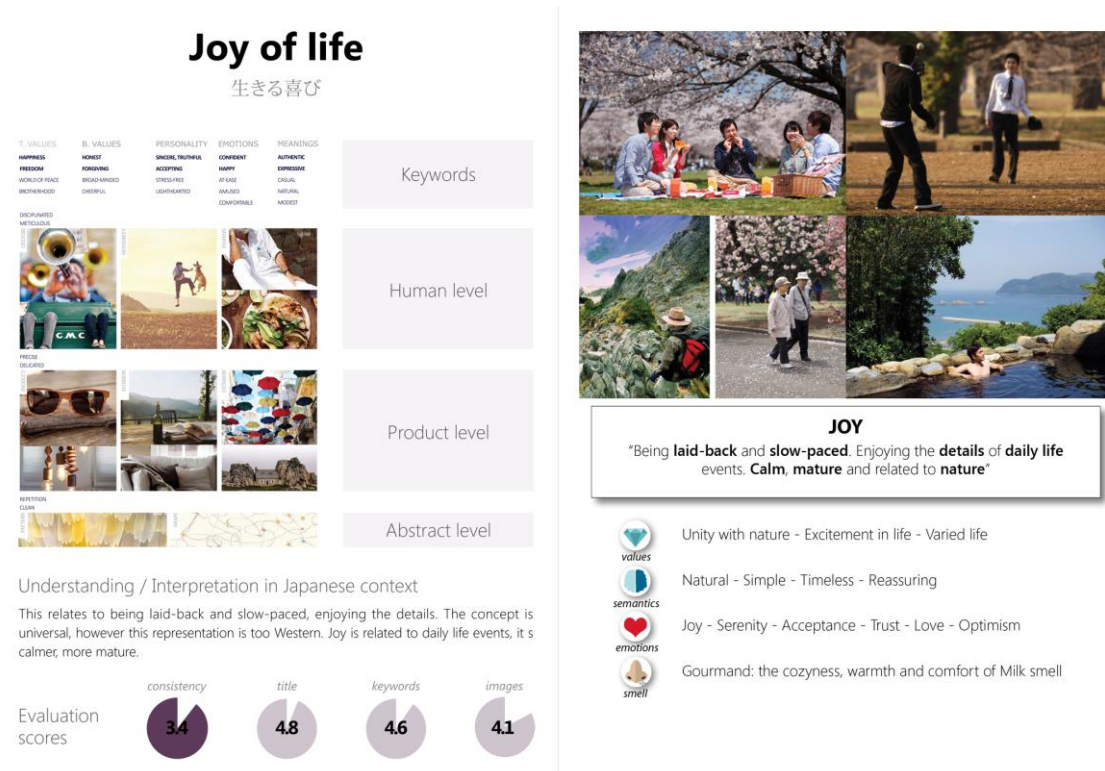


Figure 3: Analysis of an Experience Board (left side) and resulting Ethnographic card (right side)

These findings prompted us to address the role of specific cultural layers in inspirational tools for designers or product planners during the initial phase which will lead to the creation of the Ethnographic Card. The Ethnographic Card is a set of cards depicting experiences and value based information. Therefore, based on the feedback provided during experimentation in JP, each experience was represented visually by more daily-life experiences. In addition, it was paired with associated values, semantics, emotions and smell references, through qualitative exercises with Japanese TME members (fig.3).

5. RESULTS AND DISCUSSION

The projects introduced in the previous section aimed to investigate how different levels of design information (from low to high level of abstraction) could be applied in cross-cultural research, both using their own approach.

5.1. Output

In the case of the *Value Perception research*, it mainly works with high level design information because it is centred in clusters of values and the quantitative analysis comparing their perception from different standpoints. The tool derived from the analysis consists of a group of tables that display the value clusters, main points of comparison, ratings and the most relevant keywords used to describe cultures from the different expert points of view (fig 4).







	Japanese experts point of view	European experts point of view
 <p>Security social order / national security / avoid/dislike uncertainty / clean, neat / cautious, prudent</p>	 <p>"Show interest in things they don't know" "Foreigners living here are the ones not neat" "Not so tight with the rules"</p> <p>National security being a high priority at the present / Everyone has a place in the community</p>	 <p>"Too punctual to like uncertainty" "Cautious with rules" "Cleanliness not a priority"</p>
 <p>Self-direction freedom / curious / inventive, creative / self-respect / individualist</p>	 <p>"Curious but they still try to keep distance" "Here people put themselves first" "Self-respect is related to being proud and individualist"</p> <p>The country is quite free / Highly creative, always on the move</p>	 <p>"Not really interested in the outside world" "They have invented many collective sports but they praise individual progress"</p>

Figure 4: Extract of Japanese/European perception table for English culture

In the case of the Ethnographic Cards, the main intention was to simplify the information presented in the previous EFB and to combine low level abstraction information like pictures and quotes that is related to everyday lifestyle and contextual information with high level information that includes semantics and values in a way that could be easily interpreted and understood (fig.3).

Hence, referring to the question of *how to increase the value of design information while minimizing communication problems through the use of cross-cultural tools during early-phase?* And the hypothesis: *adding context and experience based information layers to value based cross-cultural tools will improve communication of design information during early design process.* Since the results of both study have proven that the use of contextual cues and individual experiences to be essential part of the culture-based design information, it can be concluded that these proposed tools deliver the necessary information about specific cultures that combines diverse levels of abstraction in order to generate a good base to implement accurate cross-cultural communication. Thus, by using this sort of tools, it enables the establishment of a common ground and understanding to minimise reliance on stereotypical or biased information.

5.2. Applications

The output of the study is considered to be quite useful as proposed tools are used to establish stronger and relatively grounded discussions on cultural layers as well as to provide a good source of inspiration while defining target users or to draft the very first ideas on a new project. The direct application of these tools is at the very beginning of the initial design process, right during the fuzzy stage of defining targets and brainstorming concepts. The simple and visual format of these tools allow them to be easily interpreted by strategists and designers alike and they provide more information than the traditional images-only material for inspiration.

Certainly, the cases presented in this paper highlighted specific cultural combinations that mostly consist of Asian or Japanese and European perspectives given the corporate background in TME. However, the methodology and the output itself are adjustable to any cultural context as the information is displayed in an intuitive way, which is of great importance in starting any cross-cultural process. The tools are also versatile which enables it to be used across the design process that includes the concept & product development as an iterative guide to check the correct implementation of cultural and value layers. Moreover, both tools could equally involve final users in decision making by selecting the material that resonates with their context, their preferences and own individual values.

On a final note, the perspective on cross-cultural tools to improve communication of design information that was derived from research projects is still being developed at an empirical level. This provides ample room for improvement in its application and to properly test the potential improvements of the process. Nevertheless, the main intention with this paper was to highlight the importance of addressing a proper and more honest implementation of culture and value based layers to any cross-cultural project, since these opportunities to work with different cultures are constantly presented in design practice and academic research.

6. REFERENCES

- Bouchard, C., Kim, J.E., & Aoussat, A. (2009). Kansei Information Processing in Design. *In Proceedings of IASDR conference*, 3327–3337.
- Bunderson, J. S., & Sutcliffe, K.M. (2002). Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects. *Academy of Management Journal*, 45(5), 875-893.
- Dahlin, K.B., Weingart, L.R. & Hinds, P.J. (2005). Team diversity and information use. *Academy of Management Journal*, 48(6), 1107-1123.
- Esquivel, D., Bouchard, C. & Favart, C. (2016). Defining Brand Identity through a Kansei-Experience approach. *Proceedings KEER Conference*, University of Linköping, Sweden.

Garcia-Prieto, P., Bellard, E., & Schneider, S. C. (2003). Experiencing diversity, conflict, and emotions in teams. *Applied Psychology: An International Review*, 52(3), 413-440.

Gibson, C. B. and Gibbs, J. L. (2006), Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure, and national diversity on team innovation. *Administrative Science Quarterly*, (51), 451-495.

Gentner, A. (2014). Definition and representation of user experience intentions in the early phase of the industrial design process: a focus on the kansei process. PhD dissertation, *Arts et Métiers ParisTech*.

Gentner, A., Esquivel, D., Badoil, A. & Favart, C. (2016). European perception of East Asian cultures: Research on cultural values from China, Japan, South Korea and Thailand. *Proceedings KEER Conference*. University of Linköping, Sweden.

Gruenfeld, D. H., Mannix, E., Williams, K. Y., and Neale, M. A. (1996). Group composition and decision making: How member familiarity and information distribution affect process and performance. *Organizational Behavior and Human Decision Processes*, 67(1), 1-15.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage.

Hofstede, G. (1994). *Cultures and organizations: Software of the mind*. London: Harper Collins Business.

Eckert, C., & Stacey, M. (2000). *Sources of inspiration: a language of design*, *Design studies*, (21), 523–538.

Matsumoto, D. (1996). *Culture and psychology*. Pacific Grove, CA: Brooks/Cole.

Schein, E. (1990). Organizational culture. *American Psychologist* 45(2), 109-119.

Schwartz, S.H., & Bilsky, W. (1990). Toward a theory of the universal content and structure of values: extensions and cross-cultural replications. *Journal of Personality and Social Psychology*, (58), 878-891.

Spencer-Oatey, H. (2008). Culturally speaking. *Culture, Communication and Politeness Theory*. 2nd Ed. London: Continuum.

Spencer-Oatey, H. (2012). What is culture? A compilation of quotations. *Global PAD Core Concepts*. Retrieved March 29, 2016, from <http://go.warwick.ac.uk/globalintercultural>

Tajfel, H., and Turner, J. C. (1979). An integrative theory of intergroup conflict. In S. Worchel, and W. G. Austin (Eds.). *The social psychology of intergroup relations*: 94-109. Monterey, CA: Brooks-Cole.

Vilaplana, A., Esquivel, D., Favart, C. & Yamanaka, T. (2016). Culture, semantics and multi-sensory stimuli: The Experience Framework Boards. *Proceedings KEER Conference*, University of Linköping, Sweden.

A PROPOSAL OF PARTICIPATORY DESIGN TOOLS FOR EAST ASIA FOCUS ON ANONYMITY AND PLAYFULNESS

Yuki TAOCA^a, Kaho KAGOHASHI^b and Céline MOUGENOT^c

^a Tokyo Institute of Technology, Japan, taoka.y.aa@m.titech.ac.jp

^b Tokyo Institute of Technology, Japan, kagohashi.k.ab@m.titech.ac.jp

^c Tokyo Institute of Technology, Japan, mougenot@mech.titech.ac.jp

ABSTRACT

Participatory design approaches involve users in the early phases of design process for imagining and creating new products or services, thus they can help collect users' Kansei data. These approaches have been widely developed in Europe, especially in the Nordic countries where it originated, while it is not common in Japan. Since designing consists of social activities like group discussions, cultural differences between Japan and the Nordic countries might prevent the mapping of the technique into the Japanese context. In this paper, as a step for employing participatory design approach to collect users' Kansei data, the study developed new tools for idea generation. The tools offer anonymity and playfulness where participants are expected to freely express their ideas. The tools were assessed in a lab-based experiment with sixteen Japanese subjects in terms of perceived creativity of the participants and design outcome. Findings show that both playfulness and anonymity lead to higher perceived creativity in idea generation. Besides, the introduction of anonymity increases critical discussion and participants' perceived criticality of themselves in idea selection. These findings have the potential to be used in developing design tools for any specific cultural context.

Keywords: Participatory design, cultural difference, anonymity, playfulness, design tool

1. INTRODUCTION

In highly competitive markets, designing remarkable new products or services requires companies to pay attention not only to product functionalities but also to users' needs and subjective expectations, i.e. users' Kansei (Nagamachi, 1995). Kansei values can be grasped through a participatory design approach, where users are treated as partners in early design

process. (Arrighi & Mougenot, 2016; Gentner, Bouchard, Badoil, & Favart, 2014; Rasamoelina, Bouchard, & Aoussat, 2013; Sanders & Stappers, 2008). As participatory design was initially developed by Scandinavian and North-American designers (Simonsen & Robertson, 2012), it presumes equality, open discussion and commitments from participants (Yasuoka, Nakatani, & Ohno, 2013). As designing is a social activity based on collaboration (Détienne et al., 2016; Mougenot et al., 2017), cultural differences might have a major impact on the way people engage in participatory design approach. Therefore, the overall objective is to create tools for participatory design specifically catered to an East Asian (Japanese) context. In this paper, lab-based experiments with university students in Japan are reported in order to investigate the impact of anonymity and playfulness in group design activities.

2. STUDIES ON FACTORS THAT IMPACT PARTICIPATORY DESIGN

2.1. Cultural Background

Hofstede describes culture as “the collective programming of the mind that distinguishes the members of one group or category of people from others” (Hofstede et al., 2010). Comparing Japan to Nordic countries like Finland, Sweden, Norway and Denmark; where participatory design originated, major differences can be seen in all six cultural dimensions that were defined by Hofstede. More precisely referring to Power Distance scores, 54 in Japan vs. 28 in the Nordic countries, show that Japanese society is more hierarchically organised than Nordic societies, which might be a barrier to a fruitful design collaboration. Individualism scores, 46 for Japan, and 69 for the Nordic countries, show that Japan is a collectivistic culture, where people value the harmony of the group they belong to than their individual expression. Uncertainty Avoidance is high in Japan with the score of 92, one of the highest in the world, while it is rather low in the Nordic countries with the score of 40. This implies that Japanese people are reluctant to do things without any antecedent. Several studies have focused on the impact of culture on design activities in East Asia: sharing ideas freely within a hierarchy (Boeijen & Stappers, 2011; Lee & Lee, 2009; Taoka et al., 2016; Yasuoka et al., 2013), collaborating with strangers (Taoka et al., 2016; Van Boeijen, 2015) and harmony of a group (Lee & Lee, 2009; Yasuoka et al., 2013). Researchers attempted to control verbal interaction by turn management tools (Lee & Lee, 2009; van Rijn, Bahk, Stappers, & Lee, 2006), and by design game (Yasuoka et al., 2013) and on increasing indirectness of showing disagreement by tool intermediating among participants. (Lee & Lee, 2009). Therefore, it is within the knowledge that no tools have been developed to support group ideation and discussion specifically, in a Japanese context.

2.2. Anonymity and Playfulness

Other studies have explored the impact of anonymity on creativity in computer mediated interaction. (Pissarra & Jesuino, 2005) Anonymity offers hiding personal identity, which allows people to put more emphasis on a higher level of their social groups. (Reicher, Spears, & Postmes, 1995) It leads to more satisfaction and higher performance, both subjectively and objectively (Tanis & Postmes, 2008). Introduction of playfulness allows the participants to create distance

from their ordinary life, which makes participants think out of the box, in other words, be more creative (Brandt & Eva, 2006; Brandt & Messeter, 2004; Vaajakallio & Mattelmäki, 2014)

3. RESEARCH QUESTION AND HYPOTHESIS

Building up on aforementioned studies, the objective is to develop a new tool to help Japanese people to express their opinion during idea generation. It is expected that anonymity and playfulness mitigate pressure of following hierarchical order and of keeping harmony of the group and increase freedom of speech and creativity in a group face-to-face setup in the Japanese context.

4. CREATION OF TOOLS FOR ANONYMITY AND PLAYFULNESS

4.1. “Idea Train” tool for idea generation

A tool was designed where each participant has his/her own isolated space and a device sharing ideas anonymously so that participants are able to share their ideas but could not see the owner of those ideas. (cf. Figure 1) In an individual space, each participant is given sticky notes and pieces of thick papers for idea sharing. Participants write an idea on a sticky note, then hang an idea to the tool at the centre of the table. The ideas on sticky notes are moved and shared with the people around through the motion of toy-like train.

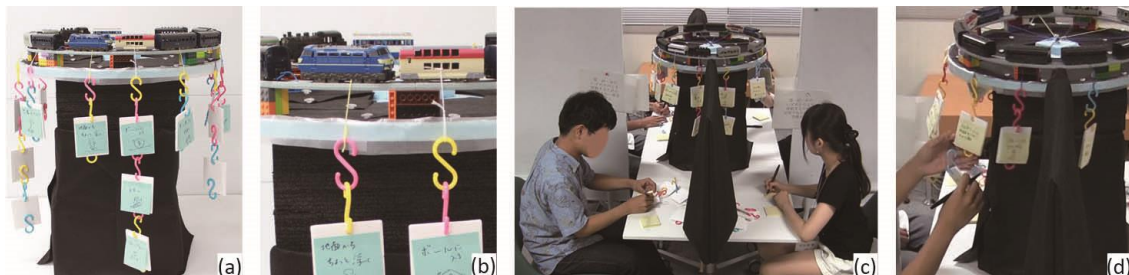


Figure 1: (a, b) tool overview (c) experiment setup (d) participant hooking idea

4.2. “Hidden Judge” tool for idea evaluation

A setup was developed where each idea has its own isolated workspace in which only one participant is allowed to enter to offer anonymity. (cf. Figure 2) Each participant is given a worksheet to indicate in which order they have to visit the four ideas' spaces. (cf. Figure 2.a right-up corner) The participants are asked to move around the spaces at the same time when facilitators ask them to do so. The worksheet and the facilitation allow participants to move around spaces individually and anonymously because the participants cannot know who is in which space. In each idea space, an idea and a grid categorising pros (advocate) and cons (opponent) are displayed on a large sheet of paper. The participants are asked to write as many pros/cons as possible on sticky notes then paste them on the sheet. The setting enables participants to write pros/cons anonymously, whereas they can take advantage of the group by seeing the ideas of other participants.



Figure 2: (a) worksheet (b) experiment setup (c) a shared pros/cons paper for each idea

5. EXPERIMENTAL ASSESSMENT OF THE TOOLS

In order to evaluate the impact of the tools on participation and creativity, sixteen university students are selected and divided into four groups of four and have participated in the experiment in two different conditions. The first session with tools and second session without tools (control condition). A group consists of two undergraduate students and two graduate students. This is done in order to introduce some perceived hierarchical differences between the participants.

5.1. Experimental Design

Two design topics were given in counter-balanced order to avoid order effect: Topic 1 “Imagine crazy solutions for thermal comfort during summer, in office, bedroom or outside” and Topic 2 “Imagine crazy solution for traveling on snow, sand or water”. All sessions were conducted in Japanese to avoid any misunderstanding. Consequently, questions and the design tasks reported in this paper were translated by the authors into English. The design session was designed to follow the second half of the Double Diamond Model (UK Design Council, 2005), where designers first diversify ideas then converge to one idea. The interactions among participants were partially restricted by only using a tool condition to offer anonymity whereas all kinds of interactions were allowed in the controlled condition. The detailed condition of each task is described in the following subsections.

5.2. Experimental Procedure (Design Session)

The first step of the session was idea generation where participants were asked to generate as many ideas as possible in 7 minutes. In the tool condition, a playful and anonymous environment was provided whereas in the controlled condition, the participants conducted the task as a group by following brainstorming rules (Osborn, 1957) in a face-to-face meeting setup. Following the idea generation, the participants evaluated and ranked four best ideas among the idea which the participants generated at a previous step, based on the originality of each idea. First, the participants were given two minutes to eliminate the same idea to avoid splitting votes into the same concept. Then, the participants had five minutes to rank the idea. Four ideas were selected by calculating the sum of ranks of the participants at the session. Four points were given to the first rank idea and one point was given to fourth rank idea. The impacts of anonymity were assessed by contrasting both the tool condition with the controlled condition where participants paste stickers of ideas in front of others. The third step is the pros or cons phase, whose objective

is to write down the pro (advocate) and the contra (opponent) of the idea. The participants had two minutes to think and write both pros and cons of each idea on sticky notes. Consequently, this step took eight minutes in total. The sticky notes are shared on a large piece of paper so that they can take advantage of group work. This is expected to increase anonymity in comparison with control condition where each participant talk face-to-face in front of a board with other participants. The following three steps which are discussion, sketch and presentation were conducted in the same way at both conditions. In the discussion step, participants discussed to select the best idea among the four ideas in five minutes. Then the participants sketched their concept in 1 minute on an A3 paper as a group. Then, in following the presentation step, participants are required to present in 1 minute as a group.

5.3. Data Collection

The questionnaires were completed by the participants. The level of anonymity and playfulness offered by the tools were evaluated by participants. Level of perceived anonymity was evaluated by two questions of seven points Likert scale question, where 1: strongly disagree to 7: strongly agree. They are based on a scale developed mainly for measuring anonymity in online environment. (Hite, Voelker, & Robertson, 2014) The level of playfulness was evaluated at after the ideation and after pro/cons by a question asking “How did you feel when conducting the task”, with seven points Likert scale questions where 1: boring to 7: fun. The experiment was evaluated by two measures; participants’ outcome created during the sessions and questionnaire evaluating participants’ perception of their performance. As a preliminary analysis, the session outcome, the number of sticky notes the participants wrote in each step, were analysed. Participants’ perceptions were evaluated by task specific questions after each activity. In the questions, the participants were asked to choose in seven points Likert scale question, where 1: strongly disagree to 7: strongly agree.

6. RESULTS

The following data was analysed: perceived anonymity of the tool, perceived playfulness of the tool, creativity (individual fluency, group fluency), perceived freedom of expression, perceived individual creativity, perceived group creativity.

6.1. Evaluation of perceived anonymity and playfulness in all sessions

The analysis shows that significant differences on the questions about anonymity in all phases Table 1 ($p < .05$). The result implies that the participants felt significantly more anonymity in the tasks with the tools. In the table Q1 represents “I am confident that others do not know which ideas I generated” and Q2 is “I could identify owner of each idea”. The questions were slightly modified to fit into the context of the task. For instance, “I could identify the owner of each comment” were asked after pros/cons session. The average score of Q1, in control condition is 3.50 whereas the score in tool condition is 4.81. It means that the participants were more strongly confident with the fact that the others could not trace the owner of the idea. As the nature of the

Japanese language, it is slightly tricky to be understood in English. Both of the result concluded that the participants felt more anonymity in the tool condition. The analysis regarding playfulness questionnaire shows that significant differences at all phases as

Table 2($p < .05$). The result implies that the participants felt significantly more fun in the ideation step, whereas they felt bored in the pro or cons step.

Table 1: Average and Standard deviation of questionnaire regarding perceived anonymity

	Q1: Certainty of not being identified			Q2: Inability of identifying others opinion		
	Control Average (SD)	Tool Average (SD)	Sig. (2-tailed)	Control Average (SD)	Tool Average (SD)	Sig. (2-tailed)
Ideation	3.50 (1.00)	4.81 (1.51)	$p=.009^*$	4.56 (1.46)	2.63 (1.49)	$p=.003^*$
Ranking	2.13 (1.17)	5.63 (1.47)	$p=.001^*$	5.19 (1.47)	2.19 (1.55)	$p=.001^*$
Pros/Cons	2.60 (1.36)	4.38 (1.17)	$p=.004^*$	5.13 (1.26)	3.56 (1.58)	$p=.027^*$

Table 2: Average and Standard deviation of questionnaire regarding perceived playfulness

	Control Average (SD)	Tool Average (SD)	Sig. (2-tailed)
Ideation	4.25 (1.61)	5.38 (1.15)	$p=.039^*$
Pros/Cons	4.81 (1.60)	4.06 (1.06)	$p=.002^*$

6.2. Assessment of the tool for idea generation

The number of ideas generated in the ideation session were measured by counting the number of sticky notes which each participant wrote. Both individual and group fluency were statistically analysed (cf.

Table 3). The individual fluency was significantly increased, but not the group fluency. The task specific questionnaires showing significantly different score ($p < .05$) were accumulated in the

Table 4. In the table, Q1 is "To what extend did you feel the freedom of expressing your thought?", Q2 is "How creative do you think you were during the task?" and Q3 is "I am satisfied with the amount of idea our group made in this task."

Table 3: individual and group fluency

No tool Average (SD)	"Idea Train" Average (SD)	Sig. (2-tailed)
-------------------------	------------------------------	--------------------

Individual fluency	4.25 (2.86)	6.27 (2.41)	p=.010*
Group fluency	20.67 (7.51)	26.00 (2.00)	p=.109

Table 4: Average and Standard deviation of task specific questionnaire

	No tool Average (SD)	"Hidden Judge" Average (SD)	Sig. (2-tailed)
Q1- Perceived freedom of speech	3.75 (1.44)	5.00 (1.58)	p=.046*
Q2- Perceived individual creativity	2.88 (1.45)	4.19 (1.42)	p=.013*
Q3- Perceived group creativity	3.38 (1.22)	5.13 (0.86)	p=.002*

6.3. Assessment of the tool for idea evaluation

The number of critics generated in the pros/cons session were measured by counting the number of sticky notes. The number of ideas generated by an individual were statistically analysed in Table 5. It shows that the participants have written significantly more number of pros, cons and both of them ($p < .05$). There were no significant differences in group level. However, the questionnaire asking their perceived own criticality did not show significant differences. ($p > .05$) The increase in the number may not be significant enough to increase the participants' perception as the increase is less than one. It means the number of comments generated in an idea were the same in some ideas.

Table 5: Average and Standard deviation of the number of criticism

	No tool Average (SD)	"Hidden Judge" Average (SD)	Sig. (2-tailed)
Pros	1.14 (0.52)	1.47 (0.67)	p=.041*
Cons	1.28 (0.60)	1.69 (0.73)	p=.043*
Pros/Cons	2.42 (0.96)	3.16 (1.30)	p=.023*

6.4. Discussion session

There are statistically significant differences ($p < .05$) on the following questions; Q1 is "How critical* were you in the task? * criticize: To express your disapproval of someone or something or talks about their faults" and Q2 is "Anonymity matters when I share my thought with others." although the discussion task itself is the same in both conditions as in Table 6.

Table 6: Average and Standard deviation of task specific questionnaire

	No tool Average (SD)	"Hidden Judge" Average (SD)	Sig. (2-tailed)
Q1- Perceived criticality	3.00 (1.27)	3.81 (1.33)	p=.032*
Q2- Perceived importance of anonymity	3.56 (1.69)	4.44 (1.54)	p=.027*

The result of Q1 shows that they perceived themselves more critical during discussion in tool conditions. Q2 results shows that the participants consider anonymity significantly more important after the session in tool condition.

7. DISCUSSION

7.1. Anonymity increasing freedom of speech and efficiency during the task

The significant differences on perceived anonymity results in the significant perceived freedom of speech (No tool: 3.75 (1.44) vs "Idea Train": 5.00 (1.58), $p=.046$) at idea generation step. The ideation tools successfully increase perceived individual creativity (No tool: 2.88 (1.45) vs "Idea Train": 4.19 (1.42), $p<.013$) and group creativity (No tool: 3.38 (1.22) vs "Idea Train": 5.13 (0.86), $p=.002$). The consistent result was observed in individual fluency of the design outcome (No tool: 4.25 (2.86) vs "Idea Train": 6.27 (2.41), $p=.010$). The selection tool significantly increased objective outcomes of the task. (No tool: Pros/Cons 2.42 (0.96) vs "Hidden Judge": 3.16 (1.30), $p=.023$). The results supported hypothesis 1 and hypothesis 2 partially. The introduction of anonymity created more perceived freedom of speech. It resulted in a more creative discussion in terms of fluency and a more critical discussion in idea selection. The differences might influence on perceived importance of anonymity. These results are consistent with Tanis' work in computer mediated interaction. (Tanis & Postmes, 2008). Further analysis on originality of generated ideas and quality of criticism is needed to implement anonymity in a practical context.

7.2. Securing anonymity in part of the design process impact following phases

Statistically significant differences of perceived anonymity at the pro or cons phases seem to lead the significantly higher perceived critical discussion at the discussion step (No tool: 3.00 (1.27) vs tool: 3.81 (1.33), $p=.032$). It seems that the securing anonymity is a part of the converging phase, could improve productivity of the overall converging phases. The differences can be justified by the fact that the participants have generated a larger number of pros and cons in previous tasks.

7.3. Anonymity may decrease playfulness of design activities

During the pro or cons step of design activities, the perceived playfulness in an anonymous (No tool: 4.81 (1.60) vs "Idea Train": 4.06 (1.06), $p=.002$) setting was significantly lower than in a non-anonymous setting. It could lead to the perception that participants think of themselves being

more critical. It can be said that the introduction of anonymity leads to lower playfulness of the task.

8. CONCLUSION

In this paper, it is reported that the development of two design tools, “Idea Train” and “Hidden Judge”, that aim at incorporating anonymity during the generation and the evaluation of design ideas in a Japanese context. The impact of these tools on creativity and participation was assessed through an experimental evaluation. The results show that introduction of anonymity increases perceived freedom of speech in the idea generation phase and significantly higher perceived creativity of the task. The higher perceived creativity is supported by a significantly higher fluency of the design outcome. The results in the idea selection show that anonymity increases the number of judgments in idea evaluation. Overall, anonymity helps the participants to express their own opinion with group members. However, anonymity compromises perceived playfulness in design tasks. The withdraw of anonymity could be mitigated by the introduction of playfulness factor in the design tool. Further research with participants from different culture is recommended to map the result into different cultural contexts.

REFERENCES

- Arrighi, P. A., & Mougnot, C. (2016). Towards user empowerment in product design: a mixed reality tool for interactive virtual prototyping. *Journal of Intelligent Manufacturing*, 1–12.
- Boeijen, A. Van, & Stappers, P. (2011). Preparing Western designers for the use of contextmapping techniques in non-Western situations. *Proceedings Engineering and Product Design Education Conference*, (September), 1–6.
- Brandt, E., & Eva. (2006). Designing exploratory design games. In *Proceedings of the ninth conference on Participatory design Expanding boundaries in design - PDC '06* (Vol. 1, p. 57). New York, New York, USA: ACM Press.
- Brandt, E., & Messeter, J. (2004). Facilitating collaboration through design games. *Proceedings of the Eighth Conference on Participatory Design Artful Integration Interweaving Media Materials and Practices PDC 04, 1*, 121–131.
- Détienne, F., Baker, M., Vanhille, M., & Mougnot, C. (2016). Cultures of collaboration in engineering design education: a contrastive case study in France and Japan. *International Journal of Design Creativity and Innovation*, 81(0), 2–12.
- Gentner, A., Bouchard, C., Badoil, A., & Favart, C. (2014). Kansei cards a visual tool supporting the investigation, discussion, and representation of the kansei-related intentions of a product to be designed Alexandre. In *INTERNATIONAL CONFERENCE ON KANSEI ENGINEERING AND EMOTION RESEARCH* (pp. 25–38).

Hite, D. M., Voelker, T., & Robertson, A. (2014). Measuring perceived anonymity: The development of a context independent instrument. *Journal of Methods and Measurement in the Social Sciences*, 5(1), 22–39.

Hofstede, G., Hofstede, G. J., & Micheal, M. (2010). *Cultures and organizations - software of the mind. Revised and expanded 3rd Edition. Cultures and Organizations*.

Lee, J. J., & Lee, K. P. (2009). Facilitating dynamics of focus group interviews in East Asia: Evidence and tools by cross-cultural study. *International Journal of Design*, 3(1), 17–28.

Nagamachi, M. (1995). Kansei Engineering: A new ergonomic consumer-oriented technology for product development. *Industrial Ergonomics ELSEVIER International Journal of Industrial Ergonomics*, 15, 3–11.

Osborn, A. F. (1957). *Applied Imagination*. Oxford.

Pissarra, J., & Jesuino, J. C. (2005). Idea generation through computer-mediated communication: The effects of anonymity. *Journal of Managerial Psychology*, 20(3), 275–291.

Rasamoelina, F., Bouchard, C., & Aoussat, A. (2013). Towards a Kansei-based user modeling methodology for eco-design. *International Journal of Affective Engineering - Special Issue on KEER 2012*, 12(2), 337–348.

Reicher, S. D., Spears, R., & Postmes, T. (1995). A social identity model of deindividuation phenomena. *European Review of Social Psychology*, 6(1), 161–198.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, 4(1), 5–18.

Simonsen, J., & Robertson, T. (2012). *Routledge international handbook of participatory design*. *Routledge International Handbooks*. Routledge.

Tanis, M., & Postmes, T. (2008). Cues to identity in online dyads: Effects of interpersonal versus intragroup perceptions on performance. *Group Dynamics: Theory, Research, and Practice*, 12(2), 96–111.

Taoka, Y., Kagohashi, K., & Mougénot, C. (2016). Living labs and co-design for social innovation: Mapping the European model to Asian societies? In *Cumulus Hong Kong 2016, Open Design for Everything*. *International Association of Universities and Colleges of Art, Design and Media*.

UK Design Council. (2005). *A study of the design process*. *Online report*: Retrieved from [http://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council \(2\).pdf](http://www.designcouncil.org.uk/sites/default/files/asset/document/ElevenLessons_Design_Council%20.pdf)

Vaajakallio, K., & Mattelmäki, T. (2014). Design games in codesign: as a tool, a mindset and a structure. *CoDesign*, 10(1), 63–77.

Van Boeijen, A. (2015). *Crossing Cultural Chasms Towards a culture-conscious approach to design*. Doctoral thesis (Industrial Design). Delft, Netherlands: TU Delft.

Van Rijn, H., Bahk, Y., Stappers, P. J., & Lee, K.-P. (2006). Three factors for contextmapping in East Asia: Trust, control and nunchi. *CoDesign*, 2(3), 157–177.

Yasuoka, M., Nakatani, M., & Ohno, T. (2013). Towards a culturally independent participatory design method: Fusing game elements into the design process. *Proceedings - 2013 International Conference on Culture and Computing, Culture and Computing 2013*, 92–97.

A STUDY OF PRODUCT ANTICIPANT IMAGES OF THE ELDERLY

Yung-Chuan MA^a, Shih-hung CHENG^b

^a National Yunlin University of Science and Technology, Taiwan, mayc@yuntech.edu.tw

^b National United University, Taiwan, achille.shc@gmail.com

ABSTRACT

Aging population is a challenge faced by most countries in the world. The aged population happen to be in the prime of their life. Although advanced in age but are still wealthy, they will become a major consumer group ready to treat themselves well and try out new things.

Although seniors are emerging as a great business opportunity, exploration of their psychological demands for the related commodities is limited. In order to avoid the mistake caused by designers in designing based on their own perceptions, the products intended for seniors, we will start a research from the perspective of Kansei Engineering. Through questionnaires, the research is intended to reveal the expectation images of seniors about their frequently used glasses and blood pressure meters through their choices of the descriptive adjectives about their preferred products and also to identify the difference in perception of quality consumer products between seniors and non-seniors.

The research shows that: 1) Seniors focus on the overall user experience about consumer products rather than their individual features. 2) Seniors pay less attention to the appearance of the products with a preference for graceful physical forms. 3) Gender does not play a big role in their choices of consumer products. 4) Female seniors pay more attention to their personal images when it comes to the choice of the consumer products involving personal appearances while their male counterparts do not pay much attention to this aspect. 5) The preference is basically consistent between seniors and non-seniors.

Keywords: *the elder, anticipant images, design practices*

* Corresponding author.

1. RESEARCH BACKGROUND AND LITERATURE REVIEW

1.1. Research background

According to the World Health Organization (WHO), an aging society is defined as one in which the number of senior citizens aged over 65 accounts for over 7% of the country's total population; an aged society has more than 14% of its population over 65, and a hyper-aged society is one with over 20%. Taiwan (ROC) became an aging society in 1993. Taiwan is projected to become an aged society in the year 2018, and a hyper-aged society in 2025.

In Taiwan, the population of older adults (over the age of 50) and senior citizens (over 65) will exceed 9.12 million by 2020, representing 40% of the total population. People in this group are just only reaching the peak of their lives. Although they are becoming aged, their lives are like brilliant maple leaves in autumn, rich and dazzling. People in this group are wealthy, exhibit a desire to consume, dare to try out new things, and treat themselves well. Hence, they will become the next mainstream of consumers.

The silver-haired population offers much business opportunities. But most enterprises do not have sufficient information about the consumption preferences of the aged population. They cannot afford to avoid the challenge of seizing the market of the silver-haired population as an aged society is taking shape. The stereotyped image that the general public has about the consumer products intended for seniors is usually associated with such descriptions as dark-coloured, function-oriented, easy in operation, and simple in appearance. (figure 1.) But do senior consumers really like these kinds of products?



Figure 1: Photos of consumer products used by seniors are searched through Google search engine.

A review of the research literature on seniors published in recent years shows that most of them focus on discussion of the effects of their declining physiological functions, such as the Exploration of Cell Phone Operation Interface for Seniors (Yu Jing, Ji Ting, and Xu Jianbo, 2016); General Design Principles Attempting to Draw Conclusions on Seniors' Visual Demands for Their Products (Jeff, Johnson. & Kate, Finn., 2016); and the Effect of Overall Environment and Social Effects on the Seniors (Tad Hirsch, Jodi Forlizzi, Elaine Hyder, Jennifer Goetz, Jacey Stroback, Chris Kurtz, 2000); Exploration of Seniors' Demands for Product Designs Sponsored by

Enterprises (Matsushita Electric Works, Ltd., 2005). The exploration of the psychological expectation image of seniors is quite limited.

This research attempts to proceed from the association between expectation image and design approaches. It first studies the preference of seniors for consumer products with examples of their frequently used products and the preference of non-seniors as well as the obvious difference between seniors and non-seniors, so as to offer a general conclusion for reference.

If we could have some understanding of the basic cognition of the design definition between designers and senior consumers, we will be able to help bridge their gap in cognition. If we could extract the design elements and methods, about which both designers and senior consumers have consistent cognition, to come up with a table of design suggestions, they could act as references for practical designing.

Through questionnaires and interviews, this research intends to identify the shared perceptions amongst seniors about consumer products. Its findings are expected to provide suggestions in the product design process and also helps to understand the demands of seniors for consumer products.

1.2. Research topics

This research initially explores the following topics:

1. Expectations of seniors about consumer products.
2. Comparison of the expectations between male and female seniors to identify whether gender will cause major differences.
3. Will the expectations of seniors vary significantly with consumer products of different nature?
4. Compare the expectations of seniors and non-seniors to find out whether non-seniors do know what seniors want.

2. RESEARCH METHOD AND PROCEDURES

The above-mentioned topics are explored through a questionnaire about choice of adjectives for expectation description supplemented by an interview on the spot.

2.1. Subjects

Subjects are divided into a senior group and a non-senior group.

2.1.1. Seniors

According to the Golden Age Theory by Lin in 1995, there are three categories of seniors (Golden Age I - III) in accordance with the five comprehensive health indexes including physical health, mental health, social health, economic health and ADL.

Golden Age I: (healthy & active, 70~80%)

Golden Age II: (moderately morbid or infirm, less active, partially dependent, 2~7%)

Golden Age III: (seriously ill or disable, totally dependent, 2~7%)

This research intends to study the senior population in Gold Age I which refers to the healthy and physically active seniors with the abilities of independent living. This group accounts for 70% of the overall senior population. In the age group of 65-74, they have just joined the senior population. Since they could express their own preferences with their abilities of independent living and choice of consumer products, they became the focus of this research which studied a total of 50 subjects in the group including 25 male seniors and 25 female seniors.

2.1.2. Non-seniors

A total of 50 subjects aged under 65 were chosen, including 10 in each of the five age groups with an interval of 10 years, namely 64-55, 54-45, 44-35, 34-25 and <25.

2.2. Consumer products studied

In choosing the consumer products for the study, we focused on the ones which seniors find familiar. Through an interview of 5 seniors, we managed to find out their most-frequently used products. They were asked for the reason for their choices. This information could be used as reference for the follow-up screening and evaluation.

Finally, blood pressure meter and glasses were chosen as the study samples. Both of the products are used by seniors on a daily basis. They are also of different nature since glasses involves personal appearance. A study based on these two products is also expected to show the preferences of seniors for the products of different nature.

2.3. Adjectives available

An interview with five product designers with more than 3 years of designing experience reveals their intended image perceptions in designing products for seniors. We also collected image words frequently used in the related literature and came up with 52 adjectives available for choices in our questionnaire.

2.4. Experiment Procedures

Among the 52 adjectives, subjects were asked to make a choice to describe their expectations about blood pressure meter and glasses respectively. In the due process, they were asked for the reason of their choices which were recorded. Finally, we counted the times each adjective had been chosen, showing their popularity.

3. EXPERIMENT RESULTS SHOW

3.1. Results of the study on the participating seniors

3.1.1. Overall expectation image of the participating seniors

The participating seniors made a choice among the 52 adjectives to describe their expectations for the two products. Table 1. shows the top 10 adjectives.

Table 1: Results of the choices by the participating seniors. (overall)

Rank	Adjectives (anticipant image)	Frequency
1	Practical	65
2	Safe	58
3	Light	51
4.5.6	Comfortable, durable, effective	49
7	Convenient	42
8	Efficient	39
9	Solid	37
10	Graceful	27

1. The participating seniors focused on the practical aspect of the products, followed by their "safety", "lightness", "comfort", "durability", "effectiveness", "convenience", "efficiency", "Solidarity" and "gracefulness". Among them, lightness refers to the product's actual size as well as its physical form. The three adjective words "comfort", "durability" and "effectiveness" were chosen for the same number of times.
2. An analysis of these words shows that most of them are related to the overall perception after the use of the products. For example, the adjectives like "practical", "comfortable", "durable", "effective", "convenient", "efficient" and "solid" are used to describe the overall experience rather than a single feature of the products. Such experience would be possible only after usage over a period of time. Thus, seniors care more about the overall user experience of the products rather than their individual features.

3. From the perspective of the seniors, products need be comfortable, convenient and safe in their operation. They also need to be durable and solid allowing for a long-term use.
4. The experiment results show that seniors pay less attention to the physical form of the products. Although the word “light” ranks the 3rd in the top 10 most frequently used words, we learned through interviews that it was chosen to mean demands in usage, operation and even for the purpose of collection rather than because of the physical form. “Graceful” is the most frequently chosen adjective that is purely related to the physical form.
5. In choosing daily consumer products, most of seniors would consider the overall user experience, followed by their operation and then their physical form.

3.1.2. The effects of the gender factor

Table 2 shows the effects of the gender factor.

Table 2: Results of the choices by the participating seniors. (Differences caused by the gender factor)

Female seniors		Male seniors	
Rank	Adjectives (Frequency)	Rank	Adjectives (Frequency)
1.2	Safe, practical (30)	1	practical (35)
3	Comfortable (26)	2	Effective (29)
4.5	Light, durable (24)	3.4	Safe, convenient (28)
6	Effective (20)	5	Light (27)
7.8	Graceful, efficient (19)	6	Durable (25)
9	Professional (16)	7	Comfortable (23)
10	Solid (15)	8	Solid (22)
		9	Efficient (20)
		10	Concise (15)

1. The results of the study on both genders show that male seniors care more about the practicality of the products while their female counterparts pay equal attention to the practicality and safety. The former pay more attention to effectiveness while the latter focus more on comfort.
2. In terms of physical form, female seniors prefer graceful designs while their male counterparts prefer concise designs.
3. Generally speaking, the choices of the adjectives are basically consistent between female and male seniors in terms of individual choices and identical in the overall choices.

3.1.3. Effects of product categories

Table 3 shows effects of different product categories on the choices of senior about their expectation image.

Table 3: Results of the choices by the participating seniors. (Differences caused by the product category)

Blood pressure meter		Glasses	
Rank	Adjectives (Frequency)	Rank	Adjectives (Frequency)
1	Practical (36)	1	Durable (30)
2.3	Safe, effective (31)	2.3	Convenient , practical (29)
4	Light (28)	4	Safe (27)
5	Convenient (22)	5	Light (23)
6	Efficient (21)	6	Graceful (21)
7	Comfortable (20)	7	Convenient (20)
8	Durable (19)	8	Durable (19)
9	Solid (18)	9.10	Efficient , effective (18)
10	Simple (14)		

As the overall results demonstrate, seniors emphasize their demands for functionality in choosing blood pressure products while they pay more attention to the comfort and gracefulness of the glasses as evidenced by the frequency of their choices of the adjectives.

The effects of both product categories and gender factors are shown in table 4 and 5.

Table 4: The gender factor vs the product category. (Blood pressure meter)

Blood pressure meter			
Female seniors		Male seniors	
Rank	Adjectives (Frequency)	Rank	Adjectives (Frequency)
1.2	Practical, safe (16)	1	Practical (20)
3	Effective (13)	2	Effective (18)
4	Light (12)	3	Light (16)
5	Efficient (11)	4	Safe (15)
6.7	Comfortable, durable (10)	5	Convenient (13)
8.9	Professional, convenient (9)	6	Solid (12)
10	Simple, clean (7)	7.8	Comfortable, efficient (10)
		9	Durable (9)
		10	Concise (8)

Regarding the blood pressure meter, there is not much difference in the choices between male and female seniors. The results are the same with the effects of gender factor. Male seniors focus on the functionality of products while their female counterpart pay equal attention to safety in addition to the functionality.

Table 5: The gender factor vs the product category. (Glasses)

Glasses			
Female seniors		Male seniors	
Rank	Adjectives (Frequency)	Rank	Adjectives(Frequency)
1	Comfortable (16)	1	Durable (16)
2	Graceful (15)	2.3	Practical, convenient (15)
3.4.5	Safe, practical, durable (14)	4.5.	Safe, comfortable (13)
6	Light (12)	6.7.	Effective, light (11)
7	Solid (9)	8.9	Efficient, solid (10)
8	Efficient (8)	10	Simple, concise (7)
9.10	Effective, professional, modern (7)		

1. Regarding the glasses, female seniors care about their comfort most while male seniors focus on their durability. In terms of their physical forms, female seniors prefer graceful designs while male seniors tend to like simpler designs.
2. Both male and female seniors pay the most attention to the practicality in choosing different products, without much difference in their choices between them. However, female seniors pay equal attention to the safety apart from the practicality. Female seniors care about their appearance while their male counterparts do not care that much on it. The former like graceful designs while the latter prefer simple designs.

3.2. Seniors vs non-seniors

3.2.1. Comparison of overall results

The comparison of the choices between seniors and non-seniors is shown in Table 6.

Table 6: Choices of seniors and non-seniors. (overall)

Seniors		Non-seniors	
Rank	Adjectives (Frequency)	Rank	Adjectives(Frequency)
1	Practical (65)	1	Light (65)
2	Safe (58)	2	Durable (64)
3	Light (51)	3	Practical (63)
4.5.6	Comfortable, durable, effective (49)	4	Comfortable (51)
7	Convenient (42)	5	Professional (49)
8	Efficient (39)	6	Safe (46)
9	Solid (37)	7	Convenient (39)
10	Graceful (27)	8	Effective (33)
		9	Efficient (32)
		10	Concise, durable (30)

1. Generally speaking, the choices of non-seniors are basically similar to those of seniors.
2. In terms of the frequency of choices, non-seniors believe that “light”, “durable” and “practical” are the most important features about the products for seniors, each chosen by 60% of them. Nearly 50% of non-senior participants chose “comfortable” and “professional”. They believe that products intended for seniors need to be as light as possible. In light of the decline of physiological function of the seniors, their product design needs to address the difficulty caused by the decline to ensure their comfort. In addition, the word

“professional” were chosen to mean the functions of the products and also their physical forms. Non-seniors consider that the physical forms of the products for seniors need to be “professional” and “concise” while seniors themselves prefer graceful design.

3.3. Overall research results

To sum up, the experiment results are as follows:

1. In choosing daily consumer products, seniors would consider the overall user experience first, followed by easiness of their operation and then their physical forms in which they prefer graceful designs.
2. In terms of choices, there are no obvious differences between male and female seniors. As indicated by the experiment results, male senior focus on the practicality of the products while their female counterparts also give equal attention to their safety. The former emphasizes the functional effectiveness of the products while the latter stress their comfort. Regarding the physical forms of the products, female seniors prefer graceful designs while their male counterparts like concise designs.
3. Regarding the products of different nature, there are not much differences among seniors in terms of their choices, although female seniors care about their appearance while their male counterparts do not care that much about their appearance.
4. The expectation images of the products for seniors are generally the same between seniors and non-seniors. The former are more concerned about the functions of the products while the latter believe that the physical forms of the products need to be “professional” and “concise”.

4. FOLLOW-UP RESEARCH AND SUGGESTIONS

Early in the research, we attempted to identify the preferences of the participating seniors about the particular products. The comparison between seniors and non-seniors revealed that both groups had similar preferences. The seniors are concerned about the overall perception of the products first rather than their individual features, followed by the physical forms in which they prefer graceful designs.

We have learned from the results of the previous experiment that in designing products for seniors we need focus on the balanced performance of the products in all aspects rather than highlighting individual features. Based on the previous findings, this research will follow up by attempting to sum up designing elements and approaches corresponding to the preferred adjectives in hopes of contributing reference data to practical designs.

5. ACKNOWLEDGMENTS

The authors would like to thank financial support by the Ministry of Science and Technology under grant number MOST 106-2410-H-224-025-.

REFERENCES

- Yu, J., Ji, T., & Xu, J. (2016). A study on interaction design of elderly mobile terminals based on Kansei engineering. *2016 International Conference on Robots & Intelligent System*, 59-62.
- Hu, Z., Wang, W., & Qiao, X. (2016). The study of the double color matching of the elderly assistive products based on the Kansei engineering. *2016 International Journal of Multimedia and Ubiquitous Engineering*, 11(4), 323-334.
- Huang, H., Wu, Y., Cheng, J., & Yang, M. (2016). Design of smart watch for old people based on the benchmark of consumers' Kansei intention. *International Conference on Human Aspects of IT for the Aged Population. Design for Aging*, 446-456.
- Fi, X. Y., Li, w., & Wu, J. F. (2015). Modeling design of electric scooter for the elderly using Kansei engineering. *Packaging Engineering*, 36(2), 59-71.
- M, Nagamachi. (2014). Ergonomic aspects for assisting facilities to elderly people. *Gerontechnology*, 13(2), 70-70.
- Ahi, M., Andy, Negin, & Yashmi. (2014). Design urban area toward aging successfully; based on Kansei methodology. *International Conference on Kansei Engineering and Emotion Research 2014*, 171-180.
- Matsushita Electric Works. Ltd. (2005). Research and business related to an aging society at Matsushita Electric Works. *Gerontechnology*, 3(4), 251-251.
- Hirsch, T., Forlizzi, J., Hyder, E., Goetz, J., Stroback, J., & Kurtz, C. (2000). The ELDer project: Social, emotional, and environmental factors in the design of eldercare technologies. *2000 conference on Universal Usability*, 72-79.

FRAMEWORK FOR EVALUATION OF SHOW WINDOW USING COMMUNICATION ITEMS REFLECTING DESIGNERS' INTENTION OF PRODUCTION

Chenyan ZOU^a and Shinji WAKIYAMA^b

^aDepartment of Design Strategy, Kyushu University, Fukuoka, Japan

^bDepartment of Contents and Creative, Kyushu University, Fukuoka, Japan

ABSTRACT

Window displays make the first impression of stores, representing the corporate images, latest fashion trend, and also influence shoppers' motivations. The usual method to evaluate successful window displays was outlined from the aspect of the contribution to the store sales or shoppers' responses. In prior research, window displays refer to store atmospherics, shoppers' behaviours, and visual merchandising were reviewed and verified as effective marketing approaches, but no systematic research has been done focusing on window displays as communication tools from a creative perspective. In this paper, we outlined the evaluation items for window displays such as design elements, visual harmony with surroundings, and seasonality through interviews with display creators, which sufficiently clarifies the stores' creative intention and what they put emphasis on. Outlining these items also give a chance to measure if the communication works effectively via window displays. The framework of evaluation structured by these items could be used as a scale to clarify the perception gap.

Keywords: Window displays, Designers' aspect, Communication item.

1. Introduction

Berman & Evans (1995) mentioned that the window display has two functions [1]. The first one is to show what kind of products the store sells. The second one is to encourage customers to enter into the store. Therefore, the contents of the window design depends on the creation purpose. Only one item centred with spot light represent the brand concept while the poster

printed with large "SALE" characters attracts consumers seeking affordable products. It is said that attractive VMD contributes to sales by disseminating brand messages and attracting consumers into stores as well. However, with the EC business boom stems in recent years, more companies have started laying emphasis on online market which leads the production budget of show window compressed in department store and fashion buildings, and even the necessity has begun to be questioned that was clarified through the interview with designers in the previous research.

As can be readily seen from examples of recent show windows that show windows tend to be "a place to provide performances and entertainment" not just "a place to display items". In the show window of "FENDI" in Tokyo Ginza Matsuya, a long established department, a unique fashion show was staged with models wearing the latest fashion, taking a pose like a real mannequin which attracted passers-by (see Fig.1).) On the same Ginza Central Street, another department store Ginza WAKO tried a special show window on the subject of white polar bears' family on Christmas season. There was a bottom set with a note written "Do not disturb!" on the window. If you press the bottom, a bell rings and the polar bear will wake up, shake his head and twinkle behaved like a real one. In another time, he sleeps and snores, and breath which makes his body move up and down that made passers-by inadvertently stopped in front of the show window and started to take a picture (see Fig. 2).



Fig.1. FENDI in Ginza Matsuya



Fig.2. Main show window of Ginza WAKO

In this way, more entertainment and performance elements have been added which makes show window plentiful and undergo a big transformation, though it is said that no systematic evaluation survey has been done to reflect consumers' view through the research interview. Consumer's evaluation of show window not only influence the store impression and the whole brand image, but also works as a key factor to be considered in terms of store management and marketing strategies. However, it is hard to determine whether it is appropriate to evaluate a show window display from unilateral consumer side without consideration of the displays' creative aims and functions. Since the show window is a media which transmit store and brand messages to consumers. In other words, the consumer's evaluation can be seen as an indicator to measure whether the intention of the production side has been understood or not. Therefore, firstly what

the production side want to express and disperse should be organized and listed up to manage as a consumer's evaluation indicator.

2. Theoretical Background and Research Framework

2.1 Prior Research

Many studies on show windows remain at practical level, and few academic prior re-search could be found. Kotler (1973) first focused on the store environment that have a greater influence on consumer purchasing behaviour than the items itself from a marketing aspect, who also established the concept of "store atmosphere"[2]. Based on Kotler's practical theory, Berman & Evans (1995), categorized the 4 physical factors that form the atmosphere of the store with "store exterior", "store interior", "layout and design", "POP(point of purchase) and decoration"[1]. Show window is stated as one of the external factor of store which includes the signboard, entrance of the store, the parking lots and so on. Then, the 5th factor, "human variables", was advocated for the store atmosphere by Turley & Milliman (2000) who pointed out that customers' behaviours are also influenced by the services experienced in the store [3]. They reviewed the prior search and found that there were only four literatures mentioned to the store exterior factor and only one study related to show windows by Edwards & Shackley (1992) which discussed the effect of the show window as an exterior factors [4]. From 2000 onwards, research on show windows began to gradually increase. From the view-point of marketing, Kim (2003) clarified that the purchasing decisions in the store are influenced by the promotion campaign and window display through the research of observing the purchasing behaviour of college students in clothing store [5]. Oh & Petrie (2012) also revealed that the window display is a key point for shoppers' decision to visit a store [6]. In addition, Somoon & Sahachaisaeree (2010; 2012), disclosed the window display as a part of the sales strategy and clarified several favourable factors like warm-coloured lights, spotlights, human-like mannequins, and graphics with letters are preferred by customers through a research of students in a clothing store[7][8].

In Japan, only few research papers could be found about show windows. Takayanagi (2002) discussed the five physical factors that form the atmosphere of the store in the show window research [9]. She also organized the historical development of show windows in Japan, back to the Edo period, a Danren which is the predecessor of show window functioned as a signboard was described [10]. In addition, a comparative re-search about the media function and customer experiences between US and Japan of the show window by Takayanagi (2006) made it clear that the purchasing judgment influenced by the selling method [11]. Regarding the design factors of the window display about fashion products, Ikeda (2010) conducted a comparative survey and described the difference among four types of brands in three different cities [12].

2.2 Research Methodology

There are three subjects that should be discussed from the prior search. First, in the prior research, a research sample composed with students only could be seen. The important role of the

show window is to disseminate information to consumers who may be a potential consumer. Therefore, it could be said that survey targeting with appropriate attributes should be selected corresponding to the purpose and store targeting.

The second issue is that in prior research paper, store locations and environmental factors were not mentioned. Most studies focused on the window itself such as layout method, graphics design, and lighting. However, show window is not necessarily a single unit, which is one part of exterior of the shops and the landscape of the town as well. Thus, the relationship with the environmental surroundings should also be taken into consideration in the research.

The third subject is that an objective criterion has not yet been established for evaluating show windows. Though in the prior research, favourable mannequins, lighting, and layouts are partly clarified, it is still limited in the contents level. Since the consumers' evaluation is an important criterion to measure what attracts consumers based on the store management and marketing strategy, there needs an evaluation criteria to clarify if the communication disseminated appropriately through the show window. In this research paper, we focused on structuring the evaluation framework of the show window with the view of production sides.

3. Research Method

3.1. Research Framework

The show window is a place where a brand conveys their corporate messages. A relation map could be used to describe the relationship between consumers and company side which quote from the model Nagumo (2004) described in Fig.3 [13]. Companies provide media, products, and messages to users aimed for sales, customer satisfaction and customer relationship management. In this cycle, show window creators works as an information transfer who connect consumers and stores through show window display composed with layout, materials, characters, graphics elements and so on which definitely and directly influence consumers' evaluation and satisfaction.

In this research, we focused on department stores and fashion buildings in Japan to find out what kind of communication messages are designed by show window creators. The purpose of this study is to outline the communication items designers' appeal by a survey to structure a framework for evaluation of show window displays. Thus, the research field of this paper is the information contents designers apply to the show windows, but not the impression the consumers got (see Fig.4).

3.2. Research Method

In this research, we applied for interviews with 10 department stores and fashion buildings handling show windows in Tokyo and successfully interviewed three companies in advance which were all located in the central shopping areas and long-established with all ranges of targeting. A questionnaire survey online was designed with the attributes, working experiences, and job titles following the question describing the messages with keywords about what the respondents put emphasis on the window creation.

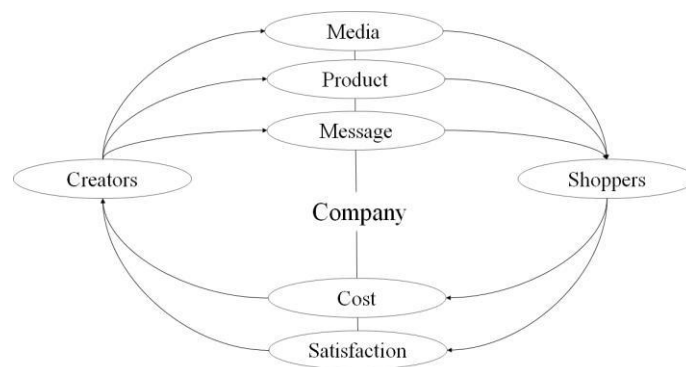


Fig.3 The relation between creators and shoppers (base on Nagumo (2014))

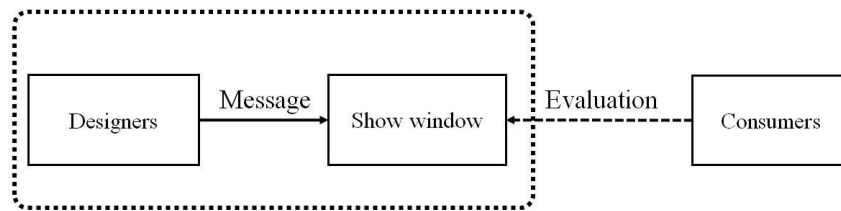


Fig. 4 Research filed

4. Research Result

As a result of the questionnaire survey, the answer of total seven designers with 5 to 40 years of work experience was collected and 10 keywords were extracted with "Seasonality", "Fashionable trend", "Visual impact", "Originality", "Brand identity", "Symbolization", "Harmony with surrounding", "Photogenicity (topicality)", "Message", and "Display quality"(see Fig.5).

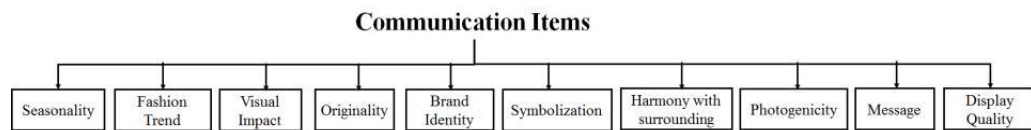


Fig. 5 Communication Items Abstract

Seasonality

One of the important roles of the show window is to catch the eye of passers-by and raise commodity demand. Especially, by displaying the latest seasonal products can encourage purchasing promotion through the materials, colour, and the motive of the decoration used for the display to emphasise on the season coming and demands of new products. Thus, how to design the window with seasonal elements is what designers focus on.

Fashion Trend

How quickly the store delivers the latest fashion information to consumers is a big criterion to measure the attractiveness of the store. If the products exhibited on the display are of low popularity, which will decrease the visit rate as well as the popularity of the store. For that reason, design work are mainly focused on the trend elements and designers work hard to collect fashionable items to display.

Visual Impact

The visual impact has been mentioned for a long time. Unlike other media, few people would watch the show window display with purpose. Therefore, how to attract passers-by depends on the designers' work. Although different role of the production such as decorators, graphic designers, and lighting staff in the whole work who attempts to try to maximize their work quality,

but on a general consumer side, it is more important that the overall visual factors such as usage of colour and materials without professional views.

Originality

It's getting hard for stores to replace whole decoration items every season. Thus, the reusing or remaking of items could be seen. Through the annual sales promotion calendar, nearly topics could be seen and lack of novelty would make the store lose their identity and originality. To cover these issues and make it engaged in production budget, designers try hard to create something new through remaking the items used before which could be recoloured or reshaped, but still keep the uniqueness of the whole display image with creative effort behind.

Brand Identity

It could be said that show window is a reflection of the brand concept. Especially, the shopping mall or fashion building in Japan, which is composed of several fashion brand with their private brand items. In this case, two patterns of display could be seen that the display by mall focus on the sale or event information, and the tenant shop focus on how to distinguish their brand concept and attract consumers to come in on the other hand. Thus, how to express the brand identity through the show window is much more important. What designers try hard is to express is the unique brand concept and try differentiation and comparison to competitors through displays instead of putting a clear logo or brand name on it.

Symbolization

The show window is seen as the face of stores. Therefore, it is occasionally used as a place for people to meet up if the store is well located with high visibility in Japan. Characteristic show windows are easy to describe and easily recognized which promote more people gathering in front of the store and increase touch-points with the items displayed through the window. Thus, waiting time is an effective advertising time which is one part of marketing strategy to stimulate peoples' purchase intention. For instance, WAKO, a department store located in the central of Ginza in Japan with historical exterior, is regarded as a symbol of Ginza. It is famous for its unique and artistic show windows organized with four parts of windows. Thus, how to make the show window as a symbol that representing the store as well as the town is one of the challenges faced by creators.

Harmony with surroundings

Since a good window display is evaluated not only by the window itself but also how successful it combines with the building, the peripheral facilities, and surrounding environment. Thus, the external appearance of a building composed of show windows, entrance, and parking areas totally affect the first impression of consumers to enter. In a store in Harajuku, a town crowded with young people and famous for pop culture in Japan, vivid colours and mode style are much more preferred that harmonises with the people in the town. On the country, usage of high quality materials in quiet colours and classical mannequin display are highly preferred among the people in pursuit for a high quality commodity. For creators, when planning the show window,

visitor attributes, and environmental influence are concerned as part of store management strategy as well.

Photogenicity

It has been preferred to record a beautiful show window display into the photo from before. Especially, in recent years, the increase of windows incorporating motions and sounds make it much easier to approach a wide range of targets. The number of posts with “#show window” in the Instagram has reached 12,703 (on September 30, 2017) that the colourful show window display worldwide could be found. Sharing the daily life scene or recording beautiful items through the social networking service have been a trend for people, which constitute a communication platform and sharing a latest information through photos and short movies. Thus, how to take an eye-catching and memorable photo, called photogenic, has been a boom among the youth generation in Japan. For the creators, the SNS media is also a good platform to deliver their art work as well. A unique window display could attract more records, topics, and media exposure that means it could attract people’s attention by providing constant topics. Therefore, it was clarified that how to make a photogenic display is also what creators keep in mind recently.

Message

The theme in the show window planning differs significantly depending on corporate strategy. Through the window display, what message the store delivers is mainly shown in the items displayed and how it’s displayed. The message could be related to sales, hottest items, and even fuse with social events sometimes. An example of a window display in the theme of Tokyo Marathon 2017 in Ginza WAKO could be mentioned that as a member of Seiko group, Ginza WAKO is famous for its watch brand (Fig.6).



Fig.6 Ginza WAKO



Fig.7. The display in Tokyo Marathon

As the timer used in the Tokyo Marathon is made by Seiko and the store faced to the running course as well, the main window display was decorated in yellow with two big timer and a catchphrase “Break your time!” behind the cut-off shaped of running (Fig.7). On the racing day, the timer works officially, when the runners reaches the corner of Ginza 4-chome that is in marathon course, time records could be checked. After the marathon, plenty of runners’ photos with smiles

taken in the goal was added into the window which made a beautiful timeline story through the show window. As a show window like this, it works not only as a simple display but also become a strong platform to deliver strong social message through tying up with events and contribution to the local community.

Display Quality

The window is an indefinite production that after a certain period of display period, the campus must be back to white and next theme would be engaged in. Every year, even a same annual theme like Christmas, changes are gradually being made year by year to avoid similar visual performance and aesthetic fatigue. However, due to the emphasis on EC business in recent years, lots of companies tend to reduce the production budes on show windows. Alternating materials with inexpensive paper and plastic and remaking materials used before would be a good cost reduction. On the other hand, it is also risky that a cheap material usage could make the display seedy-looking which hardly reflects the good quality of items displayed and even damage the brand image. For these reasons, how to guarantee a high quality within a limited budget is what creators engage in daily.

5. Conclusion

In this research, we focused on constructing a framework to evaluate show windows from a creative aspect which was not mentioned in the previous research. An approach from a creative aspect could be applied to clarify if the current consumer research is reasonable. As a result of investigating, what kind of message that creators keep in mind in the production process, 10 items with "Seasonality", "Fashion trend", "Visual impact", "Originality", "Brand image", "Symbolism", "Photogenicity", "Harmony with surroundings", "Message" and "Quality" are clarified. Among these items, items like "Seasonality" and "Visual impact" have been subjected as an evaluation item from both creative side and consumer side from before which strictly affects the window display itself. Besides, items newly appearing along with social trends such as "Photogenicity" and "Harmony with surroundings" are found through the research.

What window display convey remains no more than the realization of sales promotion, but it gets derived into much wide ranged media to connect the store or even the town with people around the world. Through the research, what the creative side put emphasis on has been outlined which helps more designers to understand the show window designing work. Another successful point to approach from the creative side is that it helps people to understand the communication gap between creative side and consumer side. Based on the extracted 10 items, constructing a show window evaluation framework makes it possible to investigate the difference in message transmission with the media of window display instead of one-sided perspective of consumers' evaluations until now. By clarifying the communication gap through show window, it helps to clarify what elements of the window is evaluated, and which part is unfavourable for consumers that can be utilized as a reference during store planning and budget decisions.

Research with this framework to conduct consumer surveys at concrete stores is planned to clarify the differences between store strategies and consumer ratings.

REFERENCES

Berman, B., & Evans, J. R. (1995). *Retail management, a strategic approach, 6th Edition*. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Kotler, P. (1973). Atmospherics as a marketing tool. *Journal of Retailing*, 49, 48-64

Turley, L. W., & Milliman, R. E. (2000). Atmospheric effects on shopping behaviour: A Re-view of the experimental evidence. *Journal of Business Research*, 49, pp193-211

Edwards, S., & Shackley, M. (1992). Measuring the effectiveness of retail window display as an element of the marketing mix. *International Journal of Advertising*, 11, 193-202

Kim, J. Y. (2003). College Students' apparel impulse buying behaviours in relation to visual merchandising. *Journal of Retailing Master of Science, BFA*. American Intercontinental University.

Oh, H. J., & Petrie, J. (2012). How do storefront window displays influence entering decisions of clothing stores?. *Journal of Retailing and Consumer Services* 19, 27-35

Somoon, K., & Sahachaisaeree, N. (2010). Factors determining window display conveying merchandise's positioning and style: a case of shopping mall clothing display targeting undergraduate students. *Procedia Social and Behavioural Sciences*, 5, 1236-1240

Somoon, K., & Sahachaisaeree, N. (2012). Design elements and user's perceptual response: A case of window display design for adolescent merchandising. *Procedia-Social and Behavioural Sciences*, 50, 685-690

Takayanagi, M. (2002). Retail Store as an information transmission space, (高柳美香、情報発信空間としての小売店舗--マーケティングからみた店舗の「雰囲気」再考-、専修経営研究年報、2002 (27) 、59-81)

Takayanagi, Mika. (1997). The History of Shop Window, Keisoshobo (高柳美香、ショーウィンドー物語、勁草書房、1997 年)

Takayanagi, M. (2007). Measuring Consumer Experiences with Atmospherics Advertising, 2006-2007 (高柳美香、ショーウィンドウディスプレイのメディアとしての役割と消費者に与える経験の日米比較、平成 18 年度～平成 19 年度科学研究費補助金研究成果報告書)

Ikeda Y. (2010). Comparison of Display in shop Window (part 1) Recent Display in Shop window and appearance of store and building, No.40 2010-03, pp53-59
(池田由貴子、ウィンドウディスプレイの比較（第 1
報）ーディスプレイと店舗外装の最近の傾向ー、松山東雲短期大学研究論集、第 40
巻、2010 年 3 月、松山東雲短期大学、53ー 59)

Nagumo H. (2004). Common Design, Graphics, (南雲治嘉、常用デザイナー21

世紀を生き抜くデザイナー、株式会社グラフィック社、2004 年)

CHARACTERISTICS OF PATTERN MAKING WORK OF MODELISTES IN FRANCE IN COMPARISON WITH PATTERN MAKERS IN JAPAN

Emi NAKANISHI^{a, b}, Kyoung Ok KIM^c, Tsuyoshi OTANI^d and Masayuki TAKATERA^{c*}

^a Graduate School of Science and Technology, Shinshu University, Japan

^b ENSAIT-Ecole Nationale Supérieure des Arts et Industries Textiles, France

^c Institute for Fiber Engineering (IFES), Interdisciplinary Cluster for Cutting Edge Research (ICCER), Shinshu University, Japan, takatera@shinshu-u.ac.jp

^d Faculty of Textile Science and Technology, Shinshu University, Japan

ABSTRACT

In French, *modéliste* describes a person who makes a toile for a fashion design produced by a designer at an *haute couture* or a *prêt-à-porter* house. A Japanese patternmaker, who is called a patterner in Japan, uses a basic pattern to make a new pattern based on a drawing by a fashion designer. The new pattern is made by adjusting the lines of the basic pattern to the desired shape. To understand the differences between French and Japanese clothing designs, we asked three French *modélistes* and four Japanese patterners to make a jacket pattern from the same design. Their background and working processes were compared and their thinking on *stylisme*, consciousness of work, and patternmaking process were investigated. As a result, Japanese patterners used flat patternmaking method whereas French *modélistes* draped a body with fabric. In the compatibility of the designs with different body shapes, the acceptable ranges of the French *modélistes'* patterns were wider than those of the Japanese patterners.

Keywords: *modéliste, French, patternmaker, patterner*

1. INTRODUCTION

In French *haute couture* houses, garment design is divided into *stylisme* and *modélisme*. *Stylisme* describes the professional activity of a *styliste* who is responsible for both departments. *Modélisme* describes the design and production of garment models [1]. The studio department handles *stylisme* and the atelier department handles *modélisme*. In Japan, the corresponding person to a *styliste* is called a designer, but their authority differs. In France, a *modéliste* performs *modélisme*, which is to make three-dimensional model of a garment according to the *styliste*'s image as shown in sketches or a memo [2-4]. In other words, *modélisme* is a practice of producing a representation of a garment (i.e., a "figure" or "shape" model) from the *styliste*'s imagination in fabric.

In French, a *modéliste* describes a person who makes a *toile* (simple-fitting clothing pinned together from muslin cloth) for a fashion design produced by a *styliste* at an *haute couture* and a *prêt-à-porter* house. *Modélistes* are also responsible for pointing out the difficulty of making clothing according to the sketch drawn by the *styliste*. In practice, the *styliste* and *modéliste* collaborate jointly to design the garment [5-7].

In Japan, the work of a French *modéliste* is performed by a patternmaker, but their roles are different. A Japanese patternmaker, who is called a patternner, uses a basic pattern to make a new pattern based on a fashion *styliste*'s sketch, usually with a plane drawing method. The new pattern is made by adjusting the lines of a basic pattern to the desired shape.

Different patternmaking methods from Japan, France, and Italy were investigated [8]. The effect of the different backgrounds of patternmakers on the appearance of the final garments was shown [9]. In a comparison of commercial Japanese and European jackets, more curved lines on European jackets were shown [10]. Japanese and Chinese jackets also have different appearances [11]. Furthermore, even with the same design, an Italian patternmaker made a more three-dimensional (3D)-shaped jacket pattern than the Japanese patternner did [12, 13]. Thus, Japanese patternners may tend to use a basic pattern to make new straight-line patterns with model limitations in expressing the figures and shapes of curvaceous human bodies. However, the differences between French *modélistes* and Japanese patternners in their practical patternmaking process, detailed work, and the resulting garment model are unclear.

To clarify the effect of patternmakers' work on garment modeling, we compared the work contents and consciousnesses of French *modélistes* and Japanese patternners. We also examined the influence of French and Japanese thinking on *stylisme*, work consciousness, and modeling methods for garments.

2. EXPERIMENTAL

To clarify the difference between Japanese and French *modélisme*, we asked French *modélistes* and Japanese patterners to create patterns and toiles for the same design. After they completed their work, we compared the resultant patterns, toiles, the working time before designer's check, and modification points. We also investigated the relationship between their working backgrounds.

A jacket with 3D volume (which means that it will be difficult to make a pattern from) was designed by a professional designer who had worked in both France and Japan. The jacket's size and measurements were determined by the designer. Figure 1 and Table 1 show the sketch, size, and measurements for the designer's jacket. Four Japanese patterners (J1–J4) and three French *modélistes* (F1–F3) were selected for this study. The patterners and *modélistes* have an average of 10 to 20 years of work experience in Japan and France, and have never worked with the designer before this experiment. They were given the design sketches and size measurements and asked to make patterns and toiles. To evaluate their understanding of the design, the designer did not check the patterns in the middle of all the processes. Before starting the patternmaking work, each *modéliste* and patternmaker completed a questionnaire about their work background. The questionnaire topics were as follows: (1) school where they studied, (2) career, (3) any experience of creating patterns using the draping method, and (4) any experience of creating patterns using the plane drawing method. The results are shown in Table 2.

After finishing all patternmaking, we asked the *modélistes* and patternmakers about their work process during this experiment, such as the type of basic pattern used at this time, work process during this time, and working time for the jacket (each toile, pattern, and modification). We then compared the toiles. We took photos of the toiles on two bodies: Stockman size 38 (Siegel & Stockman, France, bust 86.2 cm, waist 67.5 cm, hip 91.0 cm, front waist length [from front neck point to waistline] 36.5 cm) and Kypris 9AR size (Kiiya Co. Ltd., Japan, bust 85.8 cm, waist 63, hip 91.0 cm, front waist length 33.5 cm). The designer checked neckline curve, width of collar and lapel, volume of sleeve, waist constriction, volume of peplum, whole balance of the toiles, and scored each item. We compared the patterns using apparel computer-aided design.

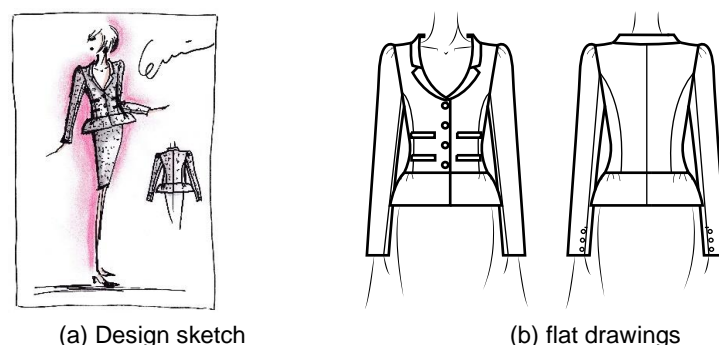


Figure 1: Design sketch and flat drawings

Table 1: Size measurements (French size 38)

Bust	Waist	Hip	Button size on bodice	Button size on sleeve
87 cm	68 cm	93 cm	23 mm	15 mm

Table 2: Work experience of *modélistes* and patterners

Name	School	Work experience			
		Years	Haute couture	Draping	Flat patternmaking
F1	French professional school	17 years in France	○	○	○
F2	French professional school	20 years in France	○	○	-
F3	French professional school	26 years in France	○	○	-
J1	Japanese professional school	15 years in Japan	-	○	○
J2	French professional school	10 years in Japan	-	-	○
J3	Japanese professional school	20 years in Japan	-	○	○
J4	Japanese professional school	15 years in Japan	-	-	○

3. RESULTS AND DISCUSSION

Figure 2 shows the toiles on a Stockman body. The toiles created by the *modélistes* can be worn by both Stockman and Kypris bodies. However, although the same size (i.e., bust, waist, and hip sizes) was specified, the toiles created by the patterners could only be worn by Kypris bodies and were small on Stockman bodies. The sizes for the patterners' toiles needed to be corrected, including an increase of 3 cm to 6 cm on bust measurements. In addition, the bodice length for all patterners' patterns were short.

The overall measurements were different between the *modélistes'* and patterners' patterns. The bust, waist, and back length dimensions of *modélistes'* patterns were larger, which could be because of the different size setting of the body and basic pattern used.

Table 3 shows the results of the designer's evaluation of the toiles and their required modifications. All of the Japanese patterners had more required modifications than did the French *modélistes*.

Concerning the patternmaking method, *modélistes* used the draping method (only F1 made sleeves from a sleeve pattern that was close to the design, which she obtained from her experience) while all patterners made patterns using the flat patternmaking method.

As for the creation time for the toiles, the work times using the flat patternmaking method were shorter than those for the draping method except for J3. However, *modélistes'* toiles had a few of the designer's required modifications in general in contrast to patterners' toiles.

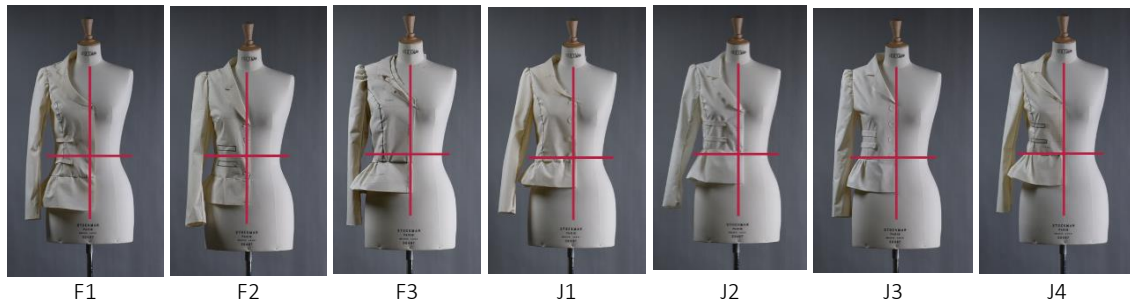


Figure 2: Comparison of toiles on a Stockman body

Table 3: Designer's evaluation of toiles and required modifications

Evaluative item	Neckline curve	Width of collar and lapel	Volume of sleeve	Waist constriction	Volume of peplum	Whole balance	Entire evaluation	Required modifications
Patternmaker								
F1	○	○	△	○	○	○	○	1
F2	×	×	○	○	△	○	△	3
F3	○	×	○	○	○	○	△	2
J1	△	△	△	△	△	△	△	6
J2	×	×	△	△	△	×	×	6
J3	×	×	○	○	○	△	△	4
J4	△	○	×	○	○	△	△	3

○: As it is; △: Partial modification is necessary; ×: need to recreate

4. CONCLUSION

We compared the patterns and toiles for the same jacket design produced by French *modélistes* and Japanese patterners. *Modélistes'* patterns showed a larger suitable body range than the patternmakers' patterns with different bodies. In addition, the back length of the Japanese patterners' toile was short compared with the balance of flat drawings, which could be because of differences in assumed body measurements in both countries. The designer evaluated French *modélistes'* toiles more highly. The draping method was more suitable for making patterns from a design with 3D volume. The flat patternmaking method had limitations in making a 3D shape from the design. The results of this study will help the design and production of ready-made garments.

ACKNOWLEDGMENTS

This work was supported under KAKENHI grant numbers JP24220012, JP17H01955, and JP16K16255 from the Ministry of Education, Culture, Sports, Science, and Technology of Japan.

REFERENCES

Modéliste. (n.d). In *Dictionnaires de français, Larousse*. Retrieved from <http://www.larousse.fr/dictionnaires/francais/mod%C3%A9liste/51926#8xiVmDv3OsZCpPMG.99>

The Japan Society of Home Economics Education. (2016) *Ifuku no hakkajiten* [Encyclopedia of clothing]. Maruzen Junkudo Bookstore Co., Ltd.

Takahashi, M., & Otani, T. (2016). An attempt for formulation of fashion apparel design. *Transactions of Japan Society of Kansei Engineering*, 15(5), 615–623. doi:10.5057/jjske.TJSKE-D-16-00080

Suzuki, A., Takatera, M., & Otani, T. (2016). Some little bewilderment of “elegance” in the LA MAISON DIOR of Raf Simons. *Transactions of Japan Society of Kansei Engineering*, 15(5), 589–601. doi:10.5057/jjske.TJSKE-D-16-00081

Marconi, R. (Director). (2014). *Lagerfeld confidential* [motion picture].

Otani, T., Kim, K.O., Takahashi, M., Inui, S., Morikawa, H., & Takatera, M. (2014). International presence and fashion business in Japan: to advocate the construction of fashion engineering. *Transactions of Japan Society of Kansei Engineering*, 13(5), 629–668. doi:10.5057/jjske.13.629

Sorger, R., & Udale, J. (2010). *Fashion design basics*. BNN, Inc.

Fujii, C., Takatera, M., & Kim, K.O. (2017). Effects of combinations of patternmaking methods and dress forms on garment appearance. *Autex Research Journal*, 7(3), 277–286. doi:10.1515/aut-2016-0020

Kim, K.O., Otani, T., & Takatera, M. (2017). Effect of patternmaker’s proficiency on the creation of clothing. *Autex Research Journal*, 17(2), 120–128. doi:10.1515/aut-2016-0005

Kim, K.O., Nozawa, A., & Takatera, M. (2015). Comparison of elegance of Japanese and European jackets. *International Journal of Clothing Science and Technology*, 27(4), 506–522. doi:10.1108/IJCST-06-2014-0078

Kim, K.O., Takatera, M., Zhu, A.C., & Otani, T. (2015). Comparison of Japanese and Chinese clothing evaluations by experts taking into account marketability. *Autex Research Journal*, 15(1), 67–76. doi:10.2478/aut-2014-0047

Kim, K.O., Miyatake, K., Sano, K., Takatera, M., & Otani, T. (2014). Research on jacket patterns and specifications of ready-to-wear for high-end in Italy and Japan. *International Journal of Affective Engineering*, 13(1), 27–33. doi:10.5057/ijae.13.27

Kim, K.O., Miyatake, K., Sano, K., Takatera, M., & Otani, T. (2014). Comparison of high-end tailored jackets for ready-to-wear produced in Italy and Japan. *International Journal of Affective Engineering*, 13(1), 35–41. doi:10.5057/ijae.13.35

COMPARATIVE STUDY ON VISUAL IMPRESSION STRUCTURE FOR CAR FRONT GRILL BETWEEN JAPAN AND THAILAND

Shun KOU^{*a}, Nana MORIYAMA^a and Mikiko KAWASUMI^a

^a Graduate School of Science and Technology, Meijo University, Nagoya, Japan,
173426009@ccalumni.meijo-u.ac.jp

ABSTRACT

The front grill is one of the most important parts on the automobile front design, and it is of significance for automobile manufactures to understand consumers' visual preference for its design. Our purpose is to produce front grill panels that are more attractive for local consumers. In this paper, the structures of visual impression in observing the front grills of Sport Utility Vehicles (SUVs) and pickup trucks were investigated by using many adjectives and comparison was made between Japanese and Thai consumers. Thirteen different front grills were chosen from the best-selling automobile brands in the world as experimental stimuli. Semantic Differential (SD) method was used to quantify visual impression, and twenty-one pairs of antonym adjectives such as 'glossy' and 'matte' were selected from the result of our previous investigation. Approximately two hundred people participated from Japan and Thailand in total. SD data from the two nations were analyzed by Principal Component Analysis (PCA), and it was clear that the structure of visual impression for a car front grill was different between Japanese and Thais, in particular, the most important principal components were 'luxuries feel' and 'sharpness' for Japanese, whereas 'stylishness' and 'lightness' for Thais. The relationship among adjectives on the first and second principal component diagram was also different between the two nations. After connecting these results with morphological features, it will be useful for manufactures to propose the more attractive products that match the preference of local consumers.

* Corresponding author.

Keywords: car front grill, visual impression, comparison by nationalities, principal component analysis

1. INTRODUCTION

Thailand is one of the biggest nations in the ASEAN region, and its market has been rapidly expanding. Recently, there are many factories of Japanese products such as cars and home appliances and they are very popular in Thailand. We have researched the visual preference of Thais to develop the automobile products matching the needs of the local customers [1] - [3].

The front grill is one of the most important parts on the automobile front design and it is significant for manufactures to understand consumers' visual impression for its design [4] [5]. This study aims to produce front grill panels that are more attractive to many consumers in each nation in cooperation with a Japanese automobile parts manufacturer.

In our study, the structures of the visual image for front grills of Sports Utility Vehicles (SUVs) and pickup truck were surveyed by using adjectives that express visual impression. And then the experimental data was analyzed by Principal Component Analysis (PCA), and the results from the two nations were compared.

2. METHOD

Thirteen front grills, which have different vertical length, design module and surface color were selected from best-selling automobile brands in the world as experimental stimuli. These three morphological features on a front grill will be used in the analysis of the relationship between visual image and physical attribute. In our thirteen stimuli, there were a variety of grills with vertical length from short to long, three types of design module: line-type, V-type, and mesh-type, and the percentage of silver and black on the surface of a grill frame (Table1). Thirteen front view images of a SUV and a pickup truck were prepared and printed on A3 sized photo paper as experimental stimuli.

The Semantic Differential (SD) method of a rating scale of seven steps was applied for this survey (Figure1). Twenty-one pairs of antonym adjectives such as 'glossy' and 'matte', 'ordinary' and 'special', 'luxury' and 'non-luxury' were selected (Table2) from the result of our previous survey to quantify visual impression for front grills. A survey form of SD method was written in Japanese for Japanese respondents and in Thai for the Thais. Ninety-six Japanese and ninety-seven Thais participated in total (Table3). After collecting SD data, it was analyzed by the PCA to clarify the visual image structure of respondents.

3. RESULTS AND DISCUSSION

The SD data from Japanese and Thai participants was compared through the PCA as shown in Table 4. Four principal components that have an accumulated contribution rate of about 60% were derived in each nation. The first principal component for Japanese includes 'luxury' and 'fine-quality' as adjectives with high score, whereas for Thais 'cool' and 'stylish'. The second

Table 1: Morphological features

Grill No.	A	B	C	D	E	F	G	H	I	J	K	L	M
Length*1	S	S	M	L	S	M	L	M	S	S	M	L	L
Design*2	L	V	L	L		L	M	M			V	L	M
Surface*3	S	S	SB	S	S	S	B	B	B	S	SB	SB	B

*1 Vertical length of grill ... S: Short M: Middle L: Long

*2 Design module of grill ... L: Line-type V: V-type M: Mesh-type

*3 Surface color of grill ... S: Silver B: Black SB: Silver & Black

Table 2: 21 pairs of adjectives

Thailand	English	Japanese		Japanese	English	Thailand
ซับซ้อน	complex	複雑な	—	単純な	simple	เรียบง่าย
ธรรมดา	ordinary	普通の	—	特別な	special	พิเศษ
หรูหรา	luxury	高級な	—	高級でない	nonluxury	กระเจอก
น่าประทับใจ	impressive	印象の強い	—	印象の弱い	unimpressive	ไม่น่าประทับใจ
ไม่มีอะไรโดดเด่น	plain	地味な	—	派手な	flashy	สะดุดตา
ดูก้าวหน้า	advanced	先進的な	—	先進的でない	regressive	ล้าหลัง
มืดทึบ	dark	暗い	—	明るい	bright	สว่าง
เป็นเส้นตรง	straight-lined	直線的な	—	曲線的な	curving-lined	มีความโค้งมน
ไม่มีสไตล์	unstylish	スタイリッシュでない	—	スタイリッシュな	stylish	มีสไตล์
มันวาว	glossy	つやのある	—	つやのない	matte	ผิวด้าน
ไม่มีมิติ	2-dimensional	平面的な	—	立体的な	3-dimensional	มีมิติ
เท่	cool	クールな	—	クールでない	uncool	เชิมน/เชย
หนัก	heavy	重い	—	軽い	light	เบาๆ
บอบบาง	delicate	弱い	—	強い	strong	แข็งแกร่ง
นิ่งเฉย	passive	受身な	—	アグレッシブな	aggressive	ดุดัน
ดูโฉบเฉี่ยวปราดเปรียว	sporty	スポーティーな	—	スポーティでない	unsporty	ไม่โฉบเฉี่ยวปราดเปรียว
ตัดกันอย่างชัดเจน	high-contrast	コントラストの強い	—	コントラストの弱い	low-contrast	ไม่ค่อยตัดกัน
ดี	fine	細かい	—	粗い	rough	ห่าง
มีคุณภาพต่ำ	low-quality	上質でない	—	上質な	fine-quality	มีคุณภาพสูง
ไม่ดึงดูดใจ	unappealing	魅力的でない	—	魅力的な	appealing	ดึงดูดใจ
ไม่ชอบ	unfavorite	嫌いな	—	好ましい	favorite	ชอบ

การออกแบบของหมายเลข _____ ให้มีความรู้สึกตามความหมายดังต่อไปนี้
(The design of No. _____ gives the following feeling for me.)

No. _____
(The design of No. _____ gives the following feeling for me.)

11	(complex) 複雑	1	2	3	4	5	6	7	単純 (simple) 単純
12	(ordinary) 普通	1	2	3	4	5	6	7	特別 (special) 特別
13	(luxury) 高級	1	2	3	4	5	6	7	高級でない (non-luxury) 高級でない
14	(impressive) 印象的	1	2	3	4	5	6	7	印象の無い (non-impressive) 印象の無い
15	(plain) 地味	1	2	3	4	5	6	7	派手な (fashy) 派手な
16	(adorned) 先進的	1	2	3	4	5	6	7	先進的でない (vague) 先進的でない
17	(dark) 暗い	1	2	3	4	5	6	7	明るい (bright) 明るい
18	(straight-lined) 直線的	1	2	3	4	5	6	7	曲線的 (curving-lined) 曲線的
19	(stylish) スタイリッシュでない (unstylish) 1	2	3	4	5	6	7	スタイリッシュ (stylish) スタイリッシュ	
20	(delicate) 繊細	1	2	3	4	5	6	7	つやのある (matte) つやのある
21	(cool) 平面的な (2-dimensional) 1	2	3	4	5	6	7	立体的な (3-dimensional) 立体的な	
22	(cool) クール	1	2	3	4	5	6	7	クールでない (uncool) クールでない
23	(heavy) 重い	1	2	3	4	5	6	7	軽い (light) 軽い
24	(delicate) 繊細	1	2	3	4	5	6	7	強い (strong) 強い
25	(passive) 受動的	1	2	3	4	5	6	7	アグレッシブな (aggressive) アグレッシブな
26	(agony) スローター (agony) 1	2	3	4	5	6	7	スローターでない (unagony) スローターでない	
27	(low-quality) コントラストの低い (low-contrast) 1	2	3	4	5	6	7	コントラストの高い (high-contrast) コントラストの高い	
28	(appealing) 細かい (fine) 1	2	3	4	5	6	7	粗い (rough) 粗い	
29	(appealing) 上質でない (low-quality) 1	2	3	4	5	6	7	上質な (fine-quality) 上質な	
30	(appealing) 魅力的でない (unappealing) 1	2	3	4	5	6	7	魅力的な (appealing) 魅力的な	
31	(unfavorable) 嫌い (unfavorable) 1	2	3	4	5	6	7	好ましい (favorable) 好ましい	

Figure 1: Survey form in Japanese and Thai

Table 3: Respondents

a) Japanese people

	Male	Female	Total
20s～30s	21	18	39
40s～50s	20	19	39
60s～	10	8	18
Total	51	45	96

b) Thai people

	Male	Female	Total
20s～30s	29	25	54
40s～50s	12	19	31
60s～	4	8	12
Total	45	52	97

principal component for the Japanese includes 'high-contrast' and 'rough', and whereas the Thais 'light'. The third principal component in common in both nations is 'simple'.

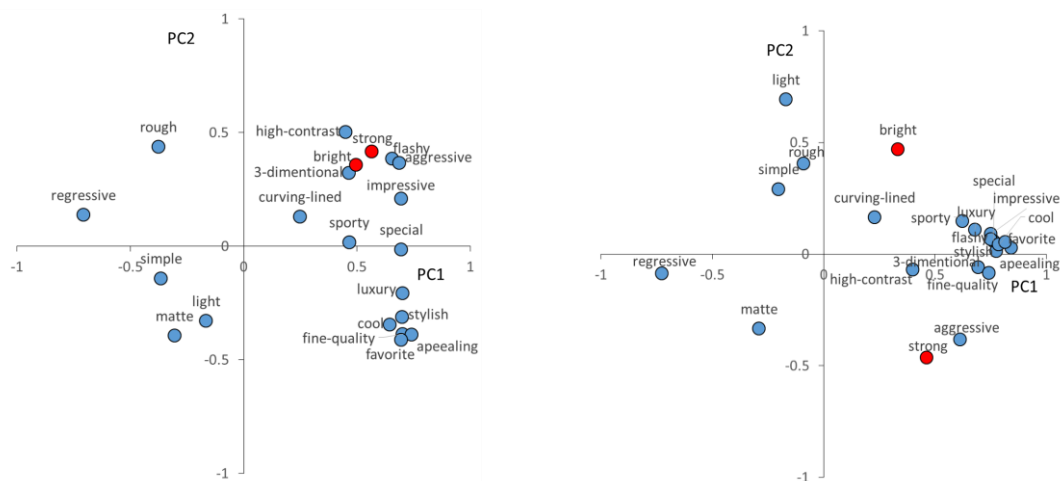
Table 5 describes the four principal components that are named after the adjectives by the PCA. On the broader basis, a visual impression structure of Japanese people consists of two

Table 4: PCA scores of Japanese people and Thai people

a) Japanese people					b) Thai people				
	component1	component2	component3	component4		component1	component2	component3	component4
acumulated contribution rate(%)	0.331	0.437	0.52	0.578	acumulated contribution rate(%)	0.371	0.444	0.505	0.565
simple	-0.364	-0.142	0.647	-0.13	simple	-0.202	0.291	0.614	-0.352
special	0.696	-0.015	-0.388	0.027	special	0.763	0.058	-0.233	-0.028
luxury	0.702	-0.207	-0.046	-0.125	luxury	0.679	0.109	-0.044	-0.201
impressive	0.696	0.208	-0.147	-0.025	impressive	0.75	0.089	-0.009	-0.147
flashy	0.656	0.385	-0.146	0.133	flashy	0.75	0.067	-0.104	-0.079
regressive	-0.706	0.137	0.078	-0.1	regressive	-0.727	-0.088	0.052	0.139
bright	0.498	0.357	0.404	0.33	bright	0.335	0.468	0.156	0.53
curving-lined	0.25	0.13	-0.334	0.226	curving-lined	0.23	0.164	-0.334	0.417
stylish	0.699	-0.312	0.096	-0.035	stylish	0.776	0.014	-0.026	-0.012
matte	-0.305	-0.395	-0.524	-0.256	matte	-0.29	-0.335	-0.303	-0.502
3-dimensional	0.464	0.322	-0.27	0.235	3-dimensional	0.694	-0.06	-0.093	0.134
cool	0.645	-0.345	0.197	-0.163	cool	0.787	0.042	0.067	-0.12
light	-0.165	-0.33	0.129	0.782	light	-0.169	0.692	-0.264	-0.266
strong	0.566	0.415	0.066	-0.442	strong	0.463	-0.464	0.434	0.191
aggressive	0.688	0.366	-0.043	-0.051	aggressive	0.612	-0.384	0.172	0.08
sporty	0.467	0.017	0.203	0.032	sporty	0.624	0.148	-0.092	-0.12
high-contrast	0.45	0.501	0.211	0.033	high-contrast	0.4	-0.069	-0.195	0.364
rough	-0.376	0.437	0.451	-0.132	rough	-0.09	0.406	0.458	0.086
fine-quality	0.702	-0.387	0.136	-0.1	fine-quality	0.743	-0.085	0.198	-0.1
apealing	0.742	-0.389	0.196	-0.02	apealing	0.843	0.027	0.025	-0.114
favorite	0.695	-0.413	0.283	0.032	favorite	0.816	0.053	0.098	-0.152

Table 5: Principal components of Japanese people and Thai people

	component1	component2	component3	component4
Japanese people	luxuries feel	sharpness	simpleness	lightness
Thai people	stylishness	lightness	simpleness	gloss



a) Japanese people

b) Thai people

Figure 2: Relationship among adjectives

main factors; 'luxuries feel' and 'sharpness', whereas 'stylishness' and 'lightness' were the main factors for the Thais.

Figure 2 shows the PCA scores of each adjective on the first and second principal component diagram. The horizontal axis describes the first principal component and the vertical axis the second principal component. We can easily find the common and/or different points of features between the two nations. For example, the distance between the two adjectives such as 'appealing' and 'fine-quality' is very close in both nationalities, but about 'bright' and 'strong', close among the Japanese, far among the Thais.

4. CONCLUSION AND FUTURE WORKS

The visual impression structure for front grills was surveyed by the SD method and analyzed by the PCA, and the results were compared between Japanese and Thais. We grasped that the structure has common and different points in the two nations. Also, some effects of the morphological feature to visual impression were found, for instance, the vertical length of a grill would affect 'stylishness'. After the survey, we designed new front grill for the Thais using computer graphics (CGs) based on these results in cooperation with a manufacturer and presented it at an exhibition of automobile parts in Bangkok. It received a high evaluation rate by Thai visitors.

We are still analyzing the SD data by gender, age, and a lifestyle of respondents. New results related to these attributes of consumers will be clear in near future. When the analysis is done, many front grill designs using CGs should be created to confirm the effect of each morphological feature. The results from the study will be useful for manufacturers to propose more attractive products that match the preferences of local consumers.

REFERENCES

- Yongsue, K. et al. (2015). A Study on Silver Metallic Color Preference: A comparison of Responses by age and gender in Thailand. *Proceedings of AIC 2015 TOKYO*, 343-347.
- Kawasumi, M. et al. (2015). A study on silver metallic color preference: A comparison of responses between Japanese and Thai people. *Proceedings of AIC 2015 TOKYO*, 735-739.
- Kou, S. et al. (2016). Studies on visual image structure of car front grill in Thailand. *CSAJ* 40(6) 56-57.
- Yoon, H. (2015). Chinese sensitivity analysis for the interior design of the automobile. *International Journal of Affective Engineering*, 16(4), 259-268.
- Sato, H. (2016). Kansei evaluation for the front grill design of automobile. *Transactions of Japan Society of Kansei Engineering*, 16(1), 51-60.

EMOTIONAL BIONICS - A PICKUP TRUCK IS A LION! A STUDY USING EMOTIONAL PROFILING TO ANALYSE BIONIC ANALOGIES IN CAR DESIGN

Susan Gretchen ZÖLLERA^a, Tina SCHRÖPPELB^b, and Sandro WARTZACKC^c

^a Friedrich-Alexander-University Erlangen-Nuremberg, Germany, zoeller@mfk.fau.de

^b Friedrich-Alexander-University Erlangen-Nuremberg, Germany, schroeppel@mfk.fau.de

^c Friedrich-Alexander-University Erlangen-Nuremberg, Germany, wartzack@mfk.fau.de

ABSTRACT

So far, bionic design has mainly been systematically applied to support functional solutions. But in recent times, subjective aspects in product quality became increasingly important to users too. Under the aspect of a sustainable, targeted value creation for users, bionic design may also help to better address users' subjective needs in product design. Therefore, a new method is presented. Its first step is the numeric and perception-related investigation of main geometrical criteria in object shape changes between technical solutions and their bionic models. The second step is the identification and utilization of impressions analogies between the two domains. Thus, subjective similarities between the product and its bionic model are examined both in geometrical and in impressions respect in order to derive implications for the field of Emotional Bionics.

Keywords: *Emotional Bionics, Subjective Value Creation, Kansei Engineering, Design Analytics.*

1 Introduction: The Potential of Bionics in Emotional Design

The basic principle of bionic design, and the analogy adoption of a biological model to technical products influenced many designers so far. The ability of nature for integrative form and function design is unsurpassed. Hence, bionic inspired technology has proven to be more sustainable, efficient, and robust to raise the functionality of technical products. Moreover, besides their functional advantages, many application examples further demonstrate that design inspired by nature often shows to be very attractive to users [1].

In recent times, subjective aspects in product quality became increasingly important to users too. Indeed, systematic bionic design has mainly been applied to support functional solutions so far, but under the aspect of a sustainable, targeted value creation for users, bionic design may also help to better understand and to address the users' subjective needs in product design. In this contribution, a systematic approach to understand bionic mechanisms in subjective value perception of technical products is presented. Therefore, the bionic design analogies are investigated under objective Gestalt variation and subjective user impression aspects. In this way systematic bionic design could also be used to unlock the Nature's subjective design potential for a sustainable user satisfaction.

2 State of the Art

2.1 Bionic Design and Emotions

Biologically inspired design or bionic design as a discipline investigates structures, processes and design principles of biological systems and transfers them into technical problem solving [1]. Therefore, basic procedures and design principles do exist that are firmly integrated into the bionic product development process [2] [3]. E.g., different computational approaches help to link biological and engineering systems and allow a solution adaptation from different domains. In doing so, they formalize and functionalize design principles in order to support a systematic bionic design [4].

Measuring semantics and emotional responses to bio-inspired design has been done, e.g. to investigate animal posture [5]. Therein, formal connections between bio-inspired sources and design solutions have been examined. Research shows that there is a correlation of emotional terms and semantic descriptions between bionic and technical models. Also design formalization and computational creativity is applied in bionics research. Therefore, cognitive psychology theories [6] or genetic algorithms [7] are used to generate new design solutions. Especially in the case of bionic design for subjective value creation, the bionic principle has been decomposed to formal models of (visual) perception considered in the context and of aesthetics and Gestalt principles [6]. However, a transfer into systematic design synthesis for user impressions and therefore addressing the subjective value of a product is outstanding.

2.2 Product appearance and Gestalt analysis

A product's overall appearance is mainly defined by its Gestalt (ger. Form, shape), represented by perceptually relevant pattern elements for human vision like lines, edges, and more gradual changes in contrast [8] [9]. A computational approach that investigates a product's Gestalt is presented by ORSBORN ET AL, which used principal components analysis to extract the main visual characteristics of technical products [10]. In doing so, design patterns and user recognition can be investigated. Those computer-aided procedures help to formally analyse user feedback to subjective product experience depending on different design characteristics (e. g. [11]).

2.3 Kansei Engineering and ACADE

Kansei Engineering as a form of emotional engineering supports the formal interpretation of users' subjective experience. It links design changes to their impact on user's subjective impression of the product [12]. An approach that takes these relations between product design changes and user impressions, and systematically links them to the individual's subjective evaluation system is ACADE [13]. It works with specific quantitative impressions profiles (semantic differentials with ratings between opposite word pairs) that represent the full spectrum of user attitudes towards a product. They are used to subjectively characterize both the product and the user. In doing so, an overall impressions profile of both is derived. In this way, an optimal product-user-fit can be targeted [14].

Subsuming, the Gestalt of a product plays a major role in subjective human perception and therefore for subjective value creation. In order to derive a systematic and transparent procedure to use bionic principles for subjective value creation, ACADE as quantitative emotional engineering tool can be used. It links quantitative Gestalt variation with subjective qualities. Subjective bionic principles may thus become quantitatively assessable for product design.

3 Methodology and Application Example

3.1 Methodology and core questions

The aim of the method is to unveil bionic mechanisms for subjective value creation of technical products. Therefore, existing analogies are examined in order to create a systematic approach to describe these mechanisms. It helps to better understand relations of bionic principles in subjective value perception of technical products. Therefore, the design analysis is split into three main steps, wherein both quantitative and qualitative methods are used in order to compare analytical (objective) and intuitive (subjective) design aspects (see Fig. 1).

For the analytical investigation, a Gestalt analysis using principal components analysis (PCA) is processed. Therein, the products' form variation is examined numerically. Those areas that show highest Gestalt variation are Areas of Variance (AoV) (analysis A).

For the human perception analysis, image-based recognition recording is used. By asking users via survey to indicate those areas that they are mostly focusing on, the product design's Areas of Attention (AoA) are derived (analysis B).

Lastly, an impressions analysis is conducted in order to derive insights into unique subjective qualities of technical solutions and their bionic models. Therefore, ACADE is applied to get characteristic impressions profiles that can be compared to each other (analysis C).

Building on that, similarities between the product and its bionic model are examined in two ways. First, Gestalt variation and the users' intuitive design recognition are analysed to unveil the products' Areas of Interest (AoI) (A + B). Thus, it highlights differences between objective design variations and subjective user attention, differentiating subjectively relevant areas from objective changes. With respect to design differences between natural models and technical solutions, the ACADE analysis unveils subjective analogies by comparing the complementary profiles and Gestalt specifics (A+B+C). The combination of the three different analysis lastly allows the derivation of design implications that allow systematic Emotional bionic design.

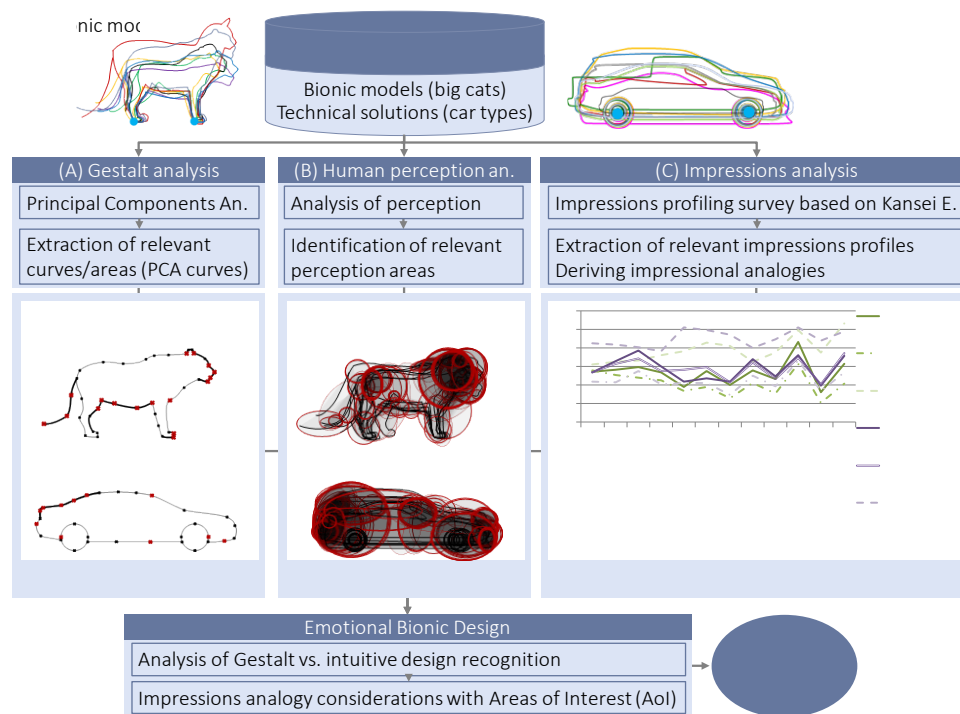


Fig. 1. Structural Approach of an Emotional Bionics Analysis.

3.2 Application example

As indicated in Fig. 1; a sample of cats and a sample of cars are chosen for the application study. On one hand, cats have already been bionic models for many successful car designs - only to mention the Ford Mustang or the Jaguar as a brand name here. Therefore, valuable study outcomes are expected with regard to bionic analogies. On the other hand, very different subjective impressions are expected as big cats as well as cars are often experienced very emotionally differentiated, e.g. ranging from very cute (like a kitten or a VW Beetle) to very dangerous (like a lion or a Dodge RAM). Each of these natural models and technical solutions pose a very distinct overall impression. In this sense, variations of both subjects cause very different user impressions that raise the quality of the study outcome.

Within each sample, different characteristic silhouettes of cats and car types were collected. Subsuming there are 6 different cats (a jaguar, a tiger, a leopard, a snow leopard, a cheetah, and a lion) and 8 different cars (a family van, a 3-doors and a 5-doors limousine, a station wagon, a SUV, a pickup truck, a convertible, and a sports car). To check the targeting of the study, a domestic cat and a stretch limousine are additionally admitted. A domestic cat, as an example, should provoke very different impressions to users (like cuddly, clumsy, playful ...) and a stretch limousine is only used for special purposes instead of daily uses. Furthermore, it will be investigated whether the areas of attention widely differ there. Lastly these 2D representations are standardized via feet distance (cats) and wheel distance (cars).

4 Study results

The study is conducted using the standardized silhouettes of cats and cars and a two-part survey to subjectively characterize these technical solutions and their bionic models. 20 users were firstly asked to encircle those areas within each cat's and car's design where they put most at-

tention to (for analysis B). Secondly, they were asked to fill in impressions profiles for each silhouette that base on characteristic semantic differentials like “high-value/simple” or “exclusive/usual” (for analysis C). Therefore, the ACADE structure was used that comprises a predefined set of opposite word pairs (semantic differentials) to measure users' subjective product value [14].

In the following, the results of the outlined three analyses are presented. First of all, the Gestalt analysis is conducted using PCA (analysis A). It shows that there are differences in the data interpretation, depending on the dimensional reference system (x-axis, y-axis, and combined). Nevertheless, some dominating curves appeared in all three dimensions that indicate the designs' objective Gestalt variation. On the contrary, within the human perception analysis (analysis B), some defined design areas show to be characteristic for users to get their overall impression. Within the impression analysis (analysis C), the survey feedback unveils that there are distinct impressions profiles for each cat and car model. Due to high response consistencies, these profiles seem to be commonly characteristic and give hints to some general bionic clichés in society.

Lastly, an integrated analysis including all three analyses is conducted. Their findings will be reflected and subsumed to general statements regarding Gestalt approaches in the bionic design context of subjective value creation.

4.1 Gestalt analysis

For an analytical analysis of the objects, a PCA is conducted as computational form of Gestalt analysis by strictly following ORSBORN ET AL. [10]. Therein, the geometrically described silhouettes of object variations are analysed in order to identify the main components of the object's structure.

First of all, an atomization of the 6 cats' and 8 cars' silhouettes is processed to represent the objects by vectors, scalars, and angles [10]. Therein, characteristic design points are extracted to fully describe the outlines of each object sample. It is ensured that each object contains all design points within the two input data sets. For the following principal components decomposition, the data is further prepared by norming (mean value subtraction) and standardization. Thereafter, the load matrix with principal components is created, whereas the components are reduced to the only important ones using the KAISER'S Criterion (EIGENVALUE >1). In doing so, dominant points and relevant curves can be identified [10].

The PCA is processed separately for 7 cats with 2 dimensions and 40 sample points and 8 cars with 2 dimensions and 31 sample points. In a sum, six different resulting data sets are created, depending on the analysis direction (x-axis, y-axis, integrated x+y-axis). Therefore, the vectors of the PCA data sets are split into their x- and y-parts. Fig. 2 (left and middle) exemplarily shows the results of the so derived separate PCAs for a tiger. Whereas all analyses show high relevance of e. g. the head section of a cat in general, the details can strongly differ, e. g. regarding the cat's lower jaw or the neck silhouette. For an integrated analysis, the x- and y-parts are subsumed, showing highest numeric deviations in the tail, the chest and the head of the animal (right). These areas with highest numeric deviations are defined as Areas of Variance (AoV).

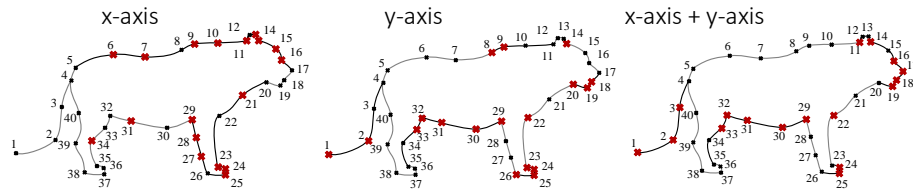


Fig. 2. Dimensional differences in PCA output: main curves (red) depending on x-axis vector parts (left), y-axis vector parts (middle) or the addition of x- and y-axis vector parts (right).

4.2 Human perception analysis

The participants of the survey were asked to circle those areas they were paying most attention whilst characterizing the objects by the given impressions (Fig. 2, left). Therefore, the size and number of these areas are not limited. In this way, object specific information about the users' design perception is quantitatively gathered. The feedbacks from every participant for the technical models and their bionic models are then cumulated. By superimposing their feedbacks through transparent circular fields, the Areas of Attention (AoA) represent the users' most recognized design areas of each model (Fig. 3, right).

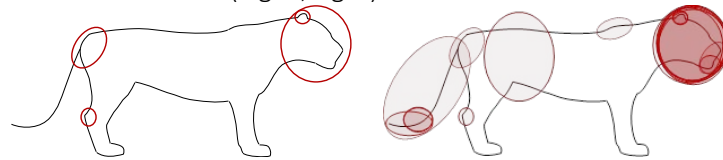


Fig. 3. Example of single feedback (left) and Areas of Attention (AoA) of a jaguar (right)

In a sum, these AoA show high homogeneity regarding the main attention areas for each model throughout the survey feedbacks. Each of it has not more than two main focus areas (in the example it's the head and the tail of the jaguar). Concluding, all provoked impressions may be derived by more or less the same perception areas, widely independent from the single person.

4.3 Impressions analysis

In the third analysis, the individual impressions profiles of each cat and car type are gathered following the ACADE procedure [14]. In this sense, the impressions profiles consist of 12 semantic differentials that are rated from 1 to 10 (Fig. 4, axes). The results' variety of each impression for one single object is low, showing that both the biological models and the technical models have clear, distinct impressions profiles to the number of persons. The mean values of all users for each impression are thus aggregated to build the overall impressions profile for every cat and car. In this sense, each of the objects is assigned to a unique impressions profile described by mean value and standard deviation of the return data on users' impressions. All impressions profiles are depicted in Fig. 4 (lines), compared per sample. It shows that there is a variation both in composition (structure) as well as in extent (parallelism). Comparing the cats to the cars' impressions profiles, there is equal variance in single impressions values. Mean standard deviations of 2.33 for cats and 2.56 for cars show high variety amongst different object variations. In more detail, the respective profiles show characteristic expressions and the additional check-examples (domestic cat and stretch limousine) succeeded. As an example, a lion was experienced to be highly masculine and strong whereas a cheetah was more female and fragile.

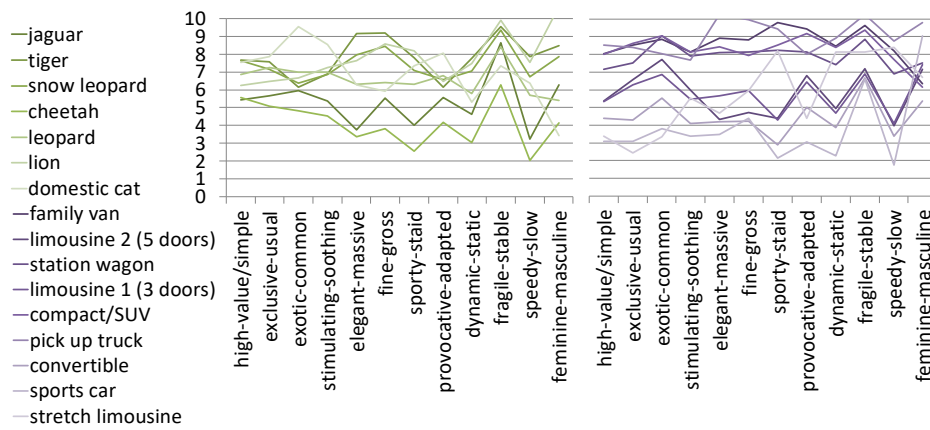


Fig. 4. Selected impressions profiles of cats' (left) and cars' variations (right) conducted with ACADE [14]

4.4 Emotional Bionic Design

The application study with the three-analysis unveiled two main findings that contribute to a systematic emotional bionic design: The first insight affects the source of subjective quality. A comparison of objective Gestalt analysis (analysis A) and human perception analysis (analysis B) shows high differences between actual design changes and user attention (AoV and AoA). The second insight affects the analogy of impressions. Comparing both the bionic models' and technical solutions' impressions profiles (cats and cars), the impression analysis (analysis C) shows higher similarities between specific cats and cars than amongst cats' and cars' sets themselves. These insights allow the derivation of new design implications in the context of emotional bionics.

Source of subjective quality: Gestalt analysis versus human perception. Fig. 5 illustrates the overall AoA for bionic models (cats) and technical solutions (cars) on the left-hand side, derived from human perception analysis. Therefore, all AoA from cats and cars are superimposed, wherein the AoA of the cats were more consistent than AoA of cars. Apart from that, both cats and cars show characteristic AoA at the upper head (front) and the tail (back) of the cat (car). On the right-hand side of Fig. 5, the results from the PCA as Gestalt analysis method are presented. Whereas the head and the tail of the cats remain as highly relevant, the cars' deviations in the front are not relevant from an objective point of view. The back of the cars, indeed, is also considered as relevant. Concluding, objective Gestalt analysis states only few similarities between cats' and a cars' design variation.

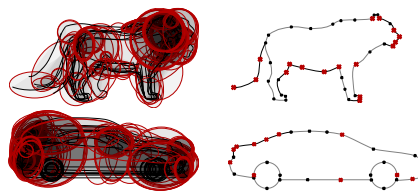


Fig. 5. Comparison of superimposed Areas of Attention (AoA) and Areas of Variance (AoV)

Differences in the results of the objective, numeric Gestalt analysis and the human perception analysis effectively show that human attention does not only recognize deviations between a model's shape and the commonality to other representatives of a group, but also general particularities that may not be considered as being relevant by numeric Gestalt analyses: Comparing objective Gestalt variation to the users' most attended design areas (analyses A and B),

those areas that are perceived most relevant for impressions creation do not necessarily depend on actual numeric design variation; they are Areas of Interest for subjective design (AoI).

Analogy of impressions: The subjective similarity between bionic pairings. Due to its similar data structure, cats and cars can be compared immediately regarding their characteristic impressions profiles (analysis C). This comparison of both technical solutions (cars) and their bionic models (cats) show the potential of emotional bionics: Whereas each domain shows high variation amongst car or cat types, high similarities between specific cars and cats can be stated.

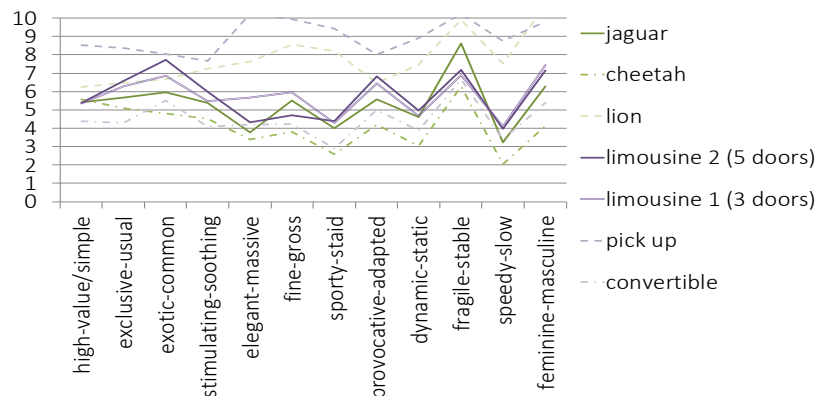


Fig. 6. Similarity analyses of impressions profiles, selected bionic models & technical solutions

As highlighted in Fig. 6, e.g. a pick-up truck (car) actually has high impressions similarities with a lion (cat). In the same row, a limousine (car) is subjectively similar to a jaguar. Contrarily, a jaguar and a lion are perceived very differently and so are a pick-up truck and a limousine: These similarities indicate the bionic potential for the respective pairings.

Design implications. Insights show that there are specific geometrical and impressions analogies between technical products and their respective bionic models, after which a product is valued by users. Whereas objective Gestalt analysis is not able to unveil design analogies from a quantitative point of view, human perception analysis shows relevant areas that are similar for both the bionic models and the technical solutions. Furthermore, a high similarity of impressions profiles in both models is stated. It shows that subjective bionic and technical counterparts can be assigned analytically.

In the bionic design context, studies following up this analytical approach represent an objective way how to align the subjective overall impressions of technical products to their bionic model. First of all, a characteristic overall impression of a bionic model is concretized using impression profiles. In this sense, technical solutions and bionic counterparts can be immediately detected due to their profile similarity; as well as their remaining differences. Furthermore, the study shows that users do not necessarily pay most attention to design areas with highest objective variance (AoV). Indeed, there are distinct areas that are most focused by all users (AoA). In these areas (Areas of Interest), the Gestalt of a technical solution can now be systematically aligned with respect to the impressions profile of the bionic model. Therefore, the application of ACADE in bionic design strategy for subjective value creation is suggested as it allows to target these similarities [14]. In doing so, characteristic design features determining the appearance of a focused bionic model could be stringently abstracted and integrated into new product

design creations. The associative process in bionic design for technical products is thus objectified to a certain stage. This offers a way to communicate bionic principles to all parts of the product design process by providing objective parameters. Consequently, subjective bionic associations are systematically deducible. With the information about functional analogies derived by this procedure, designers can now better understand where subjective value is created, what the geometrical drivers of impressions changes are and how analogies to bionic models may be used.

5 Conclusions and Outlook: The Future of Bionic Design in Subjective Value Creation

Bionic design affects all areas of product development. As nature is the ultimate origin of all existence and our needs, it is not very surprising that nature is also responsible for our emotional ability and feelings. May it happen consciously or not, everybody tends to evaluate technical products to bionic models as these forms the archetypes of our environmental system our evaluation consists of. So far, this "natural potential of attractiveness" was used rather intuitively in the product creation process. Indeed, it is only reasonable to investigate whether an analytical approach to capture relations between bionic models and technical products in the design for subjective value does exist. Subjective value creation has not been paid much attention to so far but is of rising importance. Thus, bionic design may be successfully fostered in this context. The outlined systematic approach helps to understand analogical processes in bionic design from a subjective point of view and provides systematically derived, reasonable insights.

Nevertheless, the complexity of the human feelings, being part of the inconceivable system of Mother Nature, will never be understood completely. So, all efforts made in this direction may rest fuzzy, gathering only fragments of our perception by which we try to understand our being every day.

References

- Nachtigall, W. (2006). *Biologisches Design: Systematischer Katalog für bionisches Gestalten*. Springer, Berlin.
- Helms, M., Swaroop S., Vattam, A.K., & Goel, S. (2009) Biologically inspired design: process and products. *Design studies*, 30.5, 606-622.
- Coelho, D. A., Versos, & C. AM. (2010). An approach to validation of technological industrial design concepts with a bionic character. In: *Proceedings of the International Conference on Design and Product Development (ICDPD'10)*.
- Nagel, J.K., & Stone, R.B. (2011). A systematic approach to biologically-inspired engineering design. *ASME 2011, American Society of Mechanical Engineers*, pp153-164.
- Kim, J., Bouchard, C., Bianchi-Berthouze, N., & Aoussat, A. (2011). Measuring semantic and emotional responses to bio-inspired design. *Design Creativity 2010, Springer*, pp131-138.
- Minfeng, H., & Liming, F. (2011). On auto bionic modelling design study based on cognitive psychology theories. *International Conference on Mechatronic Science, Electric Engineering and Computer (MEC), IEEE*, pp. 1641-1644.

Cluzel, F., Yannou, B., & Dihlmann, M. (2010). *Evolutionary design of car silhouettes using an interactive genetic algorithm*.

Altes, R.A. (1976). Bionic image analysis using lines and edges. *Math. Biosciences* 31(3-4), 317-339.

Lugo, J.E., Schmiedeler, J.P., Batill, S.M., & Carlson, L. (2015). Quantification of classical gestalt principles in two-dimensional product representations. *J. of Mech. Design*, 137.9.

Orsborn, S., Boatwright, B., & Cagan, J. (2008). Identifying product shape relationships using principal component analysis. *Research in Eng. Design*, 18.4, pp. 163-180.

Hsiao, S.W., & Yuan, L.C. (2000). Form and texture effects on product image. In: *Proceedings of the Human Factors and Ergonomics Society, Annual Meeting*.

Nagamachi, M. (2010). *Kansei/affective engineering*. CRC Press, New York.

Kett, S.G., Schmitt, B., & Wartzack, S. (2017). What the statistics tell us-How to use empiric data in design for emotional impressions. In: *International Conference on Research into Design*, Singapore: Springer.

Zöller, S.G., & Wartzack, S. (2017). Considering users' emotions in product development processes and the need to design for attitudes. *Emotional Engineering*, 5, 69–97.

A STUDY ON THE KANSEI IMAGE OF THE PACKING COLOUR OF INSTANT NOODLES FOR CONSUMERS

Zhongzhen LIN ^a, Chun-Heng HO ^b, Xingmin LIN ^c

^a National Cheng Kung University, Republic of China, p36053026@mail.ncku.edu.tw

^b National Cheng Kung University, Republic of China, hoch@mail.ncku.edu.tw

^c National Cheng Kung University, Republic of China, 576079447@qq.com

ABSTRACT

Instant noodles have become the major alternative food for most people in order to cater to the current pace of life. There are several kinds of packages and colours for distinct kinds of brands and flavours. The correct match of colours for instant noodles can actually reveal the flavours of the products, make the noodles look tasty and even activate and attract consumers' buying desire. The study discusses the importance of matching the colours of instant noodles by collecting 80 different match colours, choosing 10 types of products from 4 experts as studying samples and using Factor Analysis as well as SD Analysis.

Keywords: *Instant noodles, Kansei Image, SD Analysis.*

1. STUDYING BACKGROUND & MOTIVATION

Instant noodles were created by Momofuku Ando, a Japanese, who combined traditional noodles and stretched noodles together, and became the current instant noodles that are extremely popular among people during their daily lives gradually for the reason that instant noodles are inexpensive and can make us feel full (Chen, 2011). There is a statistic collected by the Ministry of Economic Affairs at the year of 104 to 105 of the Republic of China showing that 9.2 billion Taiwan dollars were produced in the Taiwan market of instant noodles. Consumers are normally most influenced by the match colours besides the price and commercials when they choose any product. Some of the products that do not have beautiful colours. Therefore, they

use diverse ways to enrich the products and activate consumers' buying desires by making healthy and delicious images. Cui (2012) also argues that amazing colours that can capture consumers' attention play a significant role than the shape of the package.

These designers use colours to express the taste of food (Shi, 2009). It is hoped that this study will be able to provide a reference to designers when it comes to the product packaging by discussing how colours influence consumers so that the packaging of instant noodles can cater to consumers' interest and deliver the correct information about the products and also activate consumers' purchasing desires. Therefore, the study's purposes are:

1. To find out how consumers feel and react about different match colours of instant noodles.
2. To find out the similar perception images shared by designers and consumers alike.
3. Find out the likes and dislikes about the consumers' attitude towards the match colours of instant noodles.

2. STUDY OF COLORS

People's visual organs will respond to the external lights and relevant sense of colours that appears. When looking at the matching colours of anything, people always develop various feelings that includes images and senses regarding the products. This phenomenon is called "the common feeling of colours" (Yong, 2007). The packaging of food has the power to make or break the product on how it tastes or what it might taste like in the form of colours. It is a special combination that people are used to make about colours and tastes based on the experience of everyday life and the society.

In addition, colour is one of the most significant factors in the packaging design of food and gives the very first impression for consumers at the first sight. Also, colour is the most sensitive factor among all the factors (Wang, 2009). Meanwhile not only can colour decorate the image of products but also give hints and correct information regarding its flavours for consumers. Therefore, designers are supposed to base on the ways people learn about and express things and use different kinds of colour brightness to show whether the flavour is strong or not (Shi, 2009).

3. METHODOLOGY

Researchers use some opposite meaning of words to estimate and evaluate things or concepts when they try to know about how consumers see things or concepts which is called structure of value or Semantic Differential analysis SD (Shi, 2009).

Researchers have collected 80 different matching colours of instant noodles and 100 adjectives. Then experts were asked to pick out ten (10) special studying samples in order to put those adjective into categories. This study uses questionnaires and observations to know about

the preferences and feelings of matching colours for the purpose of coming up with the final conclusion of what is the most preferred colour for instant noodles and what is the colour combination.

3.1. SUBJECTS SELECTION

The subjects selected to carry out the experiment in this research consists of two parts, the expert users and the normal users. The expert users group is defined where the subject has eaten the instant noodles at least once or twice a week in the past month. Undergraduates over the age of 20 from outstanding universities are selected as the subjects, in the total amount of 4 persons. Two of them are male and the other two are female. The normal users are basically the participants of the internet questionnaire. 81 completed questionnaires are received on 10am on January 8th, 2016, among which 31 were accomplished by male participants and 50 were completed by female participants. Whereas the experimental subjects are from all ages, representing the percentage of 75.32% are from the age range of 18 to 30.

3.2. EVALUATION TOOL

The adjectives vocabulary adapted by this research are divided into 10 groups, with the rank of No. 7. These adjectives are sourced specially from the pertinent literatures and research papers. First and foremost, 100 adjectives were collected by this paper. After discussing with four expert users with high instant noodles intake, 15 groups of adjectives were initially collected. Accordingly, through the measurement and discussion, 5 groups of adjectives were deleted, and the rest 10 groups are adapted as the evaluation tools. On the basis of comprehensive understanding of the current situation of packaging colours of instant noodles, through the SD analysis as to assess the image of packaging colours of instant noodles, the relatively objective design evaluation is achieved. Furthermore, the common factors are picked up through the factor analysis, and the major factors exerting influence on the packaging colours of instant noodles are understood.

3.3. EXPERIMENTAL PROCEDURE OF THE RESEARCH

Initially, a semantic analysis was conducted to jointly discuss the perceptual image of instant noodles in different packaging colours, secondly the evaluation of expert users is implemented on the basis of announcing the description of research and completing the personal basic data of expert users.

Second, 80 packaging sample pictures of instant noodles are collected, with different matching colours and brands. (referring to appendix 1) Through the discussion conducted for expert users, 10 representative packaging sample pictures of instant noodles are selected. Given that this paper is designed to discuss the perceptual image of consumer towards the packaging colour matching of instant noodles, the letters on 10 selected packaging sample pictures of instant noodles are blurred out (as shown in the following picture) as it is to reduce the perspective impact exerted by texts of taste on the package to experimental subject:



Instant noodles on packaging color sample

Third, there are 100 adjectives vocabulary in the earlier stage of this research. Through the discussion for expert users, 20 adjectives in 10 groups are confirmed in the Likert Scale of this paper, and they are: unsavoury/ delicious; heavy taste/ insipid; disgusting/ fragrant; spicy and hot/ tasty; single/ multiple; dilute/ full-bodied; broiled/ refreshing; queasy/ piquant; greasy/ salubrious; ordinary/ special.

Lastly, the questionnaire is issued on internet and completed by invited experimental subjects. Afterwards, the data and results of questionnaire are collected and analysed in background.

3.4. ANALYSIS OF STATISTICAL DATA

This paper adapts the SPSS software in order to analyse the collected data quantitatively. The collected projects are as follow:

3.4.1. Descriptive statistics

This project is applied to collect the average value and the standard deviation of all the samples.

3.4.2. Factor analysis

Adapted to calculate the factor loadings of all the scales and the factor points of instant noodle packaging samples as to establish the image space of packaging colour of instant noodles.

4. RESULTS AND DISCUSSION FOR RESEARCH

Huang (2000) has once mentioned in the Multivariate Analysis (Sixth Edition) that, the variance is the average value of all the variable values and the squared deviation of average values. It refers to a group of dispersive average value of data distribution. The standard deviation is the square root of the variance, and it refers to a group of data embodying the degree of average dispersion. As the variance and the standard deviation become larger, the discrepancy between variables is getting larger obviously, and accordingly the tendency of dispersion of the distance for average value is becoming larger.

The subjects' recognition of the semantic scale of instant noodles packaging colour can be directly grasped through the view of standard deviation. (as shown in table 1) In view of the standard deviation, while the standard deviation is becoming larger, the subjects have a lower

degree of recognition and correspondence to the semantic scale. On the contrary, while the standard deviation is becoming less, the subjects have a higher degree of recognition and correspondence to the semantic scale.

The following Table show that, the semantic meaning of queasy/ piquant enjoys the highest degree of recognition in sample 1; the semantic meaning of greasy/ salubrious enjoys the highest degree of recognition in sample 2; the semantic meaning of queasy/ piquant enjoys the highest degree of recognition in sample 3; the semantic meaning of disgusting/fragrant enjoys the highest degree of recognition in sample 4; the semantic meaning of dilute/ full-bodied enjoys the highest degree of recognition in sample 5; the semantic meaning of queasy/ piquant enjoys the highest degree of recognition in sample 6; the semantic meaning of spicy and hot/ delicious enjoys the highest degree of recognition in sample 7; the semantic meaning of spicy and hot/ delicious enjoys the highest degree of recognition in sample 8; the semantic meaning of single/ multiple enjoys the highest degree of recognition in sample 9; the semantic meaning of broiled/ refreshing enjoys the highest degree of recognition in sample 10.

Table 1: Mean and standard deviation for sample 1-5

Sample Measure	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	M	SD	M	SD	M	SD	M	SD	M	SD
unsavoury/delicious	4.494	1.667	5.148	1.501	4.198	1.638	4.802	1.552	4.716	1.534
heavy taste /insipid	3.593	1.889	5.457	1.500	4.506	1.598	3.605	1.869	3.272	1.796
disgusting/fragrant	4.543	1.628	5.000	1.369	4.407	1.555	4.753	1.412	4.765	1.502
spicy and hot /tasty	4.284	1.905	5.642	1.527	4.753	1.529	4.296	1.623	3.197	1.691
single /multiple	4.345	1.898	4.086	1.878	3.790	1.656	4.592	1.409	4.284	1.734
dilute/full-bodied	5.049	1.548	4.407	1.641	4.321	1.556	5.074	1.498	5.172	1.302
broiled /refreshing	3.259	1.896	5.000	1.517	4.419	1.499	3.753	1.655	3.111	1.739
queasy /piquant	4.617	1.609	4.753	1.436	4.148	1.493	4.568	1.413	4.580	1.531
greasy / salubrious	3.704	1.833	5.222	1.414	4.062	1.668	3.753	1.562	3.456	1.606
ordinary/ special	4.209	1.828	3.827	1.822	3.654	1.675	4.481	1.636	3.481	1.450

Table 2: Mean and standard deviation for sample 6-10

Sample	Sample 6		Sample 7		Sample 8		Sample 9		Sample 10	
	M	SD	M	SD	M	SD	M	SD	M	SD

Measure										
unsavoury/delicious	4.418	1.574	5.407	1.403	3.876	1.812	4.444	1.549	4.679	1.759
heavy taste /insipid	3.457	1.725	5.062	1.536	3.580	1.829	4.235	1.575	5.235	1.494
disgusting/fragrant	4.086	1.637	5.308	1.310	3.876	1.676	4.432	1.474	4.851	1.629
spicy and hot /tasty	3.803	1.495	5.419	1.254	3.864	1.489	4.642	1.345	5.025	1.369
single /multiple	3.938	1.653	5.209	1.481	4.519	1.613	3.642	1.805	4.518	1.747
dilute/full-bodied	4.629	1.470	5.086	1.362	4.778	1.557	4.419	1.564	4.629	1.592
broiled /refreshing	3.457	1.674	4.778	1.360	3.518	1.629	4.457	1.492	4.950	1.396
queasy /piquant	4.173	1.439	5.296	1.249	3.901	1.700	4.469	1.566	4.519	1.501
greasy / salubrious	3.667	1.754	5.111	1.517	3.654	1.726	4.309	1.375	4.876	1.444
ordinary/ special	3.888	1.628	5.148	1.542	4.370	1.584	4.049	1.788	4.741	1.679

The paper conducts a factor analysis towards the average of evaluation result of 10 adjective groups of instant noodles packaging colours. The factor analysis is implemented firstly through the principal component analysis and secondly through the Varimax rotation method rotating the factor axis to right angle. Eventually, the image factor load profile is acquired as shown in table 3. The adjective vocabulary factor analysis load profile indicates that the subjects' reaction towards all 10 adjectives group are affected by two common factors: (1) The first factor includes six groups of scale. (single /multiple; dilute/full-bodied; ordinary/ special; spicy and hot /tasty; unsavoury/delicious; heavy taste /insipid). These six groups are integrated as gustatory factor. (2) The second factor includes four scales. (broiled /refreshing; queasy /piquant; greasy / salubrious; disgusting/fragrant) These four factors are concluded as the preference factor.

In view of two factors mentioned above, the amount of variability being explainable accounts for 85.895% of the total amount of variability. The gustatory factor accounts for 54.053% of the total amount of variability. The preference factor accounts for 31.842% of the total amount of variability. The commonality of each variable refers to the variability amount of variable being explainable by all the factors. For example, the commonality of single/multiple is 0.944, which indicates that 94.4% of scale is given rise to the joint effort of the first factor and the second factor. The rest 5.6% is caused by the error factor. Furthermore, all the commonalities of variables are over 0.801, which indicates that all the scales are exerted less influence by other special factors and error factors, and accordingly are suitable for evaluation.

Table 3: Load factor analysis scale for adjective

Measure gauge	Factor1	Factor2	Intercommunity
single /multiple	0.959	0.312	0.944
dilute/full-bodied	0.966	0.152	0.875
ordinary/ special	0.659	0.221	0.852
spicy and hot /tasty	0.934	-0.247	0.834
unsavory/delicious	0.948	-0.135	0.903
heavy taste /insipid	-0.955	-0.251	0.801
broiled /refreshing	0.243	0.552	0.921
queasy /piquant	-0.597	-0.675	0.877
greasy / salubrious	0.147	0.812	0.873
disgusting/fragrant	0.405	0.896	0.908
Factor variance	5.405	3.184	Total:8.589
Percentage of total variance	54.053%	31.842%	Total:85.895%

5. CONCLUSION AND SUGGESTION

In accordance with the image questionnaire as mentioned above, through adapting the SPSS analysis and on the basis of the results of questionnaire, the following conclusions are drawn by this paper.

(1) The instant noodles packaged with the primary colour of grass green shall be able to convey the perceptual image of fresh and delicious to consumers. (2) The sour and fresh flavour image shall be integrated with green colour packaging as to conform to the consumer's recognition. The spicy and savoury flavour image shall be integrated with red colour packaging as to conform to the consumer's recognition. (3) The instant noodles packaged with bright and light colour can convey the corresponding perceptual image. Finally, it is found that instant noodles packaged using dark, purple and black colours are able to reduce consumer's appetite.

Several suggestions are proposed by this paper for future research in the related field.

(1) Future research should widen the population as well as the profession of subjects in order to enable the research data to be generalised.

(2) The samples mentioned in this paper are illustrated in Table 1 and 2 in order to conveniently compare between samples. Future research is recommended to conduct the research using real life samples in order to ensure the accuracy of the primary research data.

(3) This paper is conducted in the perspective of the colour of instant noodles package. Further research is recommended to be conducted from other angles or perspective such as the style and the model or the type font of used in the design of instant noodles packaging.

REFERENCES

Chen, R. J. (2011). Taiwan: Pepsi happiness you think of the first time. What the press Limited by Share Ltd.

Republic of China government information network. (2016). <http://stat.ncl.edu.tw/>.

Cui, J. (2012) *Research on color emotion of packaging design*. Doctoral dissertation, Shanxi Normal University.

Shi, X. (2009). Color reflects the taste of food packaging. China Packaging newspaper.

Yong, Z. H. (2007). A total sense of color. *Journal of Soochow University (Engineering Science Edition)*, 27(5), 42-44.

Wang, H. Y. (2010) Analysis of the influence of color on the taste of food packaging design. *Popular literature and Art: Academic Edition*, (24), 82-82.

Zhang, J. H. (2004) Investigation and analysis method in planning and design method-SD method. *Chinese landscape architecture*, 20(10), 54-58.

Huang, J. Y. (2000). *Multivariate analysis* (the Sixth Edition) Chinese Economic Enterprise Institute. (230)

Ou, L. C., Luo, M. R., Woodcock, A., & Wright, A. (2004). A study of colour emotion and colour preference. Part I: Colour emotions for single colours. *Color Research & Application*, 29(3), 232-240.

Ou, L. C., Luo, M. R., Woodcock, A., & Wright, A. (2004). A study of colour emotion and colour preference. Part II: colour emotions for two-colour combinations. *Color Research & Application*, 29(4), 292-298.


Gao, X. P., & Xin, J. H. (2006). Investigation of human's emotional responses on colors. *Color Research & Application*, 31(5), 411-417.


























Valdez, P., & Mehrabian, A. (1994). Effects of color on emotions. *Journal of experimental psychology: General*, 123(4), 394.

Naz, K. A. Y. A., & Epps, H. (2004). Relationship between color and emotion: A study of college students. *College Student J*, 38(3), 396.

APPENDIX 1

Table 4: 80 Sample for the study

 1	 2	 3	 4	 5
 6	 7	 8	 9	 10
 11	 12	 13	 14	 15
 16	 17	 18	 19	 20
 21	 22	 23	 24	 25
 26	 27	 28	 29	 30
 31	 32	 33	 34	 35
 36	 37	 38	 39	 40
 41	 42	 43	 44	 45
 46	 47	 48	 49	 50
 51	 52	 53	 54	 55

 56	 57	 58	 59	 60
 61	 62	 63	 64	 65
 66	 67	 68	 69	 70
 71	 72	 73	 74	 75
 76	 77	 78	 79	 80

SUCCESSFUL POINTS OF KANSEI PRODUCT DEVELOPMENT

Mitsuo NAGAMACHI^a

^aHiroshima University, 3-2, Kagamiyama 1-choume Higashi-Hiroshima, 739-0043, Japan
Mitsuo.nagamachi@gmail.com

ABSTRACT

The author founded “Kansei Engineering” in 1970, which is a child of Ergonomics. The ergonomics is a science that aims to build a good system between Human and Machines. Kansei Engineering stands much more on human orientation to develop a product, working system, social system as well as service system. Kansei Engineering or (KE) has developed a technological process from the survey of human emotions in relation to attain well-designed products or systems that are able to satisfy the people. The author has developed more than 60 different Kansei products from brassiere (Wacoal), refrigerator (Sharp), sports car (Mazda) and so forth, as well as Kansei Artificial Intelligence system such kitchen design AI, Brand name decision system and others. In this article, three examples of Kansei development are described for understanding how the Kansei Engineering process results in successful designs.

Keywords: Kansei engineering, brassiere, sports car, car dashboard design

1 Introduction

Nagamachi started Kansei Engineering (KE) in 1970 and published his first article related to KE in 1974¹. Since then he has developed more than 60 Kansei products. Table 1² describes his main Kansei products, which are Refrigerator (Sharp), Brassiere (Wacoal), Shovel car (Komatsu), Bus tab, Toilet (Panasonic), Cosmetic (Milbon), Bedsore preventing mattress (Panasonic), Sports car (Mazda), Aircraft (Boeing) and so forth. Nagamachi and his group has developed many Kansei AI & VR such Shovel car Cockpit (Komatsu), Car room design(Isuzu), Kitchen design (Panasonic), Brand Name Consultation system (IKD), House design (HausMall) and so forth. Those products have been popular in Japan and their copies are sold in East Asia. Nagamachi has never had any unsuccessful experience using Kansei product development. This could be due to the fact that

KE has both psychological and ergonomic procedures. Anyone can be successful in Kansei development, if the person has skills to conduct surveys pertaining to people's Kansei or emotion, and knowledge of statistical techniques.

The article will iterate (1) Good-Up Bra (brassiere, Wacoal), (2) Nissan CIMA, (3) Miata MX5 (Mazda), and (4) Car dashboard (Hyundai), and finally the overall success of Kansei Engineering Method is explained.

Table 1. The list of new main Kansei products developed using Kansei Engineering since 1974².

YEAR	COMPANY NAME	PRODUCT NAME (BRAND NAME)
1974	Fukuoka Interior	House Living System (House interior)
1979	Sharp	New refrigerator
1980	Sharp	Liquid Crystal Viewcam
	Kao	Biore-U (Body shampoo)
1984	Mazda	Persona (passenger car)
1985	Panasonic EW	Twin lamp (four-folded fluorescent lamp)
1985-87	Mazda	Eunos Roadster (Miata, MX5)
1992	Komatsu	Shovel car (digger) Avance 45t: Government Good Design Award
	Wacoal	Brassiere (Good-Up Bra)
1993	Komatsu	Avance 200t, Government Good Design Award
	Wacoal	Brassiere (2nd Good-Up Bra)
		AI & VR
		WIDAS (Brand system)
		ViVA (Kitchen design),
1995	Hyundai (Korea)	Sonata-2 (Compact car)
1996	LG (Korea)	Dish washer machine
	Panasonic EW	Roof / Roof gutter / Siding (Wall) / Gate
		Bath tab / Stair case / Washbowl / Closet
		Floor Heating System
		Kitchen design AI-VR system (ViVA)
		New shaver (Smoozer)
		VeJEAR (Isuzu)
1997		HKES (Wheel)
1999		HousMall
2000	Panasonic	Sitting shower (The shower)
2003	Milbon	Shampoo & Hair Treatment (Deesse's)
	Panasonic EW	Toilet (TRES)
		Bed sore preventing Mattress
2008	Boeing (USA)	Boeing 787 Interior design
2008	Kounan	Apricot energy jelly (Activo)
2014	Vf Lee	Urban Rider Jeans

2. Development of the new brassiere, Good-Up Bra (Wacoal)

The KE procedure is the followings.

- (1) One thousand ladies were invited to the Wacoal's Ergonomic Research Centre, where they expressed their Kansei to a brassier in general; The question is "how do you want to feel when wearing a brassiere?". A total of 80% of these ladies have answered that "we want to be *beautiful* and *elegant*" (the italics are Kansei words).
- (2) Two hundred ladies were re-invited to cooperate with a new brassiere research. Hence, Wacoal have prepared all kinds of brassieres produced by Wacoal as well as rival companies with a S, M and L size. A participant selects a sample with her size and stands before a miller while wearing the selected one, and evaluates it on a given five scale of Kansei words that are "Beautiful and Elegant". This is continued for all samples.
- (3) High scoring samples are examined and all items like material, size, cup design etc are surveyed. Several staff of the Research Institute are required to wear the selected samples and an investigation on Moire images is conducted in order to obtain the principles of realising a "beautiful and elegant brassier".
 - i. Both breasts should be inside between two body lines.
 - ii. Both breasts should be aligned parallel and face somewhat upward.
- (4) A new brassiere that is based on these two principles "beauty" and "elegance" is launched and is named as "Good-Up Bra". The new product was in the market for a long period of time that profited Wacoal since ladies enjoyed the new product range and are extremely satisfied with it. In addition to that, the 2nd Good-Up Bra and Hip-Up pants were launched as the new product range which became very popular all over Japan.

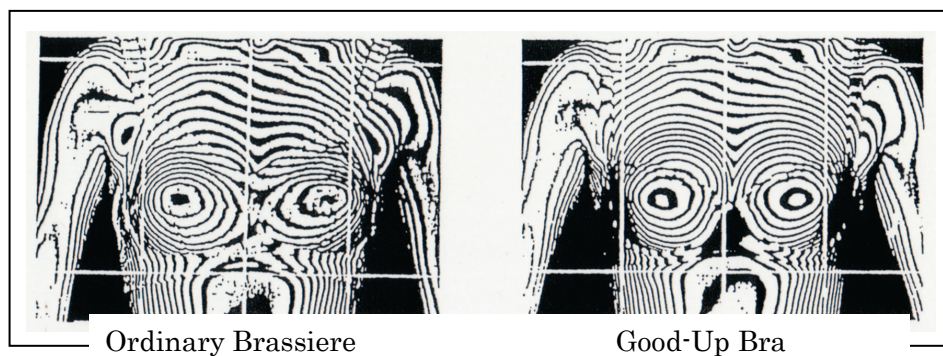


Fig. 1: Kansei brassiere named "Good-Up Bra" (Wacoal). Moire image (each 1cm high)³

3. New design of a passenger-car brake lamp (Nissan CIMA)

The Hiroshima University collaborated with Nissan Motors for a car design from the viewpoint of Kansei Engineering in 1987. A number of 20 passenger cars were rented from a car rental company which includes cars manufactured by Japanese, United States, Europe manufacturers. 20 Kansei words were selected for the survey to describe the exterior design of these selected cars from car magazines as well as discussions with sales people. A 5-scale evaluation sheet using 20 Kansei words is developed, and 20 male and female students participated to explain their emotions (Kansei) towards the exterior design of the car after being trained by using a Kansei evaluation.

In this article, only the taillights' design is being detailed. This is because the Nissan CIMA's taillight design was evaluated by students as being "very ugly". Their opinion on the design was that it is not smart and elegant, because it has wide red colour area although it will be easily perceived by driver (see Figure 2).



Fig. 2. Kansei design of taillights of the New Nissan CIMA, 1989.

Another experiment using students is conducted to find a beautiful taillight design that is more feminine by using a quasi-triangle that is better than a rectangle design. As the Nikkei News Paper printed such a good comment that the CIMA's taillight looks like "when the car passes by and when we turned to look at it, it looks like a very beautiful and elegant lady". Then, the New CIMA became very popular in the market which leads to trend among other makes to duplicate the same taillight into their models.

4. Mazda Sports Car, Miata, MX-5

Mr Nagamachi was contacted by the CEO of Mazda, Mr. Kenichi Yamamoto in 1987 where he is required to teach KE to Mazda's designers group as well as a lecture on KE to the people of Mazda. But after then, Mazda has made no request to help design a new car. However, a year passed and Mr Nagamachi was invited to Mazda to take a look at Mazda's new car that has used Kansei Engineering in its design. Mr Nagamachi accepted the invitation and with further investigation, he concluded that the new car is not properly designed using KE and it is anticipated that the car will stop being manufactured after only one year.

Mr. Yamamoto contacted Mr Nagamachi for the second time seeking the support and assist in designing Mazda's new car. The discussion leads to a new sports car as the domain and young drivers as targeted buyers. Hence, the Kansei Engineering method is used to reach the successful conclusion.

Then, an observation of young driver's manoeuvres from the inside as well as from the outside is conducted. In order to gauge the driver's experience, someone sits on the seat next to the driver and takes a picture of the driver's driving. Another man stands on the intersection and starts a video camera when a young driver car comes. Therefore, discussions are held to analyse young drivers' emotion (kansei) while driving. The video is analysed by writing down Kansei words on a card. Finally, the KE method is followed by using the *Category Classification Method* as one of KE methods⁴.

Kansei				Physical traits	Ergonomic experiment	Automotive engineering
Zero	1st	2nd	nth			
HMU	Tight feeling	—	—	Size	Tight feeling experiment	Chassis design
		—	—	Width	Interior kansei experiment	Sheet design
		—	—	Height		Interior design
	Direct feeling	—	—	Seat	Steering function	Power train development
		—	—	Steering design	Shift lever length	Steering yaw ratio
	Speedy feeling	—	—	Shift lever	Minus gravity	Steering design
		—	—	Speed meter	Noise frequency analysis	Shift lever design
		—	—	Frequency		Speed meter design
	Communication	—	—	Open style		Exhaust pipe design

Fig. 3. The Category Classification Method.

The designer group classifies each card into the same category. Then, these categories are arranged in a tree structure shown in Figure 3 and each branch transfers the car's physical trait and extend the item into the automotive engineering world. Some of the physical trait is treated in an ergonomic experiment in order to attain clearer design specifications. The total design specification gained from the Kansei words are utilised into the total car design.



Fig. 4. The first generation, MX 5 (Miata), Mazda.

The first generation of the MX5 had obtained the Car of the Year Award in Japan. This model became immensely popular in just a short period of time since the launch among young and middle aged people in the world. The second and third MX5s were also produced from Mazda. The fourth generation of the MX5 was decided to be produced in 2014. However, Mr. Yamamoto who is the R&D manager has asked his designer group to inspect the 1st, 2nd, and the 3rd Miata from the view point of KE, because of the fear of altering the fundamentals of KE. Thus, all of the MX5s are re-evaluated using a 5-scale Kansei Method that revealed that the 1st generation of Miata was the best.

The design of the 1st generation Miata that was designed by Nagamachi has brought the feeling of a more “*Joyful Driving*”. Hence, by reapplying the same Kansei Method to boost the design, the 4th Miata succeeded to attain Japan's Car of the Year Award, 2015 and The Europe Award in 2015.

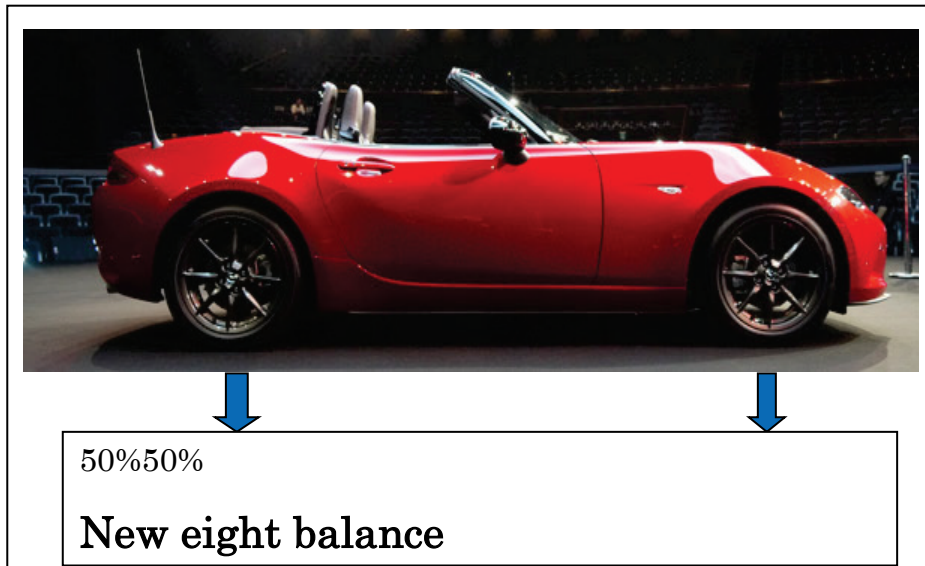


Fig. 5. The 4th Miata (The Car of the Year Japan & Europe Car of the Year 2015).

5. New dashboard and instrumental panel design (Hyundai).

In 2008, Nagamachi was requested by Hyundai Car Company to implement the KE into the dashboard design. The research procedure is as the following.

- (1) A discussion was held with Hyundai's R&D department, Korea concerning the new dashboard design project. The Kansei Engineering theory needs to be introduced into the dashboard design of the next compact car.
- (2) Ten compact cars were rented that includes cars made in Japan and Europe like Mitsubishi, Toyota, Honda, Nissan, Suzuki, Volkswagen, and Hyundai were parked in the Hiroshima International University parking area.
- (3) A number of 80 male and female students who are trained in conducting the Kansei Method took part in the experiment.
- (4) All of the participants sat inside each car in front of the dashboard with a 77 kansei question sheet, which consist of 6 different categories, such as 1) front view to dashboard, 2) the instrument panel design, 3) air-out hole design, 4) meters design, 5) centre console design, 6) shift lever design, 7) steering wheel design, and 8) the feeling of the front broad view.



Fig. 6. The experimental scene at HIU car parking area.

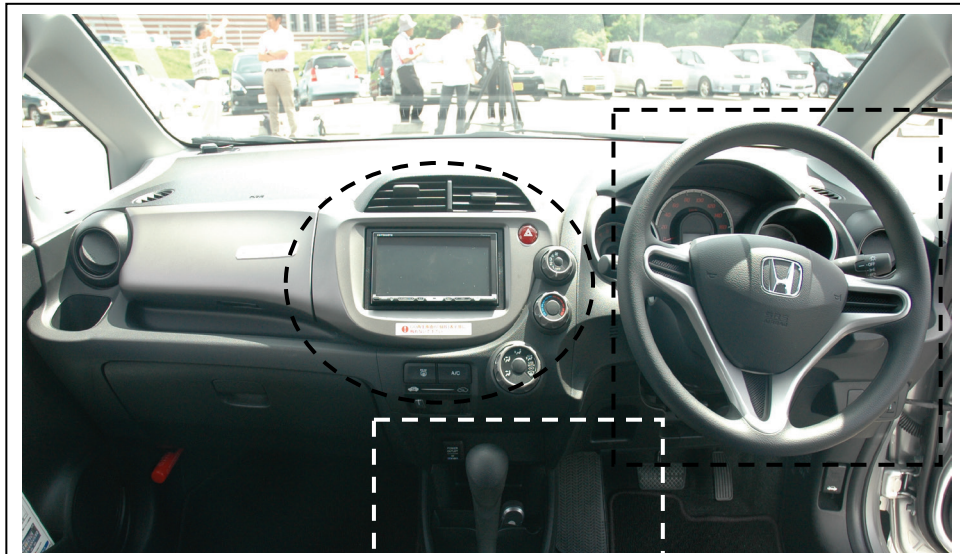


Fig. 7. The area inside a car for Kansei evaluation.

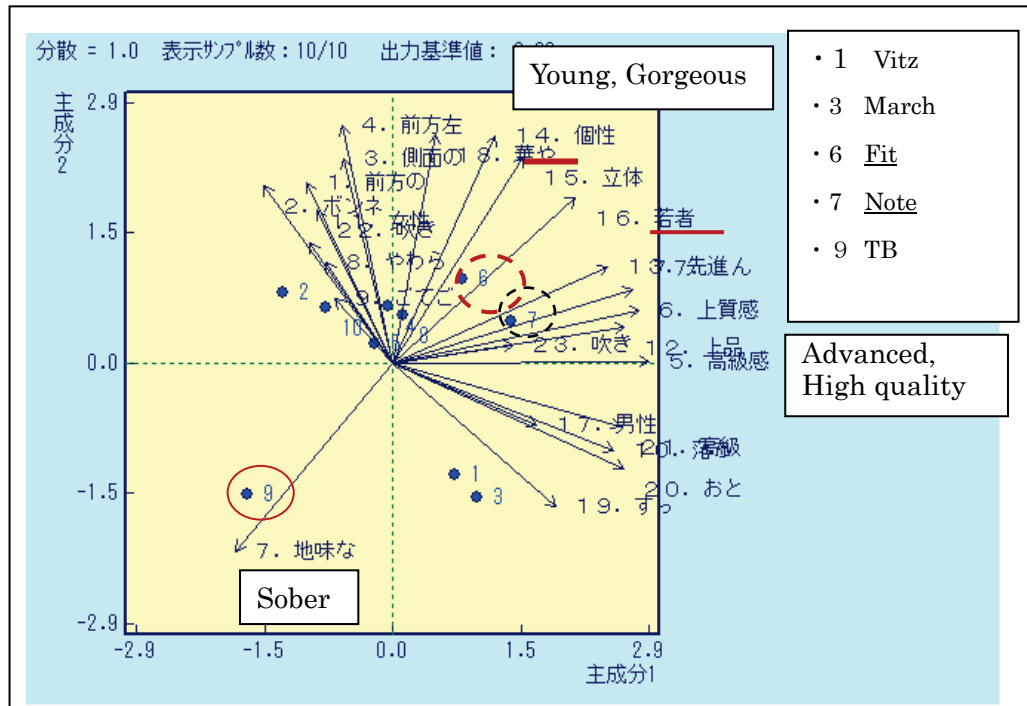


Fig. 8. Principal Component Analysis for ten cars. Each arrow means kansei word.

(5) Statistical analysis

The Factor Analysis were calculated from Kansei words and several Principal Component Analysis (Fig.8) and finally a Quantification Theory Type 1 (similar to PLS) were calculated, which shows the most important design specification items. This data suggests the most important Kansei design direction. Two dashboard designs were produced by computer graphics which Creation A and B, referred to Mitsubishi Fit and Nissan Note, based on the data of the quantification theory type 1, as shown in Figure 8.

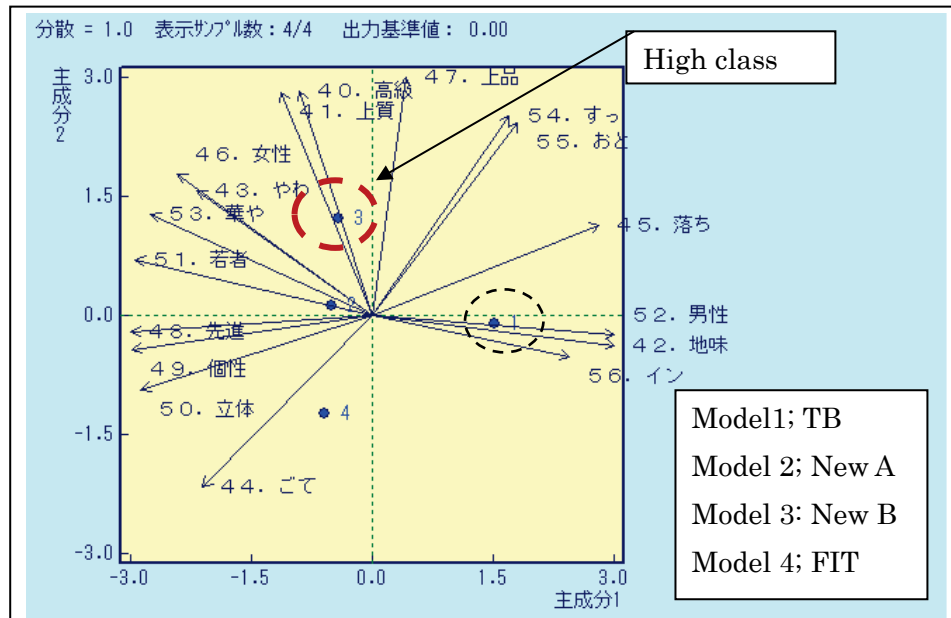


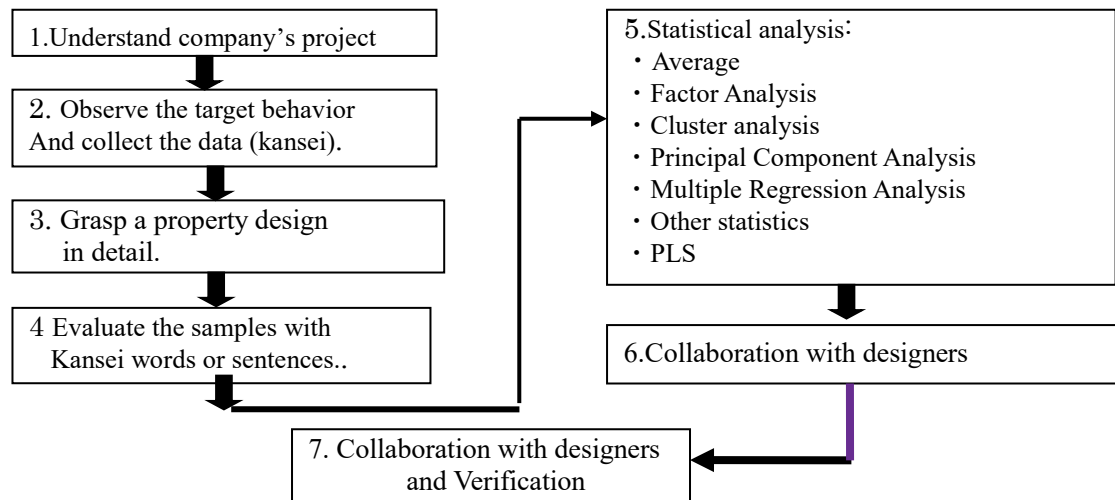
Fig. 9. Principal; Component Analysis using two new designs A & B, Fit, TB data.

Remarks: Summary of the research

The dashboard designs of 20 compact cars were surveyed where participants sit inside each car and evaluate the dashboard designs using the 5-point scale with Kansei Words (sentences). These data are analysed and found that the Fit design was the best design. Therefore, using the data calculated by the Quantification Theory Type 1, two types of new dashboard designs were produced by computer graphics, and we calculated the Principal Component Analysis using the two new designs with Fit and TB data. It was very clear that the new design B represents “high class design” and better than Fit, and that TB was still in the low level with Kansei “sober”. This step verifies the result of the research.

The Kansei Engineering procedure to analyse the present 20 compact cars as the samples and analysed the obtained design data using the statistical analysis and where it is found two Japanese cars had very good dashboard designs. After making two new dashboards by a computer graphics, three candidates of good dashboard designs as well as Hyundai’s design were re-analysed in order to attain the new best dashboard design, Candidate B. Finally, it is hoped that Hyundai would refer to the power of the Kansei Engineering function and results to continue to produce excellent car designs. Hence, it is possible that the KE matches very well with Artificial Intelligence and Virtual Reality system^{5,6,7}.

Kansei Engineering POINTS& Procedures⁴



REFERENCES

- Nagamachi, M., Senuma, I, Iwashige, R. A research of kansei engineering. *Japanes J. of Ergonomics*, 10(2), 121-130, 1074.
- Nagamachi, M. (2017). History of kansei engineering and application of artificial intelligence. *Advance in Affective and Pleasurable Design*. Springer, 357-368.
- Nagamachi, M., and Lokman, A. M. (2015). *Kansei innovation: Practical design applications for product and service development*. CRC Press.
- Nagamachi, M. (2010). *Kansei/Affective Engineering (ED.)*. CRC Press.
- Matsubara, Y., & Nagamachi, M, (1996). *Kansei virtual reality technology and evaluation on kitchen design*. *Manufacturing Agility and Hybrid Automation-I*, 77-8-.
- Tsuchiya, T., Matsubara, Y., Nagamachi, M. (1996). A development of Kansei engineering system for designing automobile interior space. *Human Factors in Organizational Design and Management-V, (ODAM '96)*, 19-24.
- Nagamachi, M. & Tsuchia, T. (2018). *Development of Japanese apricot jerry*. Workshop in KEER 2018.

THE EFFECTS OF STORE DISPLAY AND CONSUMER'S PERSONALITY ON INFORMATION-SEEKING BEHAVIOR FOR OVER-THE-COUNTER DRUGS

Shinichi KOYAMA^{*ab}, Kana AKIYAMA^b, Saki NAKAMURA^b, Mayu KAMIFUJI^b, Hikari TACHINO^b,
Seiya ISHIHARA^b, Ayaka HAYASHI^b, and Megumi IZUMISAWA^c

^a *University of Tsukuba, Japan, skoyama@geijutsu.tsukuba.ac.jp*

^b *Chiba University, Japan*

^c *Nihon University, Japan*

ABSTRACT

Japanese Revised Pharmaceutical Affairs Law emphasizes self-medication, where consumers are expected to choose an OTC drug at their own risk. For this reason, consumers should carefully read the information on OTC drug packages. In the present study, we examined whether store display of OTC drugs can influence information-seeking behavior such as reading information on the boxes. We performed a shopping-simulation experiment and a survey. In the shopping-simulation experiment, we displayed 16 OTC cold medicines on a shelf, and asked participants to choose one drug for themselves, assuming that they had a cold and high fever. On the shelf, the drugs were displayed by brand or symptom. During the experiment, we recorded the participants' behavior using two video recorders. In the questionnaire survey, participants evaluated their own personality by Cognitive Reflection and Impulsivity Scale. The results from t-test indicated no significant differences between the two display types. However, in the 2-way ANOVA (display type x personality), the results indicated significant interaction between the two factors. While the participants with high score in Cognitive Reflection and Impulsivity Scale box-reading behavior did not change significantly between the two display types, participants with low score in Cognitive Reflection and Impulsivity Scale read boxes more frequently and for a longer time when the drugs were displayed by brand than symptom. The results suggested influence of store display and personality on information-seeking behavior.

Keywords: *Information Design, Store Display, Personality Test*

* Corresponding author

1. BACKGROUND

An over-the-counter (OTC) drug is a drug that can be purchased without a doctor's prescription. In Japan, the Pharmaceutical Affairs Law was revised in June 2009 so as to emphasize "self-medication" and the consumer's "own risk." The implication is that consumers should read drug information on the package carefully when buying an OTC drug. However, our previous study using eye-tracking showed that Japanese consumers read risk-related information on the drug package only briefly (Choi et al. 2012a). The lack of information-seeking behavior was also demonstrated by a study by Kawase et al. (2011, 2016), in which Japanese consumers paid more attention to the drug names whereas U.S. consumers paid more attention to ingredients and risks.

In order to promote information-seeking behavior, revision of labeling design was proposed in the subsequent study. For example, a study by Choi et al. (2012b) on the package design of Japanese OTC drugs demonstrated that emphasizing risk category signs in red color and bold square frame increases viewing durations for not only the risk category sign per se but also for the other important information such as ingredients and warning.

The revision of the design of online shopping sites for OTC drugs was also proposed. Mukai et al. (2015) demonstrated that indicating a warning message and a pictures of serious side effects increases viewing time for "precautions", "advice before taking", and "side effects".

In the present study, we examined whether store display of OTC drugs can influence information-seeking behavior such as reading information on the boxes. We performed a shopping-simulation experiment and a survey.

2. METHODS

2.1. Participants

Forty-two undergraduate and graduate students participated in the experiment and survey. The experiment and survey were conducted at Chiba University, based on the declaration of Helsinki. The study was approved by the ethical committee of Graduate School of Engineering, Chiba University (approval number 28-07). Written informed consent was obtained from all participants.

2.2. PROCEDURES OF THE EXPERIMENT AND SURVEY

The participants participated in the shopping-simulation experiment and survey. In the experiment, sixteen OTC cold medicines were used in the experiment. They were all sold from 4 major brands (Benza, Lulu, Stona, and Estac). We used 4 types of cold medicine (one comprehensive cold medicine, one for nose, one for sore throat, and one for high fever) from

each brand (4 type x 4 brand = 16 drugs). The drugs were displayed on the shelf. The participants were asked to imagine that they were having a high fever (38 degree Celsius) and that they had to go to a drug store and choose a drug which they thought was the best for their symptom. They were also told that they could spend as much time as they wanted in order to choose a drug. The drugs were displayed either by brand or by symptom (Figure 1). When the drugs were displayed by brand, 4 drugs of the same brand were displayed on the same shelf. When the drugs were displayed by symptom, 4 drugs for the same symptom were displayed on the same shelf. Twenty-one participants chose a drug from the display by brand and the other twenty-one participants chose a drug from the display by symptom. Participants' behavior was recorded by two video cameras, and the video images were analyzed by 3 students. In the video analysis, information-seeking behaviors such as "frequency of box-reading" and "time spent before choosing a drug" were coded.

After the shopping-simulation experiment, the participants performed Cognitive Impulsive-Reflective Scale (Takigiku & Sakamoto, 1991). The personality test aims to measure tendency to make a decision after carefully collecting information vs. tendency to make a quick decision before collecting sufficient amount of information. The top 25% in the test were considered as "reflective participants" whereas the bottom 25% were considered as "impulsive participants".



Figure 1: Two types of the shopping-simulation displays.

3. RESULTS

The results from t-test indicated no significant differences between the two display types. However, in the 2-way ANOVA (display type x personality), the results indicated significant interaction between the two factors. While in the participants with high score in Cognitive

Reflection and Impulsivity Scale (= reflective participants) box-reading behavior did not change significantly between the two display types, participants with low score in Cognitive Reflection and Impulsivity Scale (=impulsive participants) read boxes more frequently ($p < .05$) and for a longer time ($p < .05$) when the drugs were displayed by brand than symptom.

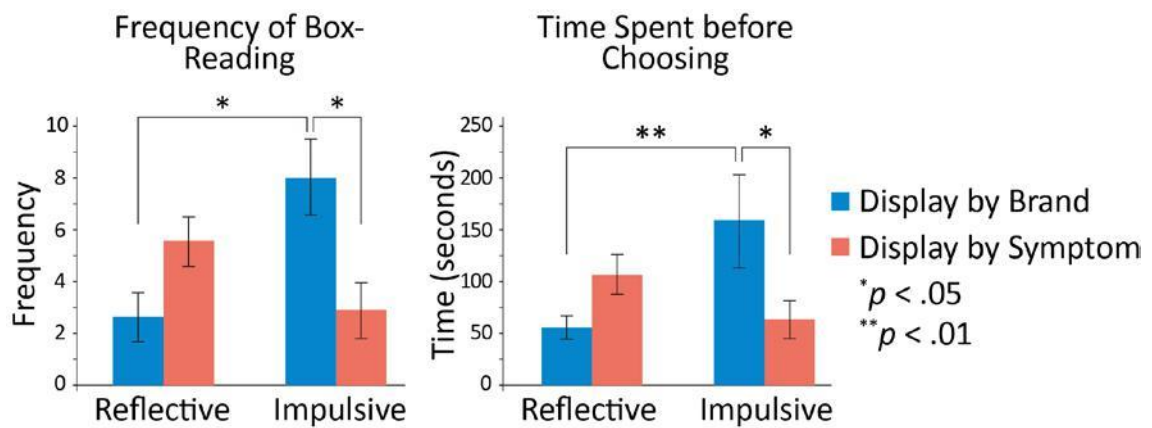


Figure 2: Results from the experiment

4. DISCUSSION

The results suggested influence of store display and personality on information-seeking behavior. Consistent with studies on package design (Choi et al., 2012b) and interface design (Mukai et al., 2015), store display design has an influence on the consumers' behavior before choosing drugs. The influence of the brand is especially strong to those who has cognitive-impulsive personality. In order to examine more details about how the participants read information on the drug boxes, experiments using an eye-tracker will be useful.

5. ACKNOWLEDGMENTS

The present study was supported by Japan Society for the Promotion of Science (JSPS) Grant-in-Aid for Scientific Research (C) to Shinichi Koyama (Number 17K00712).

REFERENCES

- Choi, J., Koyama, S., Izumisawa, M., Shiragami, M., Akazawa, C. & Hibino, H. (2012a). Evaluation of users' attention to the labeling information of over-the-counter medicines using eye-tracker. *Transactions of Japan Society of Kansei Engineering*, 11(1), 69-78. [in Japanese]
- Choi, J., Koyama, S., Izumisawa, M., Shiragami, M. & Hibino, H. (2012b). Guiding consumers' attention to safety-related information by highlighting "risk classification" on OTC drug packaging. *Bulletin of Japanese Society for Science of Design*, 59(4), 11-18. [in Japanese]
- Kawase, A., Sembiring, E. T., Choi, J., Koyama, S., Izumisawa, M., & Hibino, H. (2011). Comparison between the Japanese and US consumer's eye movement while choosing over-the-counter drugs: "name and benefits" vs. "ingredients and risks". *International Association of Societies of Design Research 2011 Proceedings*, p146.
- Kawase, A., Choi, J., Izumisawa, M., Hibino, H., & Koyama, S. (2016). Consumers' viewpoints to the labeling information of OTC medicines can change by brand. *Bulletin of Japanese Society for Science of Design*, 62(4), 35-42. [in Japanese]
- Mukai, S., Tanaka, S., Mizuno, Y., Hibino, H., & Koyama, S. (2015). Design of web screens that promote viewing of detailed information about over-the-counter drugs by warning about potential side effects. *International Association of Societies of Design Research 2015 Proceedings*, 2829-2837.
- Takigiku, K., & Sakamoto, A. (1991). Development of cognitive impulsive-reflective scale – an examination of reliability and validity. *The 39th meeting of the Japanese Group Dynamics Association Proceedings*, 39-40. [in Japanese]

CASE STUDY OF RENOVATION DESIGN PLAN OF GOLF CLUB HOUSE BY COLOR MARKETING METHOD AND KANSEI VALUE EVALUATION ANALYSIS

Miyuki ITOU^{*a}, Takashi SAKAMOTO^b and Toshikazu KATO^c

^a Graduate School of Chuo University, Japan, miyumiyucold@yahoo.co.jp

^b National Institute of Advanced Industrial Science and Technology, Japan, takashi-sakamoto@aist.go.jp

^c Chuo University, Japan, kato@indsys.chuo-u.ac.jp

ABSTRACT

Improvement of customer satisfaction and facilitation of corporate activities are important in making goods and events. In the current market, we cannot deal with customer satisfactions and purchasing promotions merely by customer benefits such as functionalities and prices. We need customer benefits to improve sensitivity value and empirical value that emphasize sensitivity. Comparative analyzes of sensitivity value evaluation were conducted on cases of institutional renovation design based on the previous research results of the author and cases of other competing facility designs. The result became effective data for the research of comprehensive emotional value methodology and the construction of universal model of color, form and material feeling, which are the future research objectives of our authors,

Keywords: KANSEI Value, Visual /design/ image, Color Marketing

1 INTRODUCTION

The purpose of this research is to find factors that increase the KANSEI value in the building field. Specifically, it is to verify whether improving the KANSEI value of facility design leads to improvement of customer satisfaction. Research by analytical approach of stimulus characteristics regulating color preference such as hue, lightness, saturation and study by a psychological approach to verify cognitive processes leading to personal color preference

* Corresponding author.

formation process or color preference expression in the field of sensitivity engineering / cognitive science are a useful research result. However, many mention only the preference of color, study of three elements of color, form and material and study the relationship between these three factors and palatability, sensibility value and purchase intention are few.

In this research, focusing on the relationship between elements of color, form and material (sense). Study on subjects of the clubhouse of a golf course designed and built by a color marketing method and the existing clubhouse of a golf course considered as a competitor in the field. Then, we carry out comparative analysis by using sensitivity evaluation values for them.

By conducting this analysis, it can be considered that it is possible to verify that the sensitivity value creation based on the color marketing method is more effective.

2. Example of repair based on color marketing method

In this paper, we will focus on the clubhouse renovation of the golf course and analyze the clubhouse after the renovation. In this section, we conducted the facility innovation plan for clubhouse renovation and the clubhouse renovation based on it, so we summarize the outline. For renovation (design and construction) based on color marketing method, first, establish a facility innovation plan. The purpose of the facility innovation plan is to raise the experience value for the visual design image of the facility by improving the sensibility value and to raise the evaluation on the facility design. For that reason, we plan a rebuilding plan by means of color marketing method in accordance with sound management revenue, incorporation of next generation members, and budget amount for said renovation. Next, implement the planning process. First, the evaluation items of the clubhouse of the golf club will be formulated. Following that, we will investigate the actual condition of the facility, inspection of competing facilities, sensitivity analysis on visual /design /image, visual /design /image analysis of the whole market, building trend analysis, hearings to the person concerned with the facility and grasp the differences and improvement points from the facilities to be compared. Based on the analysis results, regarding the clubhouse of the golf course to be analyzed in this study, we decided the direction of the concept of facility innovation to natural + modern + classic. At that time, the three images were represented by three different attributes.

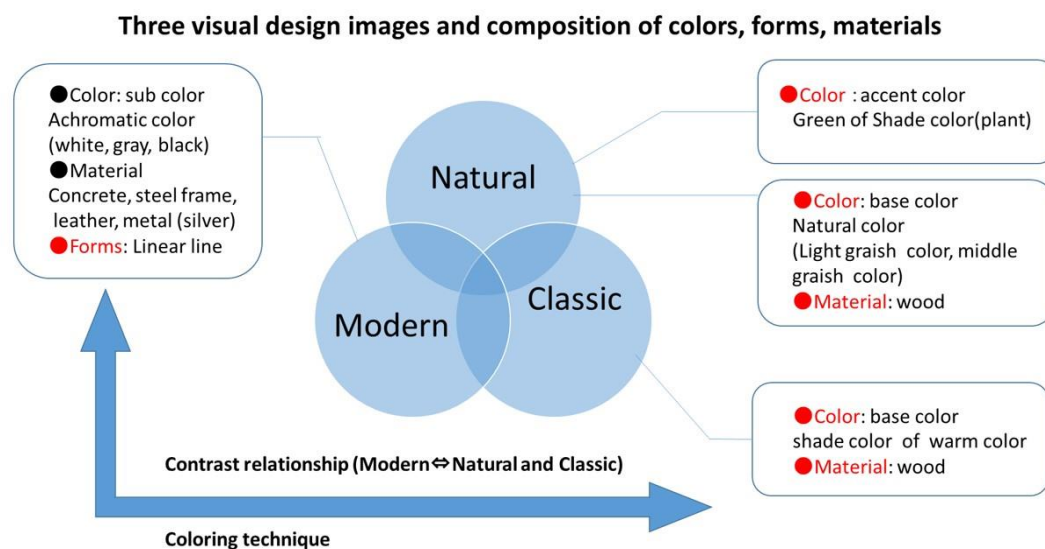


Fig. 1 Visual design image and three element composition

3. Method of comparative analysis

We investigated how the clubhouse, which was refurbished based on the color marketing method, recognizes the sensitivity value intended by the designer and how much satisfaction degree was improved by the renovation. We also investigated the existing clubhouse of the golf club that is regarded as a competitor in the same field as the comparison target.

In the questionnaire survey contents, with respect to the two facilities of the facility which were refurbished based on the color marketing method (abbreviated as the facility) and the competitive facility, the facility members were assigned to be the respondents, the variable 22 items as the sensitivity evaluation items were evaluated in five stages, and questionnaire was carried out. The facility: 55 respondents, competing facility: 30 respondents. Most of the club users of golf courses are men and females are extremely few. Competition facility are located in the competing commercial area, this is member system, and have selected the same condition that they are carrying out renovation. In the analysis method, F test is first carried out, after confirming whether the P value is significant or not, then t test is carried out, estimation of causality between the estimation for each sensibility information and the attention variable from the average value and standard error went.

4. Result of comparative analysis

With respect to the results of the sensitivity evaluation items according to the concept of the example, the sensitivity evaluation item "having sense of unity" was a significant difference ***, and exceeded the average value at the facility. "Natural" was a significant difference **, which exceeded the average value in the facility, and the difference with competing facilities was also

large. "Modern" was a significant difference ***, which slightly exceeded the average value at the facility, but the average difference from competition was large. "Clear" had a significant difference ***, which was much larger than the average value, and there was also a big difference in the comparison with the average value with the competition. "There is no significant difference in the facility "serenity", but both the facility and competing facilities exceed the average value. There is no significant difference in "there is a formality", both the facilities and the competing facilities are below the average value. Regarding the results of other sensibility evaluation items, there was no significant difference in either "flashy", "cute", "wild", "sober", "active", "brilliant " or "decorative". Both facilities are lower than the average value. "Quiet" ""Active"" "Elegant" is a significant difference *, "Quiet" both exceed the average value, but "There is movement" both are lower than the average value. "Elegant" is below the average value at the facility. "Dynamic" has a significant difference **, which exceeds the average value at the facility. "Casual" has a significant difference ***, although there are significant differences in the two facilities, both were below the average value.

Three variables, "I like", "I am satisfied", "I want to introduce it to my friends / acquaintances", are the ones I especially focused on in this research. "Like" has a significant difference *. In the facility, it exceeds the average value. "Satisfied" has a significant difference **. Satisfaction with the facility is well above the average value, there is a big difference from the average value of satisfaction of competing facilities. "I want to introduce to friends / acquaintances", there is no significant difference. Although the result shoes that there is no significant difference, the facility is far above the average value.

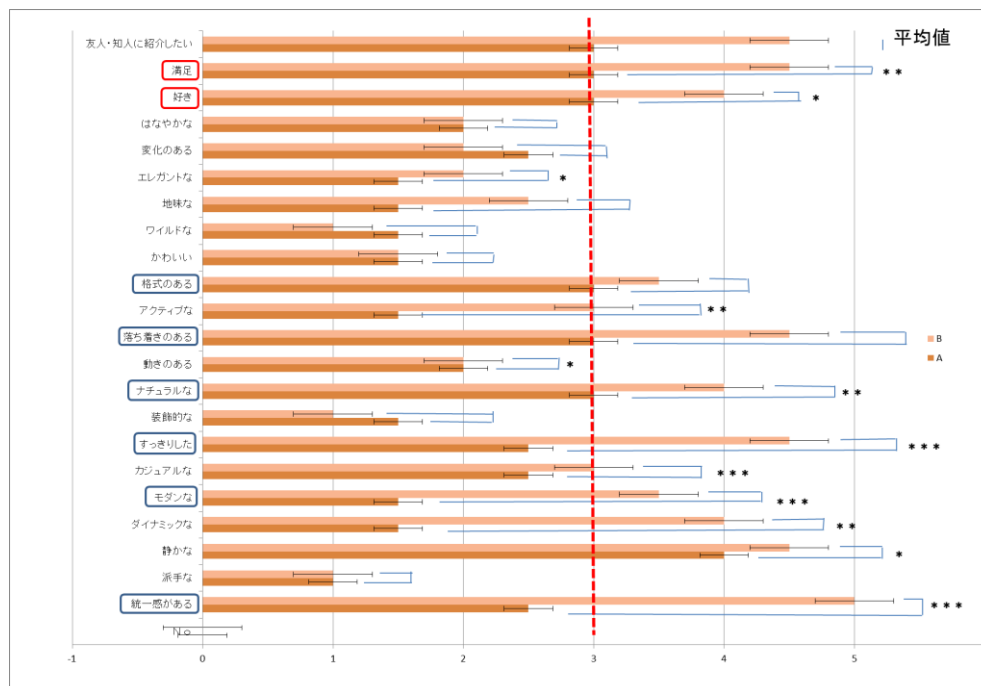


Table 2: Frequency distribution table of average values and standard errors of the institutional and competitive facilities' emotional value evaluation items etc.

5. Consideration

In this research, an example that intentionally embodied the concept by a combination of color, form, material (sense) was taken as a research resource. Based on the analysis results, the intentional sensory value evaluation items (including the concept) were significantly larger than the average value, and there was a significant difference from the competition. I recognize that it is a big natural image, a clean image. "calm" of the facility has no significant difference, but since it is much larger than the average value at the facility, it recognizes that it is a calm image. In the results of other sensitivity evaluation items, there was a significant difference in "quiet" "dynamic" "casual" "moving" "active" "elegant". However, except for "quiet" and "dynamic", it is lower than the average value, and it is inferred that not much recognition is done. We were able to find a big difference from the competing facility in comparing the average values for "liked", "satisfied", "want to introduce to friends and acquaintances", which are variables of interest. In "likes", it was found that the preference for the facility image is stronger than the competitive facility.

"Satisfied" also has a significant difference, with the average value the difference between the facility and competition is large, in the facility. It was inferred that the satisfaction level increased considerably, even though it was much larger than the previous evaluation (2.5→4.5). "I want to introduce to friends / acquaintances" did not have a significant difference, but the average value is high in the facility and it can be judged that consciousness is strong. It is speculated that those who do not receive education such as in design can support common recognition between feeling image language and created visual design image. It is also speculated that the sensibility value evaluation item as a concept contributes to a remarkable improvement in favor and satisfaction with the facility. At the same time, as a result of comparing "sensibility value evaluation item intentionally incorporated in the facility", "liking" or "satisfied" of the competing facility, the average value was also low, so that the sensibility which is the concept of the facility, it is suggested that value evaluation items are effective for satisfaction and palatability in clubhouse design.

6. Conclusion and future tasks

It was possible to demonstrate that the sensibility values of the designed examples are recognized and evaluated by the users in the same way and lead to high evaluation of facilities such as "satisfaction" and "liking" to facilities. I adopted the sensitivity evaluation language which is also used in the building field, but it seems to be a factor as well. It was able to produce results as one of the research on the creation of KANSEI value of customer benefit centered on sensitivity. However, in the questionnaire survey and the method of taking data, the number of comparative analyzes was small, and comparative analysis by the same subject was not possible. In the future, we would like to conduct researches that can obtain more informed knowledge by increasing the number of comparable examples and analyzing by comparative answers of the same subjects.

REFERENCES

Thesis: A Consideration on Model of Purchasing Behavior Creation by Kansei Information (Kosaka). (2010). *Journal of Japan Society for Kansei Engineering*, (10), 185-192.

Muramoto, I. (2012). *Coloring system using emotional coloring model and image emotion model and its application to uniform coloring*.

Oyama, I. (2005). Emotional effect of two-color coloring between different hues. *Journal of the Color Science Society of Japan*, (4).

Linstrom, M. (2005). *Brand strategy of five senses stimulation*. Diamond Company.

Hirasawa, S. (1996). *Color Marketing Techniques*. President

Color Marketing Strategy Seiji Kobayashi Japan Efficiency Association (1988)

Initiative for Kansei Value Creation METI (2007)

THE EFFECTS OF MOOD VALENCE AND AROUSAL ON CAR FOLLOWING; EVIDENCE FROM DRIVING BEHAVIOUR AND EYE TRACKING

Tatjana ZIMASAA ^a, Samantha JAMSONB ^b, Brian HENSONC ^c, Andrew TOMLINSOND ^d, Richard DONKORE ^e, Lee SKRYPCHUKE ^e

^a University of Leeds, Institute for Transport Studies, Leeds, United Kingdom, tstz@leeds.ac.uk

^b University of Leeds, Institute for Transport Studies, Leeds, United Kingdom, s.l.jamson@its.leeds.ac.uk

^c University of Leeds, School of Mechanical Engineering, Leeds, United Kingdom, B.Henson@leeds.ac.uk

^d University of Leeds, Institute for Transport Studies, Leeds, United Kingdom, A.Tomlinson@leeds.ac.uk

^e Jaguar and Land Rover, rdonkor1@jaguarlandrover.com, lskrypch@jaguarlandrover.com

ABSTRACT

The choice of time headway is individual and highly depends on the perceived likelihood of a rear-end collision. This study investigated whether this perception is dependent on drivers' mood and cognitive load. Drivers were asked to follow a lead vehicle in one of four moods (neutral, happy, sad, and angry) and under three cognitive loads (none, non-driving related load, and driving related load). Time headways were measured along with eye tracking data and physiological measurements of electro-dermal activity and heart rate. The relationship between cognitive load, visual search patterns, mood, and time headway was modelled. The results indicate that those in a sad mood followed at longer time headways than those in other moods. However, the positive effect of these changes is moderated by the reduction of attentional shift, in the form of longer eye fixations. In addition, it was found that cognitive load can act as attentional mediator for those in the sad mood but as a distractor for other drivers.

Keywords: time headway, driver's mood, cognitive load, attentional shift, driving safety

1. INTRODUCTION

Drivers have to keep a safe distance to a car in front to account for the possibility of sudden braking. Choosing an inappropriate distance can have severe consequences. For example, in the UK, close car following has been associated with 7023 accidents in 2015, 469 of which were fatal or serious (Department for Transport, 2015). One of the parameters defining a safe distance is time headway (TH). TH is a measurement of time between cars in which the front of a following car would reach the back of a lead car without changes in their speed (Evans, 1991). An alternative TH has been proposed as being the safe upper limit of safe interaction; this time varies from 1.5-3.5 seconds in good road and traffic conditions (Pasanen & Salmivaara, 1993; Piao & McDonald, 2003; Vogel, 2003; Wasielewski, 1979). Shorter TH leaves less time to respond to a potential hazard. This response is dependent on drivers' mood, cognitive load, and their ability to switch attention from object to object (Crundall, Chapman, Phelps, & Underwood, 2003; Lee, Lee, & Ng Boyle, 2007; Zimasa, Jamson, & Henson, 2017). For example, Tasca (2000) found that aggressive drivers are more likely to tailgate, and Green (2000) found that under cognitive load, the drivers' stopping distance increases. The interaction between mood and load and their effect on following behaviour has been under researched however.

Eye movement measures are reliable indicators of attentional shift (Underwood, Chapman, Berger, & Crundall, 2003; Velichkovsky et al., 2003). Previous research has shown that sad drivers are slower in attentional shift than happy and neutral drivers as indicated by longer hazard response times and eye fixation durations (Zimasa et al., 2017). However, the impacts of positive and negative mood valence and high and low arousal impacts on TH choice are unknown.

The current study addresses both these shortcomings by comparing changes in TH from baseline, as a reference point of a normal or usual driving style, to the driving style which occurs as a result of drivers' mood change. It was hypothesized that the higher arousal moods would result in shorter THs. The lower arousal moods would elicit different behaviours; sad mood would result in slower attentional shift expressed by longer fixation durations and longer TH. The neutral mood should not bring any changes in TH and eye fixation durations.

2. METHODOLOGY

2.1. Material/Apparatus

The study was performed the University of Leeds driving simulator (UoLDS), with highly immersive dynamic motion system and high level of fidelity. UoLDS is based on a 2005 Jaguar S-type vehicle, equipped with fully operational controls, rear view and side mirrors, real steering wheel with force feedback and pedals. The vehicle is placed inside a dome with spherical screen projection of 3x1920x1200 to the front and 1024x768 in the peripheral and rear view. The view is displayed in the rear and side mirrors with visual field angle of 42°. Seeing Machines face LAB v5 eye-tracker was used for recording eye movements. The eye tracker was fixed in the driving simulator car's front panel and allowed the recording of gazes with accuracy of $\pm 1^\circ$ at 60 Hz. Physiological measurements were collected via the Empatika E4, a wearable wireless multi-sensor device. This is non-invasive, small (4cm x 4cm), and lightweight (25 grams) device. Measurements are taken using 4 sensors efficiently combined into wristband.

Prior to and after the experiment participants were asked to fill in a mood assessment grid to determine their mood valence and arousal (Figure 1)

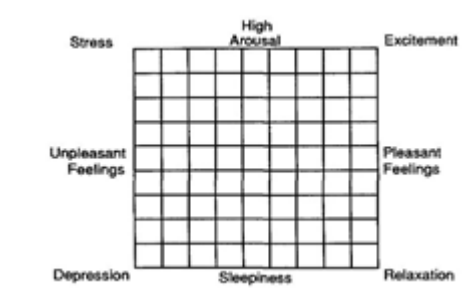


Figure 1: Self-assessment grid (Russell, Weiss, & Mendelsohn, 1989).

Mood was induced via music (Table 1) and supplemented with appropriate mental imagery (Västfjäll, 2002).

Table 1: Music used for different Mood inductions.

Mood	Music
Sad	1) Chopin (1839). Opus 28,/#6, from Preludes, Played by Alessandra Ammara, piano 2) Prokofiev (1938). Russia Under Mongolian Yoke from Alexander Nevsky
Happy	1) Delibs (1870), Mazurka from Coppelia 2) Bach (1721). Brandenburg Concerto #2
Neutral	1) Chopin Waltz No. 12 in F minor, Op. 70, No.2 2) Chopin Waltz No. 11 in G flat, Op. posth, 70 No. 1
Angry	1) Mussorgsky (1867) – Night on Bald Mountain, played by symphonic orchestra. 2) Hoist (1918). – The Planets – Mars, the Bringer of War

2.2. Design

A 3x4 mixed design was employed with Mood as the between subject's factor with four levels (neutral, happy, sad, angry), and Load as a within subjects factor with three levels (no-load (NONE), non-driving related load (NDRL), and driving related load (DRL). A baseline drive was performed before each experimental drive to establish drivers' usual driving styles and to be able to capture changes triggered by different moods. Within every Mood condition there were three drives under different Load conditions. The drives consisted of 8 events and a car following task. Due to spacial limitations, only the car following task will be discussed here.

2.3. The car following task

The car following task was developed by (Brookhuis, Waard, & Mulder, 1994) and adapted to driving simulator by (Ward, Manser, de Waard, Kuge, & Boer, 2003). The participant follows a

lead car on a single carriageway. The lead car varies its speed between 50 and 60 mph in an approximate sinusoidal cycle with a frequency of about 0.03 Hz. The instructions are to drive and consistently keeping the safest and the most convenient distance.

2.4. Cognitive load

In no-load condition no questions were asked during the drive. In the DRL condition, driving related questions were asked, and in NDRL, non-driving related questions were asked. An example of a DRL question was “Is it safe to overtake these parked cars?”, whilst a NDRL would be “Do you have a dog?” The order of the questions was counterbalanced between the conditions, so that all the participants had all the questions, but in different orders. All together there were 4 questions asked in each load condition.

2.5. Participants

The participants were recruited using the University of Leeds simulator participant pool as well as personal contacts. The inclusion criteria were driving experience no less than 3 years and driving no less than 5000 miles per a year. There were 40 participants (26 males), mean age 38.48 (SD 12.29), range 18-48. As a gesture of appreciation all participants were given £20.

2.6. Procedure

After filling in consent forms and pre-study questionnaires, participants had to perform a practice drive to familiarize themselves with the task. After the practice drive participants performed a baseline drive with instructions “drive as you would normally do”. The same instructions were given for the experimental drives. Following the baseline drive, they were asked to sit as still as possible and relax for 4 minutes to elicit baseline physiological measurements. After this, 5-minute musical excerpts were played (80 dB volume) and the second set of physiological data was collected to record changes. Next, participants were asked to perform three more experimental drives during which cognitive load was manipulated. The questions were asked through the hands-free communication system in the vehicle at a volume of 65dB, so being not too loud, but could be heard regardless of music, as the music was still played with lower volume (60 dB).

3. ANALYSIS AND RESULTS

3.1. Mood induction

The pre-study self-assessment questionnaires showed that there was no significant difference in the mood valence and arousal between different participant groups, indicating that all the participants were in the similar mood and similarly aroused before the study; valence, $F(3, 35) = 0.55$, $p = 0.65$, arousal, $F(3, 35) = 0.11$, $p = 0.95$. However, the post-study questionnaires showed significant difference in participants' mood valence, $F(3, 35) = 7.43$, $p < 0.05$. Post-hoc tests showed that the differences were between the positive valence (happy,

neutral) and negative valence (sad, angry) conditions, ($p < 0.05$). There also was a significant difference in arousal between the groups. Post hoc tests revealed differences between the low (sad, neutral) and high arousal groups (happy, angry), all $p < 0.05$. The results demonstrate the effectiveness of the mood induction.

3.2. Physiological data

Electro-dermal activity (EDA) and heart rate (HR) data were analysed to determine whether there were changes in arousal levels between the conditions. There was a significant difference between the EDA in the different Mood conditions $\chi^2 (3) = 21.76$, $p < 0.001$, with mean ranks of 29.55 for Sad, 12 for Happy, 25.83 for Neutral, and 10.5 for Angry conditions. Pairwise comparisons using the Dunn-Bonferroni correction showed that significant differences were between the low (neutral, sad) and high (happy, angry) arousal conditions (Figure 2).

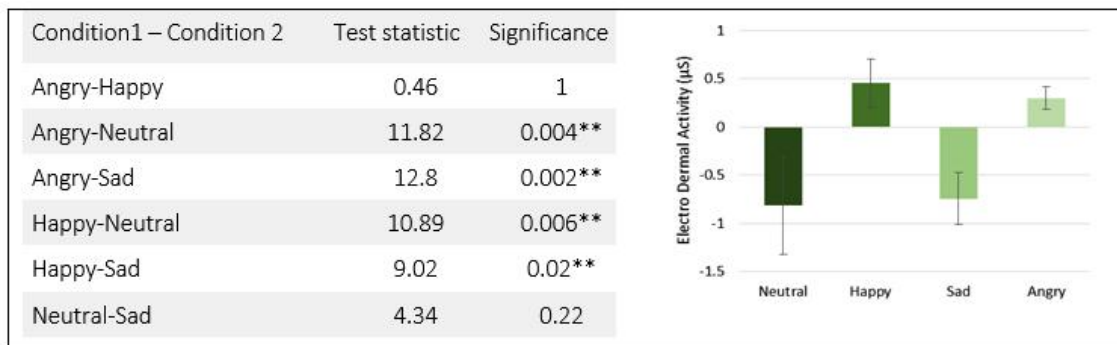


Figure 2: Kruskal-Wallis test statistics for EDA differences between the Mood conditions (left), and graph representing EDA measured in microsiemens (right). Error bars represent standard errors

There was a significant difference in HR between the Mood conditions $\chi^2 (3) = 23.2$, $p < 0.001$, with mean ranks of 24 for the sad, 12.9 for the happy, 29.63 for the neutral, and 7.5 for the angry conditions. Follow up pairwise comparisons using the Dunn-Bonferroni approach showed significant differences between the low (neutral, sad) and high (happy, angry) arousal conditions (Figure 3).

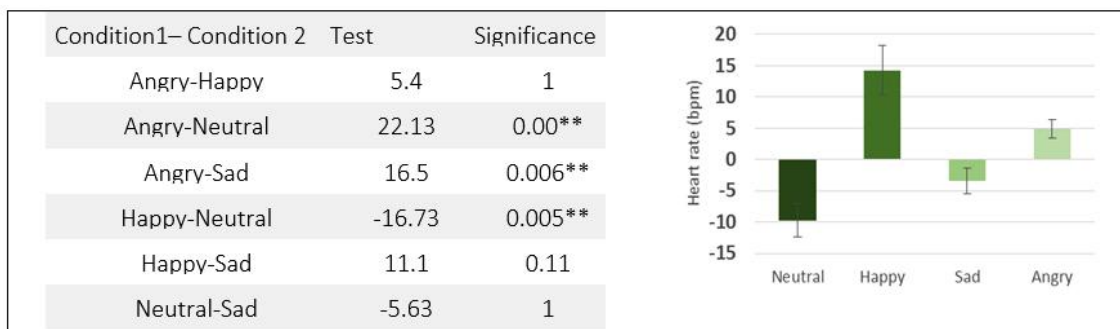


Figure 3: Kruskal-Wallis test statistics for HR differences between the Mood conditions (left), and graph representing HR measured in beats per minute (right). Error bars represent standard errors

3.3. Eye tracking data

Fixation durations in the baseline drive were subtracted from the corresponding Mood condition data. There was a significant main effect of Load, $F(1.71, 61.52) = 9.23, p < 0.01$. Within-subjects' contrasts revealed significant differences between the NONE (mean difference 0.15 sec) and NDRL (mean difference 0.07 sec), and between the NDRL and DRL (mean difference 0.03 sec). There was a significant main effect of Mood, $F(3, 36) = 4.75, p < 0.01$. Pairwise comparisons revealed that the differences were between the sad (mean -0.02 sec) and happy (mean 0.07 sec), the sad and neutral (mean 0.08 sec), and a marginally significant difference between the angry (mean 0.02 sec) and neutral conditions ($p = 0.056$). The biggest changes were in the sad mood, where fixation durations increased compared to the baseline.

There also was a significant interaction, $F(5.13, 61.52) = 3.86, p < 0.01$. Within subjects' contrast showed that the significance was between the NONE (mean -0.08 sec) and NDRL (mean 0.03 sec) in the sad mood (Figure 4)

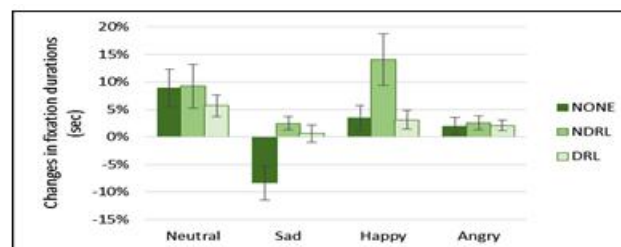


Figure 4: Changes in the fixation duration between the baselines and the corresponding Mood conditions, measured in seconds. Error bars represent standard errors.

3.4. Time Headway (TH)

For the analysis of TH, repeated measures ANOVA was used with the between subject factor Mood (four levels: neutral, happy, sad, angry) and the within subject factor Load (three levels: NONE, DRL and NDRL). For the within subject effect, a Greenhouse-Geisser correction was used, if the assumption of sphericity was violated. THs longer than 6 seconds were excluded from the analysis (Vogel, 2002). The data were divided into 6-time segments; 0 to 1 second, 1 to 2, 3 to 4, 4 to 5, and 5 to 6. The time was calculated without including the last second. For example, from 0 to less than 1 (with 1 not included), from 1 to less than 2 (with 2 not included), and so on. For each time segment, the proportion of time participants drove in each time segment as a proportion of all time was calculated and compared across conditions. Finally, the proportions

in each Mood condition was subtracted from the corresponding baseline. For example, time segment 1-2 seconds in the sad mood was subtracted from the baseline of the sad mood.

There were no significant differences in the TH of 0-1, 2-3, 4-5, and 5-6 time segments in any of the conditions. There was a significant effect of Mood on TH in the 1-2 seconds time segment, $F = 3.72$, $p < 0.05$. Pairwise comparisons showed that these differences were

between the sad and all the other moods ($p < 0.05$), demonstrating that, regardless of Load, the happy, neutral, and angry drivers preferred this time headway significantly more compared to the sad drivers.

In the time segment of 3-4 seconds there was a significant main effect of Load, $F(1.59, 55.48) = 3.5$, $p < 0.05$. Pairwise comparisons showed that this was due to the effect of NDRL, $p < 0.05$, indicating that regardless of Mood, when asked non-driving related questions, drivers preferred to spend less time at this TH. There was also a significant main effect of Mood in this time segment, $F(3, 35) = 3.22$, $p < 0.05$. Pairwise comparisons showed that this difference was between the sad and the angry moods, with the sad drivers spending significantly more time at this TH. There were no significant interactions between Mood and Load in this segment (Table 2, Figure 5).

Mood/Load	Time (Sec)	Neutral	Happy	Sad	Angry
NONE	1-2	0.26(0.21)	0.24(0.19)	0.05(0.09)	0.26(0.24)
	3-4	0.26(0.21)	0.29(0.22)	0.33(0.18)	0.14(0.16)
NDRL	1-2	0.25(0.21)	0.3(0.29)	0.1(0.14)	0.41(0.29)
	3-4	0.19(0.17)	0.18(0.19)	0.25(0.14)	0.11(0.13)
DRL	1-2	0.32(0.25)	0.19(0.28)	0.04(0.05)	0.3(0.29)
	3-4	0.19(0.19)	0.18(0.19)	0.4(0.16)	0.14(0.14)

Table 2: Means and standard deviations (in brackets) for TH in Mood and Load conditions. Non-significant results are not included.

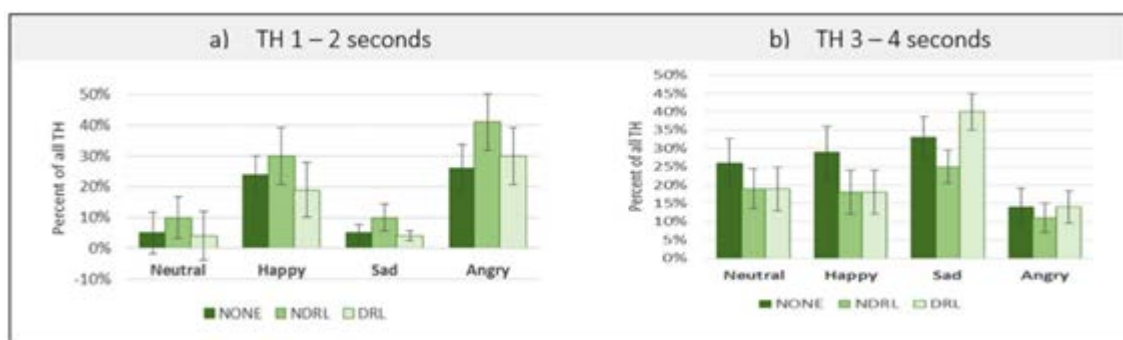


Figure 5: Percent time spent in different time headway segments by Mood and Load. Error bars represent standard errors.

The comparison of changes between the conditions and their corresponding baselines showed that there were no significant differences in the TH changes from baseline in the time segments 0-1 second, 1-2 seconds and 2-3 seconds. Figure 6 shows that the sad drivers reduced the time spent in 0-1, 1-2, 4-5, and 5-6 time segments, did not change time in the 2-3 seconds segment and increased time spent in the 3-4 segment. Neutral, happy, and angry drivers decreased time spent in the 2-3 seconds segment, and angry drivers decreased time in the 4-5 and 5-6 seconds segment as well. However, these changes are not significant.

There was a significant main effect of Load in the 3-4 second time segment, $F(1.59, 57.27) = 3.95$, $p < 0.05$. Pairwise comparisons showed that this difference was between the NDRL and other Loads, $p < 0.05$, indicating that regardless of Mood, drivers reduced the time spent in this segment in the NDRL condition (mean = -0.02, SE = 0.03) compared to the DRL (mean = 0.31, SE = 0.03) and NONE (mean = 0.06, SE = 0.06) conditions. There was a significant main effect of Mood, $F(3, 36) = 3.2$, $p < 0.05$. Pairwise comparisons showed that this effect was between the angry and all other moods, $p < 0.05$, indicating that drivers in the angry mood spent significantly less time in this time segment compared to their normal driving. There were no significant interactions (Table 3 and Figure 6).

Table 3: Means and standard deviations (in brackets) for changes in TH from the corresponding baselines to the Mood and Load conditions.

There also was a significant interaction, $F(5.13, 61.52) = 3.86$, $p < 0.01$. Within subjects' contrast showed that the significance was between the NONE (mean -0.08 sec) and NDRL (mean 0.03 sec) in the sad mood (Figure 4)

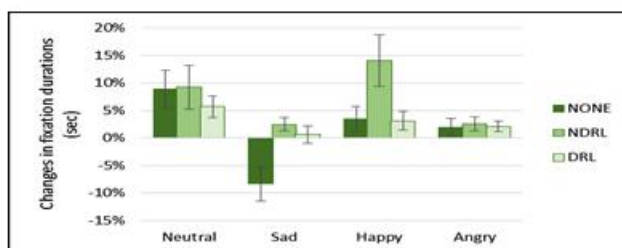


Figure 4: Changes in the fixation duration between the baselines and the corresponding Mood conditions, measured in seconds. Error bars represent standard errors.

3.4. Time Headway (TH)

For the analysis of TH, repeated measures ANOVA was used with the between subject factor Mood (four levels: neutral, happy, sad, angry) and the within subject factor Load (three levels: NONE, DRL and NDRL). For the within subject effect, a Greenhouse-Geisser correction was used, if the assumption of sphericity was violated. THs longer than 6 seconds were excluded from the analysis (Vogel, 2002). The data were divided into 6-time segments; 0 to 1 second, 1 to 2, 3 to 4,

4 to 5, and 5 to 6. The time was calculated without including the last second. For example, from 0 to less than 1 (with 1 not included), from 1 to less than 2 (with 2 not included), and so on. For each time segment, the proportion of time participants drove in each time segment as a proportion of all time was calculated and compared across conditions. Finally, the proportions in each Mood condition was subtracted from the corresponding baseline. For example, time segment 1-2 seconds in the sad mood was subtracted from the baseline of the sad mood.

There were no significant differences in the TH of 0-1, 2-3, 4-5, and 5-6 time segments in any of the conditions. There was a significant effect of Mood on TH in the 1-2 seconds time segment, $F = 3.72, p < 0.05$. Pairwise comparisons showed that these differences were

between the sad and all the other moods ($p < 0.05$), demonstrating that, regardless of Load, the happy, neutral, and angry drivers preferred this time headway significantly more compared to the sad drivers.

In the time segment of 3-4 seconds there was a significant main effect of Load, $F(1.59, 55.48) = 3.5, p < 0.05$. Pairwise comparisons showed that this was due to the effect of NDRL, $p < 0.05$, indicating that regardless of Mood, when asked non-driving related questions, drivers preferred to spend less time at this TH. There was also a significant main effect of Mood in this time segment, $F(3, 35) = 3.22, p < 0.05$. Pairwise comparisons showed that this difference was between the sad and the angry moods, with the sad drivers spending significantly more time at this TH. There were no significant interactions between Mood and Load in this segment (Table 2, Figure 5).

Table 2: Means and standard deviations (in brackets) for TH in Mood and Load conditions. Non-significant results are not included.

Mood/Load	Time (Sec)	Neutral	Happy	Sad	Angry
NONE	1-2	0.26(0.21)	0.24(0.19)	0.05(0.09)	0.26(0.24)
	3-4	0.26(0.21)	0.29(0.22)	0.33(0.18)	0.14(0.16)
NDRL	1-2	0.25(0.21)	0.3(0.29)	0.1(0.14)	0.41(0.29)
	3-4	0.19(0.17)	0.18(0.19)	0.25(0.14)	0.11(0.13)
DRL	1-2	0.32(0.25)	0.19(0.28)	0.04(0.05)	0.3(0.29)
	3-4	0.19(0.19)	0.18(0.19)	0.4(0.16)	0.14(0.14)

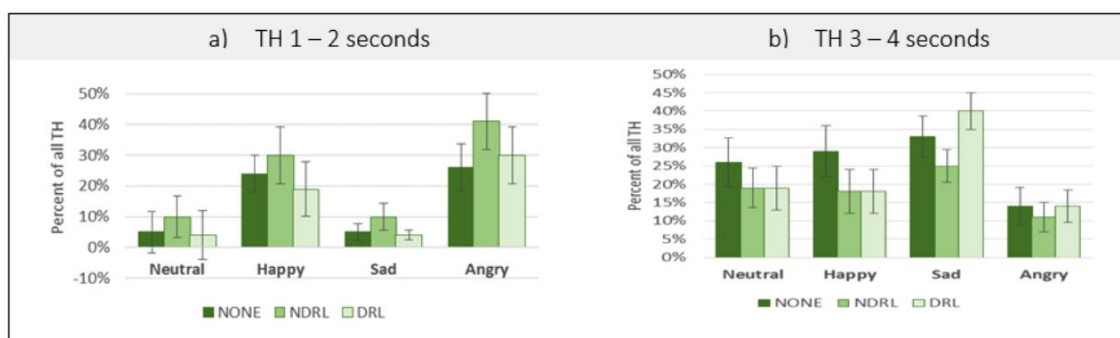


Figure 5: Percent time spent in different time headway segments by Mood and Load. Error bars represent standard errors.

The comparison of changes between the conditions and their corresponding baselines showed that there were no significant differences in the TH changes from baseline in the time segments 0-1 second, 1-2 seconds and 2-3 seconds. Figure 6 shows that the sad drivers reduced the time spent in 0-1, 1-2, 4-5, and 5-6 time segments, did not change time in the 2-3 seconds segment and increased time spent in the 3-4 segment. Neutral, happy, and angry drivers decreased time spent in the 2-3 seconds segment, and angry drivers decreased time in the 4-5 and 5-6 seconds segment as well. However, these changes are not significant.

There was a significant main effect of Load in the 3-4 second time segment, $F(1.59, 57.27) = 3.95$, $p < 0.05$. Pairwise comparisons showed that this difference was between the NDRL and other Loads, $p < 0.05$, indicating that regardless of Mood, drivers reduced the time spent in this segment in the NDRL condition (mean = -0.02, SE = 0.03) compared to the DRL (mean = 0.31, SE = 0.03) and NONE (mean = 0.06, SE = 0.06) conditions. There was a significant main effect of Mood, $F(3, 36) = 3.2$, $p < 0.05$. Pairwise comparisons showed that this effect was between the angry and all other moods, $p < 0.05$, indicating that drivers in the angry mood spent significantly less time in this time segment compared to their normal driving. There were no significant interactions (Table 3 and Figure 6).

Table 3: Means and standard deviations (in brackets) for changes in TH from the corresponding baselines to the Mood and Load conditions.

Mood Load	Time (seconds)	Neutral-Baseline	Happy- Baseline	Sad- Baseline	Angry- Baseline
NONE	3-4	0.09(0.17)	0.14(0.15)	0.09(0.23)	-0.08(0.16)
NDRL	3-4	0.01(0.12)	0.02(0.1)	0.11(0.22)	-0.11(0.22)
DRL	3-4	0.02(0.14)	0.03(0.14)	0.16(0.24)	-0.08(0.15)

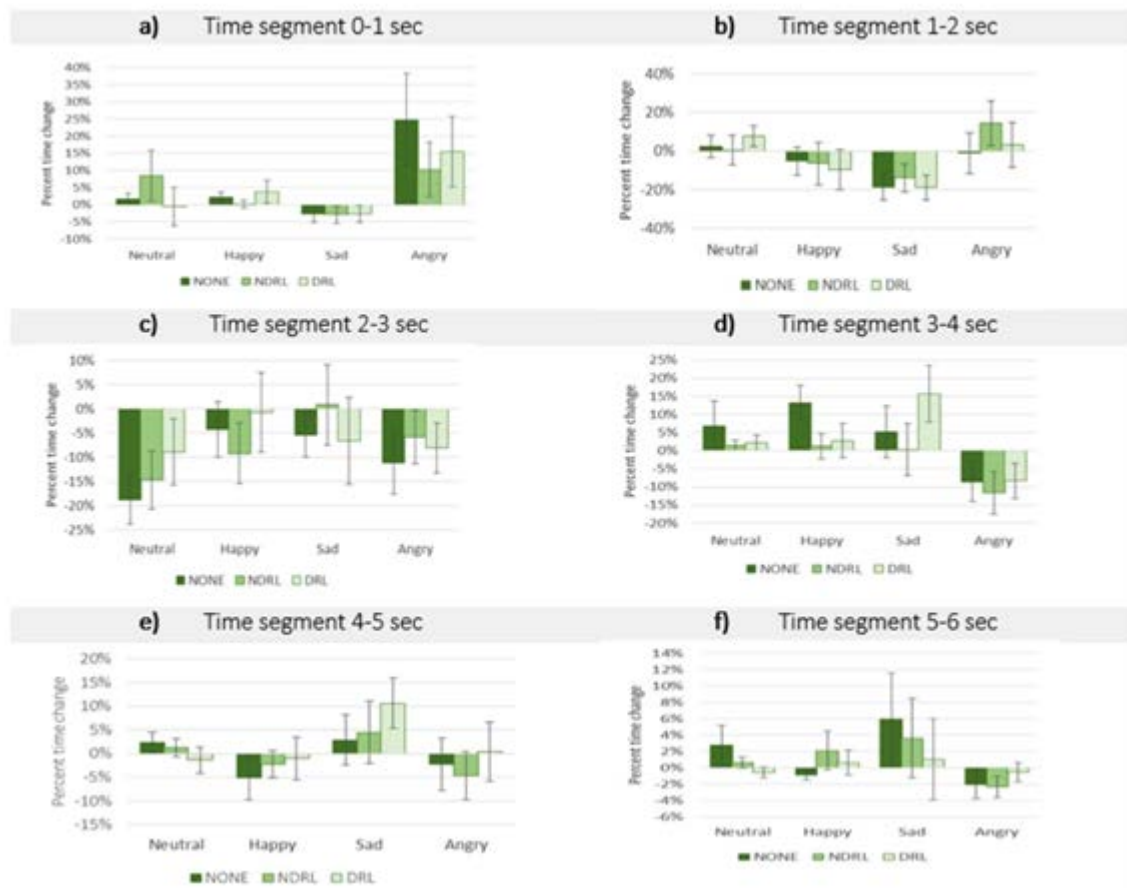


Figure 6: Changes in percent time spent in different time segments between the baselines and corresponding Mood and Load conditions. Error bars represent standard errors.

4. DISCUSSION

The present research has investigated how different moods and cognitive load affect car following as expressed by time headway. It was hypothesized that angry drivers would choose shorter following times (Tasca, 2000). It also was hypothesized that if following time can be accounted for by arousal, happy drivers following distance should be like that of the angry drivers. Sad drivers, instead would increase the car following distance due to a compensatory mechanism and the internal nature of the sad mood (Zimasa et al., 2017). The drivers in the neutral mood should not be affected by the arousal and due to no changes in the mood valence, their car following distance should not change from the baseline.

The results of the mood induction show that the participants' mood was indeed changed in accordance with the experimental manipulations. The physiological data also supports this conclusion, as the high arousal moods showed significantly higher EDA and HR compared to the low arousal conditions.

The time headway results fully support the hypotheses. Angry drivers increased their TH in 0-1 and 1-2 segments, which are the most safety-critical, and in some countries (i.e. Sweden) are not acceptable (Vogel, 2003). Happy drivers were not so consistent in their safety preferences. Some increase in the less safe 1-2 seconds segment was recorded along with an increase in the

safer 3-4 seconds segment. This shows that there are some differences in choosing safety distance between high arousal moods. Positive valence in this case moderates a negative effect of arousal. The significant decrease of time spent in the 3-4 seconds segment and increase in under 3 seconds segments for the angry drivers show that they are less concerned with possible consequences of driving too close to the car in front.

The sad drivers preferred travelling at 3-4 seconds headway significantly more often than the angry drivers, and at 1-2 seconds headway significantly less than drivers in all the other moods, thereby increasing their safety gap. However, the increase in their eye fixation durations show that the positive effect of this change reduces due to a slower switch of their attention and therefore less efficient road monitoring (Underwood et al., 2003; Zimasa et al., 2017). The biggest changes in time headway for low arousal moods were observed in the 2-3 seconds segment, indicating the importance of drivers' arousal in their perception of a safe following distance. However, the changes in low arousal were mediated by the positive valence and affected only the sad drivers.

The type of the cognitive load had a significant effect on drivers chosen following distance as well. When non-driving related questions asked, drivers found it more difficult to maintain their chosen safety gap, showing about a 20% increase in time spent at less than 2 seconds TH and a significant decrease in the safer 3-4 seconds segment. The ability to switch attention was also affected by the type of cognitive load, showing the best attentional alteration when no-load was applied. Driving related questions appeared to have the strongest effect on the drivers' environmental search abilities. However, the cognitive load not always has a negative effect, NDRL helps to improve drivers' attentional shift in the sad mood.

Conclusions and suggestions for further research. Drivers' mood valence and arousal have a significant effect on driving safety. High arousal lowers drivers' perception of danger. Low arousal reduces drivers' attentional ability. However, positive valence mediates the effect of the arousal by conveying more awareness of hazards and improving drivers' ability to search the surrounding environment. The type of cognitive load has a similar effect on driving safety, showing the best safety results when no load is applied. NDRL lowers drivers' perception of danger and attentional shifts and driving related load lowers attentional shift as well. The reasons of attentional improvement in the sad mood when NDRL is applied are not clear. It could be that NDRL switches drivers' attention away from internal state and makes them more aware about external environment. However, this is the question for further research.

REFERENCES

- Brookhuis, K., Waard, D. d., & Mulder, B. (1994). Measuring driving performance by car-following in traffic. *Ergonomics*, 37(3), 427-434.
- Crundall, D., Chapman, P., Phelps, N., & Underwood, G. (2003). Eye movements and hazard perception in police pursuit and emergency response driving. *Journal of Experimental Psychology: Applied*, 9(3), 163.
- Department for Transport. (2015). Reported Road Causalities Great Britain: 2015, Annual Report, Moving Britain Ahead. Retrieved from <https://www.gov.uk/government>
- Evans, L. (1991). *Traffic safety and the driver*: Science Serving Society.
- Green, M. (2000). "How long does it take to stop?" Methodological analysis of driver perception-brake times. *Transportation human factors*, 2(3), 195-216.
- Lee, Y.-C., Lee, J. D., & Ng Boyle, L. (2007). Visual attention in driving: The effects of cognitive load and visual disruption. *Human Factors*, 49(4), 721-733.
- Pasanen, E., & Salmivaara, H. (1993). Driving speeds and pedestrian safety in the City of Helsinki. *Traffic Engineering and Control*, 34(6), 308-310.
- Piao, J., & McDonald, M. (2003). *Low speed car following behaviour from floating vehicle data*. Paper presented at the Intelligent Vehicles Symposium, 2003. Proceedings. IEEE.
- Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: a single-item scale of pleasure and arousal. *Journal of personality and social psychology*, 57(3), 493.
- Tasca, L. (2000). *A review of the literature on aggressive driving research*: Ontario Advisory Group on Safe Driving Secretariat, Road User Safety Branch, Ontario Ministry of Transportation Ontario, Canada.
- Underwood, G., Chapman, P., Berger, Z., & Crundall, D. (2003). Driving experience, attentional focusing, and the recall of recently inspected events. *Transportation Research Part F: Traffic Psychology and Behaviour*, 6(4), 289-304. doi:10.1016/j.trf.2003.09.002
- Västfjäll, D. (2002). Emotion induction through music: A review of the musical mood induction procedure. *Musicae Scientiae*, 5(1 suppl), 173-211.
- Velichkovsky, B. M., Rothert, A., Miniotas, D., Dornhofer, S. M., Joos, M., & Pannasch, S. (2003). Visual fixations as a rapid indicator of hazard perception. *NATO SCIENCE SERIES SUB SERIES I LIFE AND BEHAVIOURAL SCIENCES*, 355, 313-322.
- Vogel, K. (2002). What characterizes a "free vehicle" in an urban area? *Transportation research part F: traffic psychology and behaviour*, 5(1), 15-29.

Vogel, K. (2003). A comparison of headway and time to collision as safety indicators. *Accident Analysis & Prevention*, 35(3), 427-433.

Ward, N. J., Manser, M. P., de Waard, D., Kuge, N., & Boer, E. (2003). *Quantifying Car following Performance as a Metric for Primary and Secondary (Distraction) Task Load: Part A— Modification of Task Parameters*. Paper presented at the Proceedings of the Human Factors and Ergonomics Society Annual Meeting.

Wasielewski, P. (1979). Car-following headways on freeways interpreted by the semi-Poisson headway distribution model. *Transportation Science*, 13(1), 36-55.

Zimasa, T., Jamson, S., & Henson, B. (2017). Are happy drivers safer drivers? Evidence from hazard response times and eye tracking data. *Transportation research part F: traffic psychology and behaviour*, 46, 14-23.

COMPARISON OF RESPONDENT IMAGES BETWEEN PICTURE AND TEXT USED SURVEYS IMPLICATIONS FOR NEW RESEARCH METHODS USING PICTURES

Katsue EDO^{*a}, Hiroharu OCHIHARA^b, Fusae KUKIHARA^c, and U HIROI^d,

^a Prefectural University of Hiroshima, Japan, edo@pu-hiroshima.ac.jp

^b Oriental Land Corporation, Japan, hiroharu1981@gmail.com

^c Survey Research Center, Japan, kuki_f@surece.co.jp

^d The University of Tokyo, Japan, hiroi@city.t.u-tokyo.ac.jp

ABSTRACT

Smartphones and iPhones, Instagram, and Twitter have drastically changed the environment of pictures and photographs. Since the beginning of 21st century, the use of pictures and photographs in research and surveys has been increasing in marketing and social sciences. However, we lack discussion about 'when', 'where', and 'how' to use pictures in surveys. Some studies reveal 'when' and 'where' to use pictures and its usefulness in surveys, however much more discussion of 'how' to use pictures is an urgent issue for this new research method. In this study, we focus on experience and the memory biases that may influence in surveys to give implication to 'how' pictures should be used. Comparison of images formed by pictures with images by texts was investigated using an internet survey research (total of 1600 respondents). F-tests of standard deviation of 20 image words to the pictures (e.g. Energetic, lively, intellectual) between the two groups (visitors and non-visitors) were conducted to confirm the influence of experience. From the results of the F-tests, we found out that in some cases the variance difference of images formed by picture and by texts are significant in a few cases. This leaves us with a possibility that there might be an influence of experience on images by picture, where further discussion and research should be made as soon as possible.

Keywords: *Picture-used surveys, Experience effect, Standard Deviation*

* Katsue EDO email: edo@pu-hiroshima.ac.jp

1. INTRODUCTION

The attention of using pictures (including photographs) in research and surveys has been increasing in social studies since the beginning of the 21st century. The reasons analyzed in the recent literature refer to the environmental changes in pictures (Edo et.al. 2013). Technological changes, such as low price digital cameras and iPhones, high information transmission speed, low costs for information transferring and high performance and resolution of the cameras of mobile phones have changed the photographing behavior of people. Consequently, social changes, for example, less resistance in taking and processing photographs have affected the using of pictures in research in most of the developing countries. People take pictures anywhere and anytime, upload them to the social media when they want to, like Instagram or Twitter. Behavior of taking and showing pictures has completely changed.

Due to these environmental changes, especially in the field of research using surveys, using pictures in questionnaires have become common in the recent years. However, there has not been enough discussion for how to use pictures in surveys in the past literature. Edo et.al. (2013) has pointed that it is an urgent issue to understand the characteristics of pictures in surveys, or otherwise it might be used improperly, because of the meaning encoded and decoded are different from respondents to respondents.

In this study, the objective is to identify the factors that influence pictures in surveys and give implication to the future of new research methods using pictures.

2. REVIEWS OF PICTURE-USED SURVEYS

There are two types of picture-used surveys. The first type of picture-used surveys is the ones that present pictures within the surveys. They are often used to assist the image of what to ask in the questionnaire. This type of picture-used surveys has been often used from the 1960s when advertisement effects had to be measured. They are also used in product design evaluation when verbal questions could not be sufficient for presenting and expressing the idea and concepts.

The second type of picture-used surveys is the ones that we do not present but receive as responses and answers from the respondents. In this type of picture-used surveys, we ask the respondents to draw, find, take, or select pictures for the answers to the given questions in the survey (Zaltman 2003). This second type of picture-used surveys started to be used in the late 1980s when diversification of lifestyles aroused (Kiriyaama 1992, Kuwahara 1999). This method was developed from visual psychology and anthropology (Kuwahara 1999). Kiriyaama (1992) used this method in a new product development for a Japanese New Years' dish, and pointed out the advantages and disadvantages of picture-used surveys. Kuwahara (1999) used pictures in his studies to understand post-modern consumer behavior. He proposed a method called

‘Stereo Photo Essay Method’. In this method, respondents take pictures and let them interpret the pictures to understand the respondents’ unconscious mind and the depth psychology.

During the past decade, after iPhones and smart phones diffused in daily life, using this second type of surveys became popular. The main reason was that the convenience of the picture-used surveys increased, but at the same time, many researchers and marketers realized that only quantitative marketing research was not enough to understand the consumer’s insights. In the mid-2000s, picture-used surveys started to be popular in marketing surveys in practical marketing in the qualitative research (Snyder 2012, JMRA 2006).

Academic studies to conceptualize the picture-used surveys could be seen from the beginning of the 2010s (Pauwels 2011, O’Toole 2013). In these studies, this method of collecting pictures from respondents is often called as ‘participant-generated photography’ or ‘respondent-generated visual imagery’, which focuses on the collection of pictured data and its analysis. Ochiara and Edo (2013) demonstrated methods to analyze the collected pictures, which they called ‘Picture Mining’ because it resembles the Data Mining and Text Mining methods. Ochiara and Edo (2013) defined Picture Mining as ‘an explorative research analysis method that takes useful information from pictures, photographs, and static or moving images’. The Picture Mining concept includes observational research in the broad sense, because it also aims to analyze moving images (Ochiara and Edo 2013). However, there are few conceptual studies that support its significance of these picture-used methods.

3. PAST EXPERIENCE EFFECTS ON IMAGE FORMED BY PICTURES

The contemporary issues underlying in the field of picture-used research are common to both types. They are ‘when’, ‘where’, and ‘how’ to use pictures in surveys. No theories nor conceptualized knowledge give us clear answers to these questions.

Edo et.al. (2014) has identified ‘when’ and ‘where’ the most efficient fields are for picture-used surveys. They say that picture-used surveys are useful in 1) Research in Consumer and Customer Lifestyles, 2) New Product Development and 3) Research in Fashion and Design.

The main objective of this study is to give implication to ‘how’ to use pictures in surveys. We will focus on the influence past experience, a factor that could affect the images of the objects and ideas asked in surveys.

Experiences in the past form memories, and these will be biases when answering surveys. One reason for this bias is memory biases. Memory biases are mainly studied in psychology and consumer behavior field. Tulving (1972) has discussed episodic and semantic memory and its processes. We think that because pictures are easier to understand than texts, they are likely to recall various memories. The various memories will influence the images of the respondents to

be various. In this study, we will examine if the past experience will influence the image formed by the shown pictures are different with image by texts.

4. METHODOLOGY

In this research, the field of tourism and sightseeing was selected. Tourism and sightseeing is one of the areas that people express their experiences using pictures. Experience of sightseeing is episodic, which makes it even more difficult to express. This is one of the reasons why so many people upload their pictures of sightseeing on the social media.



Picture 1: Pictures used in the survey (left Hiroshima, right Kyoto)

Itsukushima Shrine	Kiyomizu Temple
1)A shrine in Miyajima, Hiroshima Prefecture. The head shrine of 500 2)It is one of the UNESCO world heritige site 'Itsukushima Shrine'. 3)Famous for the red torii gate which looks like floating on the water which many tourists visit.	1)A historical Hosō sect Buddhism temple built before the Heian period. 2)It is one of the UNESCO world heritige site 'Historic Monuments of 3)Famous for the 'stage of Kiyomizu Temple', which many excursion student visit.

Table 1. Text explanations used in the survey (left Hiroshima, right Kyoto).

A quantitative survey research was conducted on the internet in March 2017. Total of 1600 respondents (male 800, female 800) living in the Tokyo and suburbs were collected. Their age range is from 20 to 49 years old (800 were 20 to 34 yrs. old, and 800 were 35-49 yrs. old). In this study, pictures of Kyoto (Kiyomizudera temple) and Hiroshima (Itsukushima shrine) were selected for image evaluation (Picture 1). Kyoto and Hiroshima were selected because of the respondents visiting behaviors. Although both sightseeing spots are world heritages, Kyoto is

visited by most of the Japanese people. On the other hand, Hiroshima is not so much a popular place compared to Kyoto. To verify our hypothesis of experience effects, it was necessary to select a place like Hiroshima, where we could collect enough respondents who have not visited that place. Pictures were chosen from a pre-test prior to the research.

The respondents were divided into two groups. The first group was shown a picture of Kiyomizudera temple and then they were asked 20 image questions (see Table 3) in a 5-point scale. After that, they read an explanation of Itsukushima Shrine (Table 2) using texts (Group A). After that, the same 20 image questions were asked again. The second group was shown a picture of Itsukushima Shrine. After this, they read the explanation of Kiyomizudera temple (Table 2), just the opposite contents of the first group (Group B). All groups answered their experience, lifestyles, involvement towards sightseeing.

5. RESULTS

Past experience of the sightseeing spots (Hiroshima and Kyoto) in each group are shown in Table 2. The experience of visiting Hiroshima was 41.94% in total (single and multiple experiences). Kyoto was 73.80%. There is a large difference in experience between the two sightseeing spots.

Table 2: Past visiting of sightseeing spots of respondents (MA)

		Group A (n=800)	Group B (n=800)	Total (n=1600)	Total (%)
Hiroshima	Living Experience	44	35	79	4.94%
	Single Visiting Experience	274	292	566	35.38%
	Multiple Visiting Experience	53	52	105	6.56%
	Visiting Intention	399	380	779	38.95%
	NA	235	227	462	23.10%
Kyoto	Living Experience	41	38	79	3.95%
	Single Visiting Experience	570	573	1143	57.15%
	Multiple Visiting Experience	165	168	333	16.65%
	Visiting Intention	266	289	555	27.75%
	NA	137	127	264	13.20%

To verify the experience effect on image using pictures, standard deviation was used to see if there is variance between the two groups. We have determined that standard deviation as one of the measurements of diversity and variance for an image that a picture or texts make. Low standard deviation indicates low diversity and variance, which means that experience did not influence the image of the object to the respondents.

To examine the experience effect on pictures, we compared the standard deviation of image by picture with the image by text. F-test was used to verify the difference of standard deviation of image by picture and by text among visitors and non-visitors. Most of the image questions were not significant for both Kyoto and Hiroshima non-visitors. We can say that if there is no experience, the image formed by pictures and text does not differ much.

However, there were some significant measures for Hiroshima visitors (Table 3). There were 9 image questions that were significant. Although the images by picture and by text were mostly similar among the Kyoto visitors, the significant measures of Hiroshima will lead us to further discussion and research that experience might influence the image formed by pictures.

Table 3: F-test of Image by picture and by text (Hiroshima visitors)

		Group A (n= 327)		Group B (n= 344)		Difference		F-Test
		Image by Picture		Image by Text				
		Average	SD	Average	SD	Average	SD	p-value
1	Active	2.96	1.02	2.67	1.18	0.29	-0.17	0.13
2	Vigorous	2.76	0.98	2.63	1.14	0.13	-0.16	0.14
3	Energetic	3.26	1.00	3.04	1.24	0.22	-0.24	0.03 *
4	Lively	3.22	0.97	3.04	1.20	0.18	-0.24	0.03 *
5	Merry	3.14	0.95	3.00	1.37	0.14	-0.42	0.00 **
6	Adorable	3.09	1.03	3.10	1.26	0.00	-0.22	0.05 *
7	Beloved	3.17	1.11	3.21	1.29	-0.04	-0.18	0.13
8	Favorite	2.21	0.95	2.12	1.02	0.09	-0.07	0.44
9	Pretty	3.20	1.03	3.13	1.33	0.06	-0.30	0.01 **
10	Awesome	1.92	0.85	2.25	1.17	-0.33	-0.32	0.00 **
11	Amazed	3.37	1.05	3.17	1.26	0.20	-0.21	0.07 *
12	Surprised	3.32	1.07	3.00	1.31	0.32	-0.24	0.04 *
13	Astonished	3.61	1.04	3.35	1.22	0.26	-0.18	0.12
14	Agitated	3.68	1.08	3.35	1.25	0.33	-0.17	0.15
15	Startled	3.06	1.09	3.00	1.25	0.06	-0.17	0.16
16	Extraordinary	2.14	0.92	2.31	1.13	-0.17	-0.21	0.04 *
17	Intellectual	2.57	1.02	2.33	1.10	0.24	-0.08	0.47
18	International	2.57	1.02	2.35	1.14	0.22	-0.12	0.28
19	Enjoyable	2.83	1.05	2.60	1.11	0.23	-0.06	0.58
20	Precious	1.96	0.89	1.88	0.94	0.08	-0.05	0.58

*p<0. 05 **p<0. 01

6. CONCLUSION AND FOR DISCUSSION

In this research, we have discussed how we should use pictures in surveys. Images formed by pictures are not so different compared to images formed by text in most cases. Thus, we can

say that it is possible for us to use both picture and text in a similar way to measure images of an object. Advantages using pictures in surveys, such as easier decision-making, memory recalling, will decrease the burden of respondent responses, and these will generate the using of pictures in surveys.

Even if the advantages of using pictures were confirmed in this way, still we have to consider the experience of the respondents. As the results of Hiroshima visitors suggest, images by pictures tend to be different with the images by the text. We need further discussion of the antecedents of this circumstance, but we have to take in the characteristics that pictures are polysemantic rather than unambiguous. As a result, existence of experience might lead to the reinforcement of recalling different episodes inside the memory, which might conclude to a different image.

Pictures in surveys will definitely increase in the future. Although we need further research and studies of how to use pictures in surveys, and the implication to this crucial issue was shown in our research.

ACKNOWLEDGMENTS

This work was supported by JSPS KAKENHI Grant Number JP26380575.

REFERENCES

Edo K., H. Kitakata and T.Yamazaki (2013), 'Consideration of the concepts of Coolness: The women's evaluation of Cool Biz styles as men's fashion', *Fashion Business*, 18, pp.21-31

Edo K. H. Kitakata and A. Yamai (2014), 'The Social and Economic Impacts of 'Cool Biz' and 'Super Cool Biz' fashion in Japan', 2014 IFFTI Conference papers, *International Federation of Fashion Technological Institutes*, under publishing

Kiriyama, N. (1992), 'Fashion Research for Japanese New Years' dish', in H.Asano eds, *The Frontier of Marketing Research*, pp. 79-95, Doubunkan

Kuwahara, T. (1999) *Understanding of The Consumer Mind by post-modern method*, Nihon Keizai Shimbunsha

JMRA (2006), 'The Frontier of Surveys without words: Why non-verbal surveys?', *Marketing Researcher*, 101, pp.32-42, Japan Marketing Research Association

Ochihara H. and K. Edo (2013), Basic studies for conceptualizing Picture Mining: Classification of Picture researches and issues for new research methods', *JMRA Annual Conference Proceedings*, pp.23-32

O'Toole P., 'Capturing Undergraduate Experience through Participant-Generated Video', *The Qualitative Report* 2013, 18, Article 66, pp.1-14

Nelson, D.L.; Reed, U.S.; Walling, J.R. (1976). "Pictorial superiority effect". *Journal of Experimental Psychology: Human Learning & Memory*, 2: 523–528.

Pauwels, L. (2011), 'An integrated conceptual framework for visual social research' in E. Margolis & L. Pauwels eds., *The Sage handbook of visual research methods*, pp. 3-23, Los Angeles, CA: Sage.

Snyder, C. (2012), 'A Case Study of a Case Study: Analysis of a Robust Qualitative Research Methodology', *The Qualitative Report*, 17, pp1-21

Shaughnessy, J. J., Zechmeister, E. B., & Zechmeister, J. S. (2006). *Research methods in psychology*. New York: McGraw-Hill.

Tulving, E. (1972). 'Episodic and semantic memory' in E. Tulving and W. Donaldson eds., *Organization of Memory*, pp. 381–402, New York: Academic Press.

Zaltman, G. (2003), *How Customers Think*, Harvard Business School Press

THE COMPILATION OF EMOTIONAL EVALUATION PARAMETERS FOR TAIWAN PLUMING, FURNITURE AND MACHINE TOOLS INDUSTRY

ERIC CHEN-F HSIEH ^a, MIN-YUAN MA ^b, MAGGIE YEI-MEI SHEU ^c, and YU-CHUN HUANG ^d

^a National Cheng Kung University, Taiwan, chenfhsieh@gmail.com

^b National Cheng Kung University, Taiwan, mamy@mail.ncku.edu.tw

^c Industrial Technology Research Institute, Taiwan, sheu.maggie@gmail.com

^d Industrial Technology Research Institute, Taiwan, itriA40508@itri.org.tw

ABSTRACT

In the recent years, many Taiwan's companies attempt to make the transition from OEM to ODM manufacturing. Responding to the need of industry to evaluate or measure design execution in product development, this research develops evaluation parameters to perceive design and give efficient and effective product feedback. This research is based on the 70 design indexes from Human design technology (Yamaoka, 2012), and aims to develop a design evaluation index to measure design quality and discover the challenges from Kansei perspectives for industries in Taiwan. Therefore, focus group and KJ method were used to reanalyze then simplify the 70 design items into 50 parameters. With the parameters been gradually established, seven facets were extracted as the "Seven Emotional (kansei) Elements", included happiness, heart-warming, relaxing, convenience, stability and reliability, safeness and environment-friendly. The Kansei evaluation parameters were tested in Taiwan industry for verification. Finally, each parameter was designed into a card, and the validation has discussed for modification.

Keywords: Kansei Engineering, Emotion, Evaluation Parameters, Design, Product Development

1. MOTIVATION

This research was initiated with a grand vision to facilitate Taiwan's economic growth through the implementation of design methodologies. Historically Taiwan's economic growth came from OEM manufacturing. In the recent years, many companies attempt to make the transition from OEM to ODM. This research responds to the need of industry to evaluate or measure design

execution in product development. Emotional (Kansei) evaluation parameter assesses products based on emotional perspective to perceive design and give efficient and effective product feedback in product development.

Existing methodologies, such as Kansei methodologies, revolved around market survey, analysis and categorization. Often times are too theoretical, too complex, or too abstract, and rarely focuses on a technique to evaluate design. This research is based on Human design technology 70 design indexes (Yamaoka, 2012) to develop the product evaluation parameters for Taiwanese industries.

2. PURPOSE

The goal of this research is to develop a design evaluation index to measure the design quality and discover the challenges from emotional (Kansei) perspectives for the industries in Taiwan. There are three phases in the research: (1) Aggregation of emotional design parameters; (2) Design of emotional evaluation parameter; (3) Industry test and validation.

3. LITERATURE REVIEW

Kansei Engineering has been developed to deal with customers' subjective feeling or emotions of a product (Nagamachi, 1996) Yet Kansei terms are normally abstract, fuzzy, or conceptual terms, leaving space for vague assumptions and implicit inference. (Jiao, 2006)

Enforced hierarchical structure(Saaty,1980) or AND/Or tree structure for the articulation of customer needs, for example the requirement taxonomy (Hauge & Stauffer, 1993), the customer attribute hierarchy, (Yan, et al., 2001) and the functional requirement topology (Jiao & Tseng, 1998). Some methods strengthen hierarchical structure to better convey users' needs, for example Hauge & Stauffer (1993) requirements taxonomy structured in AND/Or tree or Tseng & Jiao (1998) functional requirement topology. Some methods customer needs with semantics. Sedgwick et al (2003) uses semantic differential techniques for packaging surface characteristics, similarly Kawakita Jiro (KJ) method (Kawakita, 1991) and multi-pickup method (MPM) also analyzes from the semantic level.

Many methods focus on analysis, understanding and projection of customer needs. Ofuji's method, assists in finding customer needs, it is difficult to translate these needs into design requirements. Information customers, marketing employee, and design engineers do not have a common language. (Jiao et al. 2006)

This research attempts to bring both semantic and hierarchical structure into variables understandable by all parties, including customers, marketing, design, and engineers for a company's product development process.

4. APPROACH/METHODOLOGY

This research begun with T. Yamaoka's "Human design technology and construction principles" derived 70 design items which evokes Kansei reaction. Two methods; focus group method and KJ methodology were used to reanalyze then simplify the 70 design items into 50 parameters fit for Taiwanese industries. A list of parameters has little value when applied into industry design, this project took the abstract parameters to create tangible design evaluation card set. These cards are validated with local industries for practical feedback. The validation process is recorded. The emotional evaluation parameters are optimized according to feedback and observations. This session will elaborate on methodologies and steps used.

4.1. Aggregation of emotional design indexes

The assembly of emotional evaluation parameters consists of two steps: deconstruction and reorganization of design parameters (section 4.1.1), and deriving the emotional elements (section 4.1.2).

4.1.1. Deconstruct and reconstruction of parameters

During the construction of emotional evaluation parameters, a total of three focus groups studies were conducted for validation and modification. Each focus group session includes 9 design master graduates, familiar with product design process and with design related background. As the target end user for the emotional evaluation tool are for Taiwanese industries, thus the main language used was Mandarin Chinese, terminologies were adjusted into habitual vocabulary. Below depicts two of the focus group sessions.

With the intention to increase productivity during analysis of design parameters, the research begun with providing participants human design technology's 70 design items original terminology and Chinese translation, as a reference for discussion. Additionally, the Kawakita Jiro (KJ) method (i.e. affinity diagram) was applied. All participants focused on discussing one item at a time. This increased focus and assisted documentation of results, preventing participants affected by fatigue. This research contained three round of focus group discussion, each consisting with two hours of categorization.

As a result, 50 "emotional evaluation parameters" were compiled through the use of three focus group method, from 70 human design technology design items. The documentation of three focus group meetings is shown on Table 1.

Table 1: Emotional evaluation parameters and definitions

No.	Emotional Evaluation Parameters	Definition of Emotional Evaluation Parameters
1	Aesthetics	Simplicity or harmony of form allowing one to appreciate it's beauty
2	Good texture	Consists of quality material allowing the user to enjoy the product
3	Fitting color	colors used fits its design image or scenario
4	Simple graphic display	The operator panel layout is fit its position and proportions

5	Clear precise style	clearly communicates product style and image
6	Easy to operate	Great experience is created when being used
7	Fits scenario	fits in the environment and cohesive to the scenario
8	Innovative combination	a new or Innovative combination giving users a fresh experience
9	Excellent function	has good functions allowing user satisfaction beyond expectations
10	Builds satisfaction	Through progressively building towards a goal, users accumulate the feeling of satisfaction
11	Customizable setting	user can adjust the structure and order of the product
12	Power of choice	allows users to proceed based on their own choices
13	Substitution	When parts do not function correctly, there are still means to achieve the desired actions
14	Assistance	provides users with effective problem solving support
15	Kind reminders	Provides additional and unexpected feedback allowing users to feel touched.
16	Considers user background	Puts in consideration the cultural fit
17	Guidance	Simplicity or harmony of form allowing one to appreciate it's beauty
18	Operation instructions	Provides clear instruction for novice users to easily follow operation procedures
19	Strengthening of main points	Communicating through highlighting information in a way users can accept
20	Smooth process flow	Providing a smooth flowing operation
21	Reduce physical burden	Minimize burden or work the user physically requires
22	Ergonomics	Fits human ergonomic design
23	Intuitive	Provides users an operation experience which can be understood upon seeing it the first time
24	Consistency in operation methods	The logic behind operation is consistent
25	Effective operation	Minimize the number of steps required to improve efficiency
26	Easy to retrieve information	Allowing users easily access to specific information
27	Understandable	Provides visual aid or icons to understand signal or message conveyed, allowing users judge and correctly react upon information
28	Readability	Allowing users to easily read information provided
29	Providing necessary information	Provides user enough important information to correctly judge systems state
30	Overview	Provides a complete overview of message and signals
31	Easily maintain or repair	Can be efficiently repaired or provides replaceable parts
32	Common parts	Specification of components are commonly used
33	Selection of material	According to user scenario, applying fit material on products ensure stability during use
34	Strengthen external form	Strengthen regional parts to product against external forces
35	Strengthening of internal	Strengthening of internal structure to insure product's stability

	structure	
36	Dispersion of impact	When receiving pressure from outside, product has the ability to separate impact equally
37	Durability /Length of life cycle	Ability to lengthen product lifespan
38	Form-fitting design	The use of form to insure correct usage
39	Tolerance to mistakes	The system allows common and expectable mistakes to occur
40	Prevention of misuse	Ability to prevent users from incorrectly forms of contact or use.
41	Automatic protection	The application of physical principles to provide a self-protection mechanism and insure safety
42	Chained protection	Forces user to follow correct operation methods to proceed for correct use
43	Elimination of danger	The elimination of dangerous parts
44	Isolation of danger	A protective mechanism to product users from danger through separation
45	Warning sign	Display of warning signal, informing users of the system or products dangerous aspects
46	Recycle to reuse	Ability to recycle and reuse
47	Minimal material	The use of minimal manufacturing material to achieve the same results
48	Harmless material	The selection of material with minimal impact on environment or human body
49	Regional replacement	The ability to replace specific parts
50	Shortening manufacturing process	Affectively shortening production time while increasing product rates

4.1.2. Relative emotional facets

In the step, the new categorizations were discussed through applying KJ method (reference to Figure 1) with reference to the 8 original facets (山岡俊樹, 2003) (see table 2), seven new facets were extracted to create the “Seven Emotional Elements”; “Happiness”, “heart-warming”, “Relaxing”, “Convenient”, “Stability and reliable”, “Safeness”, “environmentally-friendly”. Each aspect is relative to more than one emotional evaluation parameter.



Figure 1: Extracting emotional facets by applying KJ method

Table 2: 8 original facets (山岡俊樹, 2003)

No.	8 original facets (山岡俊樹, 2003)	
1	ユーザインタフェースデザイン関係 (29 項目)	User Interface Design
2	ユニバーサルデザイン設計項目(9 項目)	Universal Design
3	感性デザイン項目(9 項目)	Kansei Design
4	安全性(PL)項目(6 項目)	Safety-related Design (PL)
5	ロバストデザイン項目(5 項目)	Eco-Friendly and Sustainable Design
6	メンテナンス(保守性)項目(2 項目)	Robust design
7	エコロジーデザイン項目(5 項目)	Maintenance
8	その他 (HMI の 5 側面他) (5 項目)	Others (Human Machine Interface)

4.2. Emotional evaluation card

The emotional evaluation parameters were tested in Taiwan industry to verify if the content for each parameter are communicated effectively, whether the parameters are unclearly defined parameter, repetitive or unevaluable. During this phase, each parameter was made into a card. Design examples were found to explain each parameter.

To further assist industry easy in use and understanding of each parameter, specific procedure was designed for the parameters and named the emotional evaluation toolkit. To increase user involvement and make the evaluation procedure more interesting, each card includes: (A) a parameter number; (B) parameter name; (C) parameter definition; (D) visual example; and (E) description of example; on the back of the card includes (F) emotional facet(s) of each design parameter. The example can be seen in Figure 2.



Figure 2: Example of one emotional evaluation card

4.3. Industry validation

The validation of emotional evaluation parameters was conducted by inviting company from the plumbing industry, furniture industry and machines tool industry to participate. The following

pictures in Figure 3 shows the scenario where an engineer from the machine tool industry is guided through the series of validation procedures.



Figure 3: Validation of emotional evaluation tool with Machine tool industry

A total of five companies participated in the validation. Each session was conducted using the same cards and designed procedures to evaluate the company's product. While the researching facilitator guides the company in evaluation of the company product using emotional evaluation cards, another researcher records the interaction and understanding for each parameter. Recorded content includes; understanding of participant, hesitation, readability, repetitive explanation, and modification of each parameter. Feedback and modifications made are recorded in section 5, results and conclusion.

5. RESULTS AND CONCLUSION

In continuation to the last section where the research process is described, the emotional evaluation cards as a tool is described in section 5.1, the actual feedback and modification are described in section 5.2.

5.1. Emotional evaluation module

Using T. Yamaoka's 70 design items "Human design technology and construction principles" as a basis to develop the 50 emotional evaluation parameters, KJ Method was applied to derive the 7 main emotional elements, together creates the emotional evaluation module.

Emotional evaluation tool is the collection of the emotional evaluation parameters, where each parameter corresponds to one or more emotional element. Using card number 11 as "Customizable setting" as an example: Its definition is "user can adjust the structure and order of the product", reflecting the user's control and personalize on the content, corresponds to both elements "heart-warming" and "convenient". The diagram below shows the correlation between parameter and elements.

Table 2: Correlation between evaluation parameters and emotional elements

Emotional Elements	Emotional Evaluation Parameters (Number)
Happiness	Aesthetics ⁽¹⁾ , Good texture ⁽²⁾ , Fitting color ⁽³⁾ , Simple graphic display ⁽⁴⁾ , Clear precise style ⁽⁵⁾ , Easy to operate ⁽⁶⁾ , Fits scenario ⁽⁷⁾ , Innovative combination ⁽⁸⁾ , Excellent function ⁽⁹⁾ , Builds satisfaction ⁽¹⁰⁾
Heart-warming	Good function ⁽⁹⁾ , Customizable setting ⁽¹¹⁾ , Power of choice of the user ⁽¹²⁾ , Substitution ⁽¹³⁾ , Assistance ⁽¹⁴⁾ , Kind reminders ⁽¹⁵⁾ , Considers user background ⁽¹⁶⁾ , Guidance ⁽¹⁷⁾ , Operation instructions ⁽¹⁸⁾ , Strengthening of main points ⁽¹⁹⁾ , Automatic protection ⁽⁴¹⁾
Relaxing	Guidance ⁽¹⁷⁾ , Operation instructions ⁽¹⁸⁾ , Strengthening of main points ⁽¹⁹⁾ , Smooth process flow ⁽²⁰⁾ , Reduce physical burden ⁽²¹⁾ , Ergonomics ⁽²²⁾ , Intuitive ⁽²³⁾ , Consistency in operation methods ⁽²⁴⁾ , Effective operation ⁽²⁵⁾ , Easy to retrieve information ⁽²⁶⁾ , Understandable ⁽²⁷⁾ , Readability ⁽²⁸⁾ , Providing necessary information ⁽²⁹⁾
Convenience	Customizable setting ⁽¹¹⁾ , Smooth process flow ⁽²⁰⁾ , Easy to retrieve information ⁽²⁶⁾ , Providing necessary information ⁽²⁹⁾ , Overview ⁽³⁰⁾ , Easily maintain or repair ⁽³¹⁾ , Common parts ⁽³²⁾ , Regional replacement ⁽⁴⁹⁾
Stability and Reliability	Substitution ⁽¹³⁾ , Selection of material ⁽³³⁾ , Strengthen external form ⁽³⁴⁾ , Strengthening of internal structure ⁽³⁵⁾ , Dispersion of impact ⁽³⁶⁾ , Durability (Length of life cycle) ⁽³⁷⁾ , Form-fitting design ⁽³⁸⁾ , Tolerance to mistakes ⁽³⁹⁾
Safeness	Selection of material ⁽³³⁾ , Strengthen external form ⁽³⁴⁾ , Strengthening of internal structure ⁽³⁵⁾ , Dispersion of impact ⁽³⁶⁾ , Tolerance to mistakes ⁽³⁹⁾ , Prevention of misuse ⁽⁴⁰⁾ , Automatic protection ⁽⁴¹⁾ , Chained protection ⁽⁴²⁾ , Elimination of danger ⁽⁴³⁾ , Isolation of danger ⁽⁴⁴⁾ , Warning sign ⁽⁴⁵⁾ , Harmless material ⁽⁴⁸⁾
Environment-friendly	Length of life cycle ⁽³⁷⁾ , Recycle to reuse ⁽⁴⁶⁾ , Minimal material ⁽⁴⁷⁾ , Harmless material ⁽⁴⁸⁾ , Regional replacement ⁽⁴⁹⁾ , Shortening manufacturing process ⁽⁵⁰⁾

5.2. Validation and modification

After validating parameters with Taiwanese companies in the three main industries, feedback and observation forms were analyzed. Optimization for the emotional evaluation module, the 7 emotional elements, and emotional evaluation parameters are analyzed in the following sections. The validation process was not limited to participants' role or responsibilities. The validation session includes opinions and understanding from managers, designers, engineers...etc.

5.2.1. Seven emotional elements modification suggestions

When industry representatives used the seven emotional elements, a few participants had different understanding for each definition. Thus a definition was given to the seven elements. Of the seven elements, relaxing and convenient were easily confused. Thus relaxing was modified to specifically refer to whether "information communicated" was easily received, while convenient focuses on the interaction level, if the process was conducted smoothly and efficiently. Definitions for the other seven elements are translated as below.

Table 3: Definitions of the seven elements

Emotional Elements	Definitions of Emotional Elements
Happiness	Product and product interaction allows users a feeling of happiness
Heart-warming	Product provides feedback or assistance allowing users experience to surpass expectations
Relaxing	Ease to receive information, or the product alleviates user's burden
Convenience	Product allows affective work flow during use and repair
Stable and Reliable	Structure or system of product is stable or reliable
Safeness	Product considers dangerous situations or emergency precautions
Environment-friendly	Material or manufacturing process is environmentally friendly and reduces harm

5.2.2. Emotional evaluation parameter selection and modification suggestions

Our validation results proves effective in evaluating product from various perspectives, to affectively guide, stimulate discussion, and initiate reflection. Each parameter was tested and modified to fit Taiwan industry understanding. During the process of industry validation, two cards within the emotional evaluation parameter, customizable setting (card 11) and Power of choice (card 12) were easily confused. For example, the name "users power of control was modified into "users power of choice (card 12)". As design parameter were translated into emotional evaluation parameters applicable by the industry, each parameter was given a description. After validation, parameters and were found to be unclear or confusing, and were modified respectively. Through validation, the picture was modified to highlight the doors of separation, further strengthening the definition.

6. FUTURE WORK

In continuation to the pervious section, industry validation feedback and suggestions for modification resulted in future research direction based on "evaluator (user)" and "industry differences", the two directions are evaluated below to elaborate on:

1. consideration for user

The emotional evaluation parameters itself are a qualitative measurement, it becomes difficult to separate subjective variables such as the user background, experience or values. Different industry background or different rank and roles within a corporation could easily result in different results. Secondly, the research suggests further studies for "product developer" and "user" to have separate sets of evaluation process; or to develop a method for evaluators cross analyze and manage data evaluated for the same product; create more objective process decipher data, the implications behind parameters results.

2. Differences across industry

In different industries, product development and markets vary greatly. When emotional evaluation parameters were applied, features for each industry were not put in consideration. More validation for industry products are needed to further optimize the emotional evaluation parameter module. The goals and target users for each industrial product are different, not all emotional evaluation parameters are applicable to each industry. To increase emotional evaluation parameter reliability, this research suggests further studies regarding how to adjust modify parameters when used on specific industrial products.

ACKNOWLEDGEMENT

This work was greatly done by the Kansei Labs of Industrial Design Department, NCKU. The authors would like to thank all colleagues (Prof Min-Yuan Ma, Prof. Chun-Heng Ho) and students (Yu-Wen Chen, Lu-Xiang Ru, Jia-Xuan Han, Ko-Chen, Chang, Ching-Yuan, Huang, Xiang-Ru Lu, Zhong-Zhen Lin, Viva Huang, Yo-Zhen Lu and Yi-Ling Tu) who contributed to this study. And we are grateful to ITRI as the partner and for enhancing the quality of this work.

REFERENCES / BIBLIOGRAPHY

1. Hauge, P. L., & Stauffer, L. A. (1993). ELK: A method for eliciting knowledge from customers. ASME DES ENG DIV PUBL DE., ASME, NEW YORK, NY(USA), 1993, 53, 73-81.
2. Jiao, J. R., Zhang, Y., & Helander, M. (2006). A Kansei mining system for affective design. Expert Systems with Applications, 30(4), 658-673.
3. Kawakita, J. (1991). The original KJ method. Tokyo: Kawakita Research Institute.
4. Nagamachi, M. (1996). Introduction of Kansei engineering. Japan Standard Association.
5. Jiao, J., Tseng, M. M., Duffy, V. G., & Lin, F. (1998). Product family modeling for mass customization. Computers & Industrial Engineering, 35(3), 495-498.
6. Jiao, J. R., Zhang, Y., & Helander, M. (2006). A Kansei mining system for affective design. Expert Systems with Applications, 30(4), 658-673.
7. Saaty, T. L. (1980). The analytic hierarchy process: planning. Priority Setting. Resource Allocation, MacGraw-Hill, New York International Book Company, 287.
8. Sedgwick, J., Henson, B., & Barnes, C. (2003). Designing pleasurable products and interfaces. In Proceedings of the 2003 International conference on designing pleasurable products and interfaces, Pittsburgh.
9. Yan, W., Chen, C. H., & Khoo, L. P. (2001). A radial basis function neural network multicultural factors evaluation engine for product concept development. Expert Systems, 18(5), 219-232.
10. Yamaoka, T. (2012). How to Construct Form Logically Based on Human Design Technology and Form Construction Principles. In DS 73-2 Proceedings of the 2nd International conference on Design Creativity Volume 2.
11. 山岡俊樹. (2003). ヒューマンデザインテクノロジー入門. P23-32, 海文堂.

SEGMENTATION IN KANSEI ENGINEERING STUDIES BASED ON THE EMOTIONAL RESPONSE.

Lluís MARCO-ALMAGRO^a, Xavier TORT-MARTORELL^a and Simon SCHÜTTE^b

^a *Universitat Politècnica de Catalunya | BarcelonaTech, Spain, lluis.marco@upc.edu*

^b *Linköpings Universitet, Sweden, simon.schutte@liu.se*

ABSTRACT

Socioeconomic and demographic data of participants are often collected when performing a Kansei Engineering study for stratification purposes. This paper offers an alternative stratification procedure, directly based on the emotional response that participants give to prototypes. This approach can deliver groups that are more meaningful for the Kansei Engineering study. Socioeconomic and demographic data (among other kinds of data) can then be used to characterize the obtained emotional groups.

Keywords: *hierarchical cluster analysis, customer segmentation, Kansei engineering study*

1. INTRODUCTION

Quite often in Kansei Engineering (KE) studies, demographic, and socioeconomic data (age, gender, level of studies, etc.) is recorded for each subject before starting the proper Kansei data collection. This data is valued because it can be used, in one way or another, to make groups before or after the Kansei data collection. However, nothing is done with this data in many occasions. In fact, as the target group for a KE study is clearly defined in the choice of domain phase, chances are that all subjects are very similar in demographic and socioeconomic terms. However, can we really infer from this social homogeneity that the emotions conveyed by products will be the same for all of them?

As in market research, requirements for collecting subjects for a KE study often follow guidelines such as: "women living in cities with more than one hundred thousand inhabitants, aged 25-30, from middle-upper class, that practice a non-competitive sport at least 3 hours per week". However, it would be possible to find women fitting this description with very diverse tastes related to a product.

There are, in fact, two reasons that justify the advantages of segmenting participants of a KE study based on their emotional response:

1. A conceptual reason: As we have stated, it makes more sense to use data from the Kansei Engineering study to make segmentations. The socioeconomic or demographic data usually collected for each person can then be used to try to typify the *a posteriori* groups that come from the emotional segmentation.
2. A practical reason: If the emotional segmentation is not performed and data from all participants are analysed together, chances are that properties that do have an influence in the emotional response are not detected as significant. Basically, if two different groups react on a Kansei word in an opposite way, both effects could be compensated and thus that property not seen as affecting that Kansei word.

So the idea of this paper is the following: finding groups directly based on the emotional response on products (using data from the KE study), and not on other external data. These groups can then be characterized based on socioeconomic or demographic data, if possible. The rest of the paper develops a method, based on cluster analysis, to perform this emotional segmentation.

2. A SUGGESTED METHOD FOR AN EMOTIONAL SEGMENTATION, WITH AN EXAMPLE

The method suggested for performing an emotional segmentation comprises two steps:

1. A cluster analysis is conducted for each of the Kansei words, having participants in the study as individuals for the clustering. In this way, groups of participants are created, and these groups will most probably be different for each response.
2. A new cluster analysis is conducted on the groups found in the previous step, having Kansei words (responses) as individuals for the clustering. In this way, a global set of groups of participants is achieved.

An example will be used to better illustrate the details of the suggested method.

2.1. An example to illustrate the method.

The example shown in this section and used to illustrate the suggested segmentation method is adapted from a study first appeared in the doctoral thesis of Marco-Almagro (2011). The choice of domain for this Kansei Engineering study are fruit juices, and specifically its presentation just before being drunk. Prototypes were presented with photographs on a computer screen (so only sight was considered in this study, there was no touching or tasting of the products).

The set of emotional responses of interest (semantic space) were the following: refreshing, healthy, exotic, seductive, natural, relaxing, and tasty. For the space of properties, five different properties (factors) were used, each one at two possible values (Table 1).

Table 1: Properties and levels used in the juices experiment

Property	Levels
Straw	Yes / No
Decoration	Yes / No
Ice	Yes / No
Container	Glass / goblet
Colour	Yellow / orange

The set of prototypes for the study were built following the design matrix shown in Table 2.

Table 2: Properties and levels used in the juices experiment

	Straw	Decoration	Ice	Container	Colour
1	No	No	No	Glass	Orange
2	Yes	No	No	Glass	Yellow
3	No	Yes	No	Glass	Yellow
4	Yes	Yes	No	Glass	Orange
5	No	No	Yes	Glass	Yellow
6	Yes	No	Yes	Glass	Orange
7	No	Yes	Yes	Glass	Orange
8	Yes	Yes	Yes	Glass	Yellow
9	No	No	No	Goblet	Yellow
10	Yes	No	No	Goblet	Orange
11	No	Yes	No	Goblet	Orange
12	Yes	Yes	No	Goblet	Yellow
13	No	No	Yes	Goblet	Orange
14	Yes	No	Yes	Goblet	Yellow
15	No	Yes	Yes	Goblet	Yellow
16	Yes	Yes	Yes	Goblet	Orange

Figure 1 shows the 16 fruit juices used in the KE study.



Figure 1. The 16 prototypes created for the fruit juice experiment

A total of 19 participants rated each one of the juices on a 7 scale Likert scale for each one of the Kansei words. The data collection was done at a neutral room, all participants at the same time, looking at one fruit juice after the other in a random order, until the 16 juices were rated.

2.2. A first cluster analysis Kansei word by Kansei word.

A hierarchical cluster analysis is done for each one of the Kansei words (7 in the case of our example). For each Kansei word, the objects are all the prototypes (there are n stimuli, 16 juices in our case) and the variables are the participants (there are p participants, 19 participants in our case).

In a hierarchical cluster analysis, a distance of each object to all other objects is calculated (Manly, 2005). Groups are then created usually by agglomeration: all objects start alone in groups of one. The closest groups are gradually merged until finally all objects are in a single group. A cluster analysis needs:

The definition of a distance: the most common distance is the Euclidean distance (the one you have when using a rule on a paper). In our case, we are interested not in the absolute distance between two participants, but on the distance of their rating profile. So our suggestion as distance between participants i and j is the following:

$$d(i, j) = 1 - \frac{r(i, j)}{n}$$

If both participants have exactly the same rating profile, correlation will be 1 (so distance will be 0). In the case that one profile is completely opposite to the other, correlation will be -1 and the distance will be the maximum (2).

In order to compute correlation between participants i and j , instead of using the common Pearson coefficient of correlation, the polychoric coefficient of correlation seems more appropriate. The polychoric correlation assumes there are two continuous normally distributed latent variables, but they become ordinal variables when observed (Holgado-Tello et al., 2010). This is the case with Kansei Engineering studies, where an underlying continuous variable is present (so sometimes visual analogue scales are used to measure it), but often 5, 7, or 9-point ordinal scales are used.

A linkage method. Once observations are joined in groups in a cluster analysis, a linkage method is needed to know how to calculate the distance between clusters. Although there are several linkage methods, the Ward's linkage method seems to be the most appropriate for KE data (Ward, 1963).

Figure 2 shows the dendrogram from the hierarchical cluster analysis for the Kansei word Refreshing. A reasonable criterion to decide the number of groups is cutting the dendrogram where the vertical lines are the longest – or at least quite long. As the vertical axis represent distances, long vertical lines imply that the distances between the clusters being split are high. In this case, we have decided to split the participants in two groups.

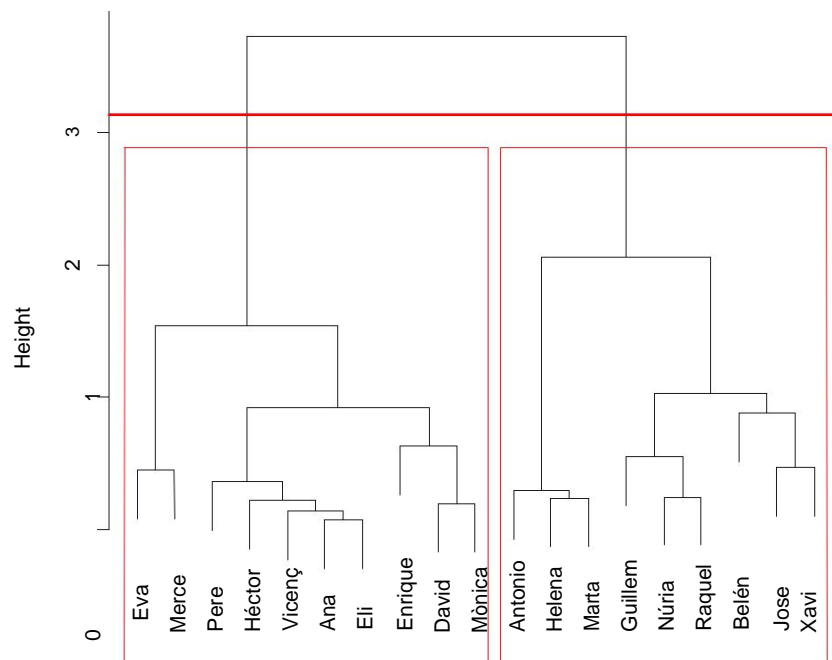


Figure 2. Dendrogram for the Kansei word Refreshing

This hierarchical cluster analysis should be performed for each one of the Kansei words in the study. Figure 3 shows the created groups for each one of the Kansei words in the study.

	Ana	Antonio	Belén	David	Eli	Enrique	Eva	Guillem	Héctor	Helena	Jose	Marta	Merce	Mònica	Núria	Pere	Raquel	Vicenç	Xavi
Refreshing	A	B	B	A	A	A	A	B	A	B	B	B	A	A	B	A	B	A	B
Healthy	A	B	B	A	A	A	B	A	A	B	A	B	A	A	B	A	A	B	A
Exotic	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	A	A
Seductive	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Relaxing	A	B	A	B	A	A	A	A	A	B	A	B	B	A	B	A	B	B	A
Natural	A	B	A	A	A	A	B	A	A	B	A	B	A	B	B	A	A	B	A
Tasty	A	B	A	A	A	A	A	B	A	A	B	B	A	A	A	A	A	A	A

Figure 3. Groups for each participant and Kansei word in the fruit juice experiment

When analysing results in the synthesis phase using, for instance, QT1, one can detect the differences between groups. Take again, for instance, Kansei word Refreshing. Figure 4 shows that having ice in the juice affects the perception of Refreshing. However, this effect is higher in group B (in blue) than in group A (in red). We can also detect that colour has an effect on this Kansei word, but in opposite ways depending on the group. Notice that the fact the effect of Colour cannot be detected when analysing all participants together, as the opposing effects will be compensated.

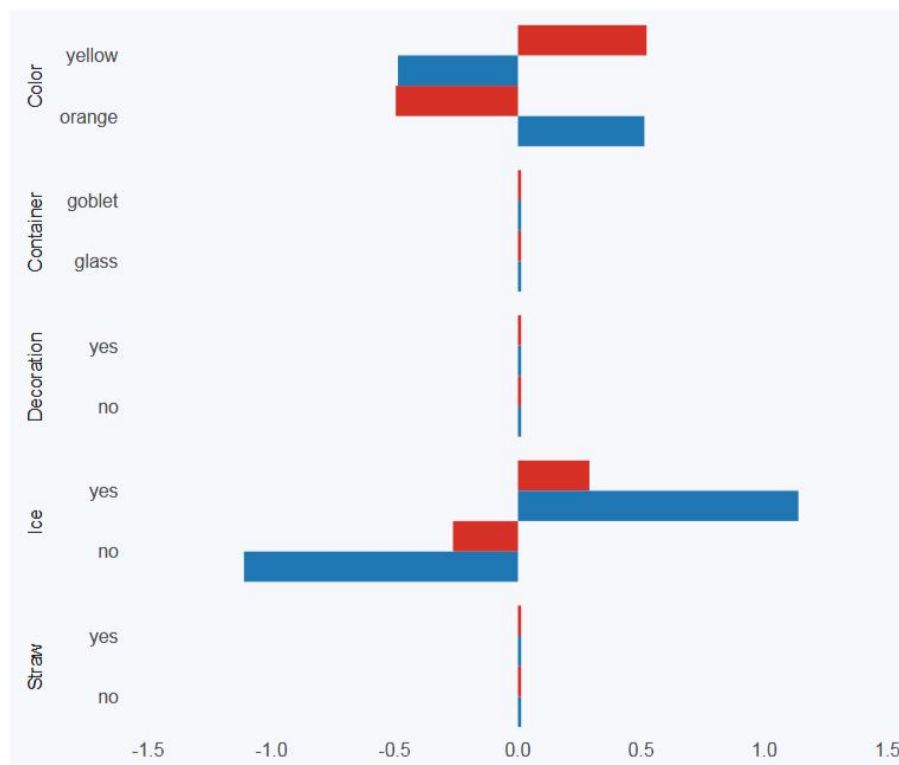


Figure 4. QT1 results for Kansei word Refreshing in the fruit juices experiment

2.3. Clustering groups of participants

After the emotional segmentation of participants done Kansei word by Kansei word, the aim now is performing a global grouping of participants, taking into account information from all Kansei words together.

The global clustering of participants will be done, again, using a hierarchic cluster analysis. Ward's linkage method will be used again. A distance must be created for the cluster analysis: it must be low if participants are close (0 if both participants fall in the same groups for all Kansei words) and high if participants are far away.

A suggested distance could be the following:

For example, $d_{(A, E)} = 0$, as columns Ana and Eli in Figure 3 are exactly the same (all A). $d_{(A, R)} = 2$, as they fall in different groups in Kansei words Refreshing and Relaxing.

Figure 5 shows the result of the hierarchical cluster analysis for all participants.

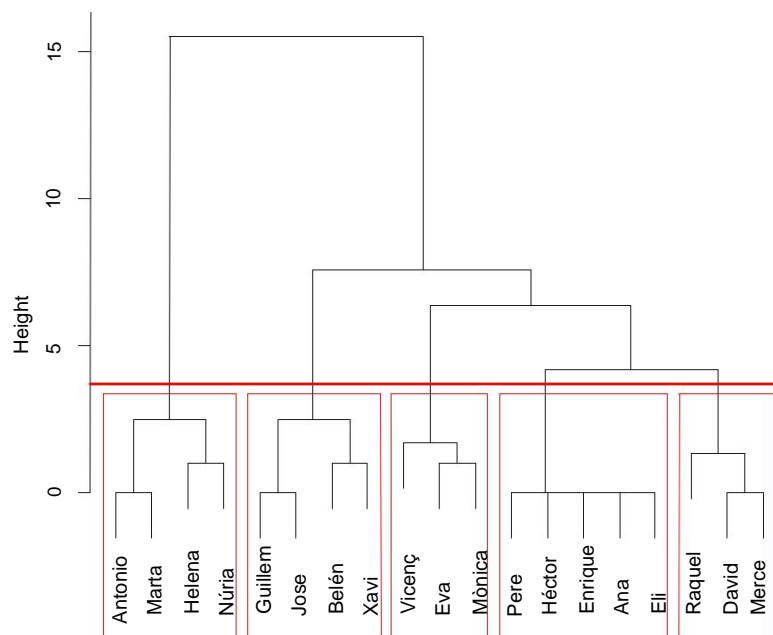


Figure 5. Dendrogram grouping subjects

In this case, 5 different groups of participants have been selected.

3. CONCLUSIONS

This paper has suggested a way to cluster participants of a Kansei Engineering study based on the emotional response that users have to the product under examination. Although socioeconomic and demographic data can be useful to stratify, the suggestion is using these data to characterize groups coming from the emotional segmentation.

The emotional segmentation is conducted in two steps. In the first step, participants are grouped in each Kansei word. In the second step, a cluster analysis is performed with the groups of participants for each Kansei word, thus having a global grouping of participants.

This global grouping could be later used as the basis for further studies (either quantitative or qualitative).

REFERENCES

Holgado-Tello, F. P., Chacón-Moscoso, S., Barbero-García, I., & Vila-Abad, E. (2010). Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. *Quality & Quantity*, 44(1), 153-166.

Manly, B. F., & Alberto, J. A. N. (2016). *Multivariate statistical methods: a primer*. CRC Press.

Marco Almagro, L. (2011). Statistical methods in Kansei engineering studies. Universitat Politècnica de Catalunya – BarcelonaTech. Doctoral Thesis.

Ward Jr, J. H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American statistical association*, 58(301), 236-244.

A BASIC CONSIDERATION OF EVALUATION METHOD AND CONSTRUCTION MODEL OF MENTAL MODEL

Toshiki YAMAOKA^a

^a*Kyoto Women's University, Japan, tyamaoka6@gmail.com*

ABSTRACT

This article aims to create a mental model according to the basic idea by using two questionnaires as well as a framework that details the construction of the mental model using two separate approaches of a top down approach and a bottom up approach. Finally, the evaluation table is constructed in order to evaluate the mental model from the viewpoint of the significant difference between pre-evaluation and ex-post evaluation.

Keywords: *Mental model, evaluation of mental model, pre-evaluation, ex-post evaluation*

1. INTRODUCTION

WHY IS THE KANSEI INFLUENCED BY MENTAL MODEL?

Whenever machines and systems are used, a mental model of these machines is constructed. The mental model is defined as a system image. The Kansei design items are related closely to “functionality and convenience” influenced by mental models with the other eight items such as colour, shape and so on (yamaoka,2001). So, the mental model which influences functionality and convenience is studied.

Kansei was examined for constructing good Kansei design regarding the basic consideration of the evaluation method and the construction method of the mental model. As the mental model is changing gradually, it was examined from a time base viewpoint. The designers and engineers should design products and systems based on the mental model. Since the process of creating the structure of the mental model is currently unclear, the study aims to clarify the process while proposing an evaluation method for the mental model.

2. BASIC IDEA OF MENTAL MODEL CREATION PROCESS

Usually, the system is restricted based on the purpose. If the purpose of product is unclear, the decision is taken without fully understanding the purpose. The system is realised based on the means under the purpose (Fig1). The means is included by the condition of the constraint.

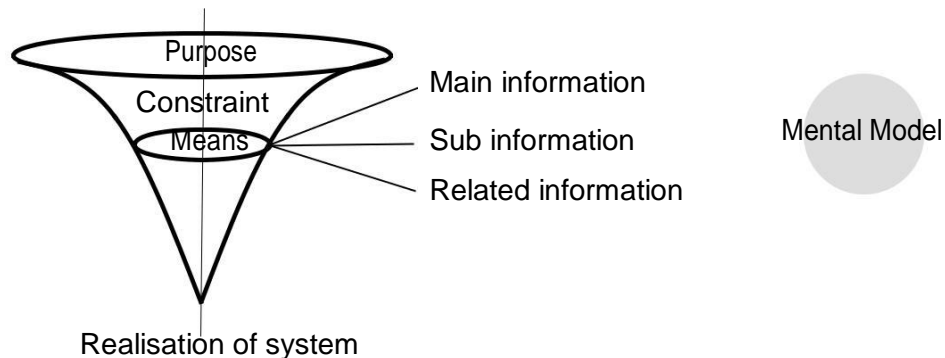


Figure 1: The realisation of system based on purpose and means(constraint)

3. TWO QUESTIONNAIRES

3.1. Questionnaire 1

The SCT (Sentence Completion Test) was done in order to let information of time base of users.

3.1.1. Method

The following SCT were done for 81 students of Kyoto Women's University. They were freshman and sophomore.

[A] takes time and makes me cheerful. [B] takes time and makes me trying.

3.1.2. Results and discussion

At that time, participant's feelings had changed since it is based on their motivation. Whenever they understood the task actively, they received a good impression. Meanwhile whenever they understood the task negatively, they received a negative impression. The results shown signifies its importance for users.

3.2. Questionnaire 2

3.2.1. Method

The participants were asked to show some examples to be able to operate when participants did not know how to use products. The participants were 98 freshmen of Kyoto Women's University.

3.2.2. Results and discussion

It is reported that participants are able to operate products based on visual clues of products and their experience of using the product by trial and error. However, they could operate without understanding how to use product. As the information revealed that a functional model was constructed but a structural model was not constructed, the participants seem to understand the structural model gradually by familiarising with products. Thus, the mental model consists of both functional and structural models.

4. FRAMEWORK OF CONSTRUCTING MENTAL MODEL

The main information, sub information and related information were created based on the results of the two questionnaires. These information is needed when the means for the purpose are examined. These information is consolidated where the mental model is derived (Fig1). A system is realised based on the purpose and the means of constraint condition. The system's construction process should be examined based on the two approaches of mental models used which are top down and bottom up approach (Fig2).

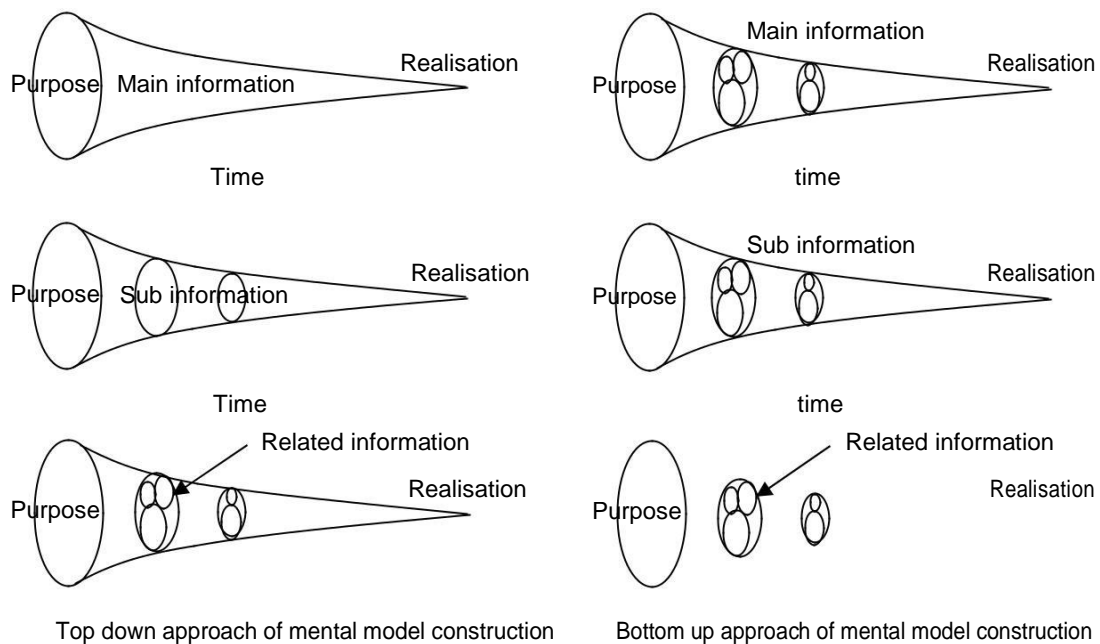


Figure 2: Top down and bottom up approach of mental model

4.1. Top down approach of mental model construction

Usually, users are able to operate products according to the purpose, information and the realisation of the system. At first, they grasp the whole and ambiguous image of the system using the purpose, main information and realisation of the system roughly. Next, they attain the sub information to identify the framework of the system and then they get the related information in order to know the detained information of system. Finally, they can construct the mental model through three steps.

4.2. Bottom up approach of mental model construction

Users are able to understand the function of displays as well as controls while experiencing them by trial and error. The displays and controls and so on are the related information to the mental model. Next, they estimate a rough mental model using the sub information. The sub information can be constructed based on the related information available. As the main information can be constructed based on the sub information, they will finally be able to construct the mental model.

4.3. Mental model construction process

The mental model changes accordingly through time. When the mental model is applied to systems such as services, users are able to estimate the mental model using two approaches; a top down approach and bottom up approach. Especially the first step of the top down approach will enable users to experience the whole and ambiguous image of the system. Next they will grasp the mental model through the three steps of the bottom up approach(Fig.3).

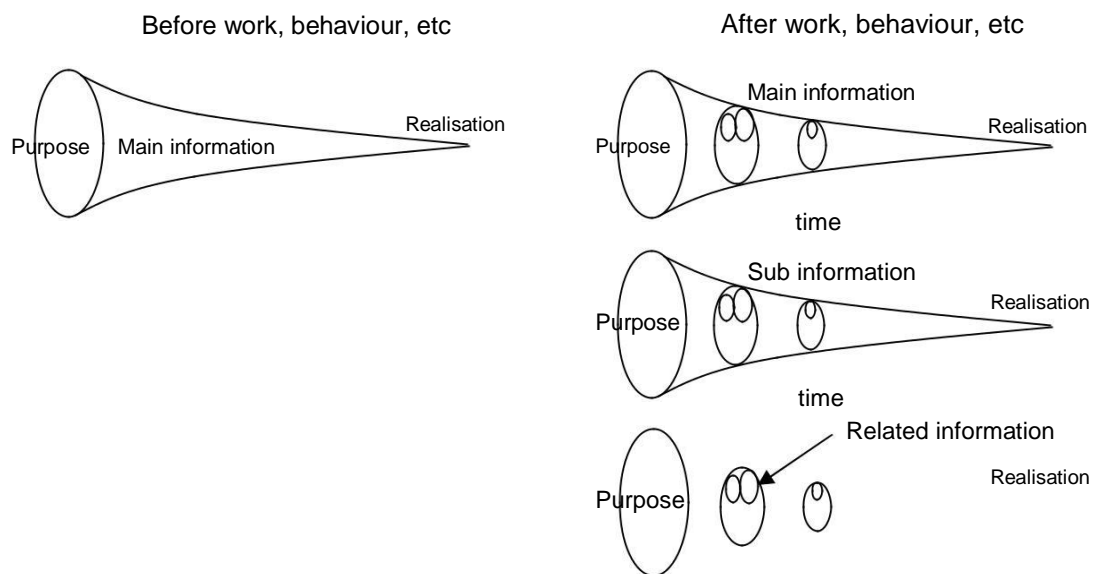


Figure 3: Mental model construction process

5. EVALUATION OF MENTAL MODEL

The evaluation method of the mental model is constructed according to the mental model construction process that is shown in (Fig.3). The evaluation items in terms of pre-evaluation are "Understand the system very well", "Understand the system", "so-so", "Don't understand the system", "Don't understand the system definitely". The evaluation of pre-evaluation is done using the five evaluation items in the main, sub, related information. The main, sub and related information are weighted according to the situation. The evaluation items in case of ex-post evaluation are "Understood the system very well", "Understood the system", "so-so", "Didn't

understand the system", "Didn't understand the system definitely". The evaluation of ex-post evaluation is done using the five evaluation items in the main, sub, related information. Table 1 shows the score of a mental model of a user regarding a high class restaurant that he / she has never visited. As the main information and sub information is important since they each carry 40 % out of the total score.

Table 1. Evaluation table of mental model

Pre-evaluation of mental model	Main information (40%)	Sub information (40%)	Related information (20%)	score
Understand the system Very well (4 points)				
Understand the system (3 p)				
So-so (2 p)	0.8	0.8	0.2	1.8
Don't understand the system (1 p)				
Don't understand the system definitely (0 p)				
Total score				1.8

Ex-post evaluation of mental model	Main information (40%)	Sub information (40%)	Related information (20%)	score
Understood the system Very well (4 points)				
Understood the system (3 p)		1.2	0.6	1.8
So-so (2 p)	0.8			0.8
Didn't understand the system (1 p)				
Didn't understand the system definitely (0 point)				
Total score				2.6

6. CONCLUSION

The framework of constructing a mental model was completed by using both top down and bottom up approaches. The evaluation table is constructed in order to evaluate the mental model from viewpoint of the difference between pre-evaluation and ex-post evaluation.

7. ACKNOWLEDGMENTS.

This work supported by JSPS Kakenhi Grant number JP17K00739

REFERENCES

Yamaoka, T. (2001). Human Design Technology as a new product design method. *First International Conference on Planning and Design*, 1-10

MEASURING AFFECTIVE RESPONSES TO CONFECTIONARIES USING PAIRED COMPARISONS

Farzilinizam AHMAD^a, Raymond HOLT^a and Brian HENSON^a

*^aInstitute Design, Robotic & Optimizations (IDRO), School of Mechanical Engineering
University of Leeds, Leeds, LS2 9JT, United Kingdom*

ABSTRACT

The use of category scales on self-report questionnaires in Kansei Engineering can be subject to biases and errors. In this research, the use of Rasch analysis of paired comparisons of products to derive linear measurement of affective response is tested. Four pieces of confectioneries and twelve evaluative statements measuring the dimension of specialness that was validated in previous researches were used. A computer-based self-report system presented one hundred and fifty-seven participants with pictures of pairs of confectionery and the evaluative statements in all combinations, and the participants were asked to indicate which confectionery satisfied the statement best. The analysis demonstrates the viability of using Rasch analysis to obtain measures of affective response from paired comparisons, that people find it easier to make paired comparisons compared with evaluating products separately against Likert statements, but that in this case the fit of the data to the Rasch model is very poor.

Keywords: *Paired comparison, Affective Engineering and Rasch Model*

1. INTRODUCTION

In Kansei Engineering approach Type III (Nagamachi, 1995), one attempts to measure people's affective responses to products so that relationships between the affective responses and the products' physical properties can be identified and used to improve design. In Nagamachi's approach, based on Osgood's semantic differential technique (Osgood, Suci and Tannenbaum 1957), people are asked to rate products against a number of adjective pairs on typically either five or seven point scales. A data reduction technique such as the Principal Components Analysis are used to establish a semantic space in which the physical properties of the products and the affective responses can be correlated.

Whilst intuitive for the research participant, the use of category scales can suffer from inaccuracies and biases. It is assumed that adjective pairs plotted in semantic space are equidistant from the neutral point (Heise 1969) and that common word-pairs are antonyms (Mordkoff 1963). Osgood (1971) demonstrated that the use of the semantic differential technique with the same stimulus that produced large numbers of failures to respond and decreased the speed of responses. Other sources of variance associated with reliability, factor scores and group means, can cause inaccuracies (Borsboom 2006). Category scales are usually treated as interval data, when they are at best ordinal (Wright and Linacre 1989, Stevens 1946).

There is some evidence from our own research that participants are often unable to clearly discriminate between the different categories of semantic differential scales during product evaluation (Camargo and Henson, 2011). In this research, a probabilistic model is applied, the Rasch model (Rasch, 1960, 1980), in order to measure people's affective responses to products. In this approach, rather than constructing a statistical model of the response data, it is determined whether the response data fits the Rasch model and, if it does, some measurement properties are demonstrated. The Rasch model, in the context of product evaluation, calculates the probability that someone will endorse a product as a mathematical function of the person's ability or willingness to endorse and the difficulty of endorsing the particular product. The result is a linear scale of how easy it is to endorse a product along the affective dimension the instrument is designed to measure. The Rasch model had been used widely in education and in medicine. Previously, various instances were observed in which the probability of participants endorsing each category on a response scale is not sequentially ordered, when it was expected to be (Camargo and Henson, 2011). Thus, while categorical response scales are intuitive, participants are not able to be easily discriminated by the categories of the response scale.

One reason why category responses might be troublesome could be because participants are asked to evaluate products separately, without reference to a benchmark product. One of the aims of this work is to establish whether participants might find it easier to evaluate products if the evaluations were made as paired comparisons. When making a paired comparison, the participant merely has to indicate which of the two products they endorse is more ready, rather than thinking about which category of response one would elicit separately. The challenge is then to derive a linear scale of affective response from such comparisons. There is a body of work from discrete choice theory which is based on making paired comparisons of products (Train, 2009). The aim in discrete choice theory, however, is to determine the relative importance of properties of the choices, which are often assumed to vary linearly, rather than to derive measurement. Thurstone's law of comparative judgement' (Thurstone, 1927) can be used to establish measurements from pairwise comparisons. It has been widely used in psychophysics to determine the relationship between perception and intensity of stimulus. The Bradley-Terry-Luce model (Bradley and Terry, 1952) is derived from Thurstone's law, but uses a slightly different statistical basis. In the context of education, it can be used to derive measurement from whether answers to questions are right or wrong. The Bradley-Terry-Luce model can be shown to be

equivalent to one of the forms of the Rasch model. However, the model is not directly applicable to evaluation of products because, whilst in the educational case there is a response associated with each question for each person, in the context of product evaluation there are questions and responses for each person for each product. In other words, the product forms an extra independent factor or facet for which the Bradley-Terry-Luce model and Thurstone's law cannot account. There are, however, forms of the Rasch model that might be able to account for the extra facet (Linacre, 1989).

The aims of the research are therefore to establish whether linear measurement of affective response can be derived from paired comparisons of products, to assess whether making paired comparisons are easier for participants, and to determine the quality of people's responses, which in this case is determined by responses that fits the Rasch model.

The approach taken is to use statements developed in previous research intended to measure the specialness of confectionary (Camargo and Henson, 2011). The previous research established that the statements can be used as a unidimensional instrument for measuring affective response. In the research reported here, the statements are used again to evaluate the same confectionary, but instead of rating each confectionary separately against Likert statements, the user is presented with all confectionary in all pair combinations, and the participant indicates which pair satisfies which evaluative statement. The responses were then analysed to determine their fit to the Rasch model. The analysis of the paired comparison data is compared with those of the original research which used Likert statements. It is concluded that the use of the Rasch Model analysis to derive a linear measurement of affective response from paired comparisons is viable, that people find it easy to make paired comparisons, but that in this case the fit of the data to the Rasch model is very poor.

2. METHOD

In previous research, 306 participants are selected to rate four pieces of confectioneries against twenty-four Likert statements on a five-point scale, related to the construct of specialness (Camargo and Henson, 2011). Four items of confectioneries that are readily available were used for these experiments. These confectioneries were Ferrero Rocher®, Lindor®, Caramel®, and Milky Way® from a Mars Celebrations® assortment (Figure 1). The confectionery was chosen because, it is viewed that they are likely to elicit different responses to statements pertaining to their specialness. The statements used in the experiment were determined through UK-based consumer research by a large confectionery company. The responses to the four pieces of confectioneries were analysed using the multi-faceted Rasch model to establish a unified scale, for which twelve statements fitted the model for all four pieces of confectionery (Table 1). The experiment established a linear scale for the measurement of the specialness of confectionery.

In the new research study, participants were asked to endorse the confectionery against the statements for specialness by paired comparisons. One hundred and fifty-seven participants,

(eighty-three males, seventy-four females) were recruited to take part in this study with an age range from 17 to 57 years old. Participants received £5 as compensation for taking part in the study. This study was conducted in the Affective Engineering Laboratory School of Mechanical Engineering, University of Leeds. Ethical approval for the study was obtained from the University of Leeds Research Ethics Committee (Reference MEEC 15-027).

The twelve statements were developed in the previous study were used in the new study. Data from participants' affective responses were collected using a bespoke, computer-based, self-report system (Figure 2). Some of the statements were modified slightly to better suit the method of paired comparisons. The system presented each participant with each pair of confectionery in all combinations, against each of the twelve statements concerning specialness, and the participant was asked to indicate which of each pair best satisfies the statement. The pair combinations, the order of statements and the order of each pair on the screen were randomized. Thus, for each participant, there were seventy-two statements in total. Participants were encouraged to look at and touch (but not eat) physical samples of the confectionery which were located next to computer terminal whilst filling in the online questionnaire (Figure 2).

Table 1 : Statements used in the experiments

Code	Statements
I0001	A box of these chocolates would be an appropriate 'thank you' gift.
I0002	A box of these chocolates would make a thoughtful gift.
I0003	This is premium chocolate
I0004	This chocolate does not need to shout about how good it is.
I0005	This chocolate would show that someone took the time to choose just the right chocolate for the occasion.
I0006	I would keep chocolates like this one for myself.
I0007	The chocolate in this wrapper is likely to exceed people's expectations.
I0008	This chocolate is like a little present for me.
I0009	With this chocolate, you feel like you are getting more than just chocolate.
I0010	This chocolate is stylish.
I0011	This chocolate would be nice at the end of a dinner party.
I0012	This chocolate would be good to enjoy with my loved-one on a quiet night



Fig. 1: Four items of confectionery



Fig. 2: Example of self-report interface

The data were analysed using the software, RUMM2030 (Andrich, Sheridan and Luo, 2012). The data from the paired comparison study were analysed to two ways. In the first way, each of the six pair combinations were treated as a separate facet, and the statements coupled with each pair were treated as the items (i.e. there were six levels in the facets and seventy-two items). The first approach does not yield linear measurement of locations of the confectionery on a scale of specialness, but was intended to reveal information about the difficulty of the task. In the second approach, the statements were combined with one of each pair to form the items, and the confectionery were separated out as a facet (i.e. there were forty-eight items and four levels in the facet). The challenge with the second approach is that the data structures required for the RUMM software needed each confectionery to be compared with itself against each statement. Initially in the analysis, this was coded as missing data, but the software was unable to process the data. The problem was solved by randomly coding each self-comparison with a one or a zero, after which the software was able to process the data. From a conceptual point of view, this is accurate because a random endorsement is equivalent to a fifty percent chance of endorsing the item, and this is equivalent to the confectionery being of equal difficulty of being endorsed when compared with itself. The second approach was intended to produce linear measurement of the affective response to the confectionery.

3. RESULTS

Figures 3 to 5 show the person-item distributions for the three analyses. There are two main regions in each of the graphs. The lower region shows the distribution of the difficulty of the items. The horizontal axis indicates increasing difficulty of endorsement in units of logit. A logit is an expression of the probability that a particular item will be endorsed. The items to the left of the graphs are easier to endorse than those on the right. The upper portion of the graphs shows the distribution of people's willingness to endorse the items. The horizontal axis indicates increasing willingness to endorse items in units of logit. Normally, one would attempt to develop items such that the spread of the difficulty of endorsement matches the distribution of the participants to endorse the items.

In the previous research, the data demonstrated a good fit to the Rasch model (Camargo and Henson, 2011). In the current research, in the analysis in which the comparison pairs were treated

as a separate facet, the data demonstrated an adequate fit to the model, but fit parameters would not be sufficient to be acceptable as a psychometric instrument. In the new analysis in which the individual pieces of confectionery were treated as a separate facet, the data demonstrated an extremely poor fit to the Rasch model.

The locations of the facets for the analysis that treated the six pair comparisons as a separate facet are shown in Table 2. The locations of the pieces of confectionery identified by the previous research and this new study are shown Table 3.

4. DISCUSSION

Figure 3 is the person-item distribution for the previous research in which participants were asked to rate the confectionary on five-point category scales against Likert statements (Camargo and Henson, 2011). The items in this case are a combination of each Likert statement with each product. It can be seen that overall, the participants found it easy to endorse the items, but that the targeting of the difficulty of the items to participants could be improved; there are many items that few people could endorse and many items that most people were able to endorse.

The person-item distribution for the analysis of the current data in which the six comparison pairs were treated as a separate facet (Figure 4) shows that the participants found it very easy to endorse the items and that the matching of the difficulty of the items with participants' willingness to endorse is quite poor. The facet locations appear to be ordered according to the ease with which the confectionery in each pair can be discriminated (Table 2). In other words, those confectionery pairs that are most similar and are difficult to discriminate have higher positive values, whereas those that are very different have more negative values. For example, the confectionery pair of Milky Way® and Ferrero Rocher®, has a large negative location relative to the other pairs, whereas Ferrero Rocher® and Lindor®, which are more similar in terms of specialness, has the most positive value of the pairs. It is speculated that it might be possible to interpret the location of the pairs as an indication of how easy it is for the participants to discriminate between those pairs, in which case the overall person-item distribution would be an indication of the ease of overall discrimination during paired comparisons. If this is the case, then the person-item distributions demonstrate that participants find it much easier to carry out paired comparisons than rating confectioneries individually against Likert statements.

The person-item distribution for the analysis of current data in which individual pieces of confectionery were treated as a separate facet (Figure 5) shows that approximately half of the items were very easy to endorse and the other half were very difficult to endorse. However, because of the way the data are coded for analysis, each comparison is represented by two data points, and consequently, each easy item has a mirror-image difficult item. In theory, therefore, the item distribution in Figure 5 should be symmetrical. The coding of the same-confectionery pairs by random ones and zeros might account for the small amount of asymmetry in the distribution. The very narrow spread of the persons' willingness to endorse shows that there was

not much variation in people's affective assessments of the confectionery. Together with the person-item distribution in Figure 4, it is interpreted as demonstrating that people find the paired comparison task very easy. The wide spread of the distribution of the items compared with the distribution of the participants indicate that these paired comparisons are perhaps too easy and that people were too consistent in making the comparisons.

The narrow spread of people's affective evaluations is compared with the wide spread of specialness of the stimuli results in a poor fit of the data to the Rasch model. Nevertheless, the locations of the confectionery on a scale of specialness derived from the paired comparisons (Table 3) is consistent with those derived from the experiment using the Likert scale. The confectioneries have identical ranks and similar relative locations within measurement error.

Measurement from paired comparisons suffer from some conceptual issues (Linacre, 1997; Wauthier and Jordan, 2013), and future work will have to address the issue of the rapid increase in the number of comparisons required when there is an increasing number of products.

Table 2: Locations of facet levels from analysis in which the confectionery pairs were treated as a separate facet.

Confectionery pair	Location (logit)	Standard error
Milky Way® - Caramel®	0.835	0.19
Milky Way® - Lindor®	-0.151	0.25
Milky Way® - Ferrero®	-0.961	0.38
Caramel® - Lindor®	0.346	0.22
Caramel® - Ferrero®	-0.959	0.39
Lindor® - Ferrero®	0.89	0.19

Table 3: Comparison of locations of confectionery between use of Likert scale (from (Camargo and Henson, 2011)) and paired comparisons.

Confectionery	Likert Scale		Paired comparisons	
	Location (logit)	Standard error	Location (logit)	Standard error
Ferrero Rocher®	1.080	0.10	1.407	0.260
Lindor®	0.780	0.10	0.552	0.190
Caramel®	-0.500	0.10	-0.720	0.230
Milky Way®	-1.370	0.10	-1.239	0.230

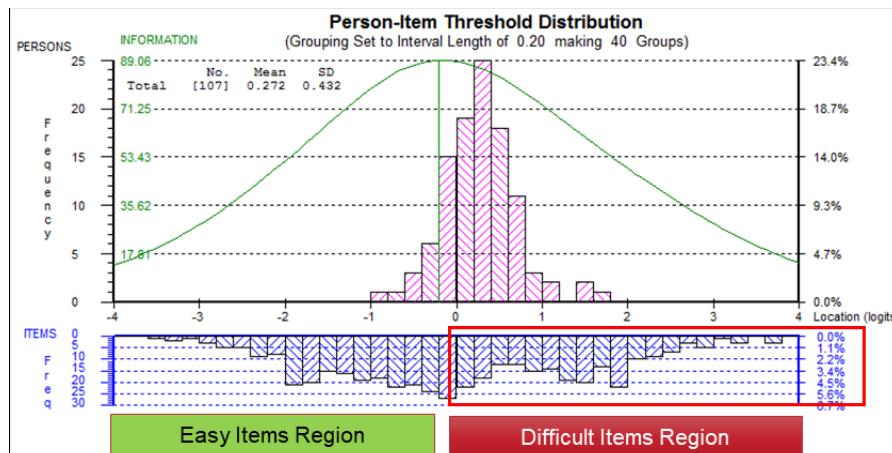


Fig. 3 Person-item distribution for data from experiment that used Likert scales (Camargo and Henson, 2011).

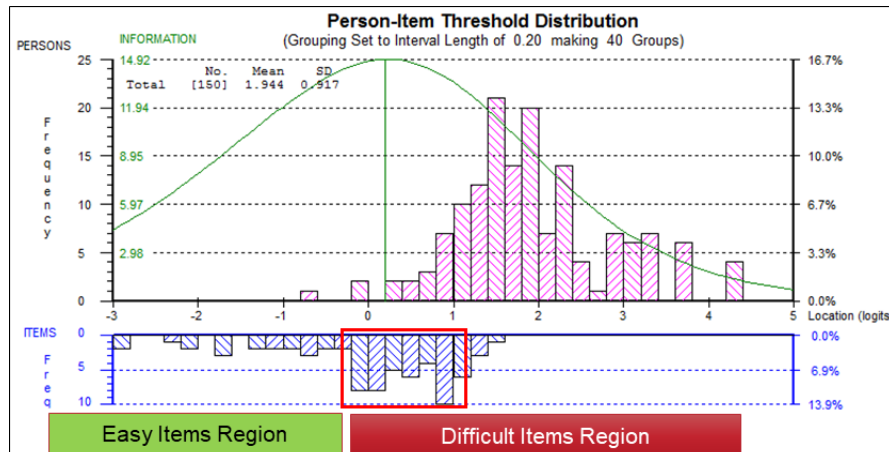


Fig. 4 Person-item distribution for analysis of current data in which confectionery pairs were treated as a separate facet.

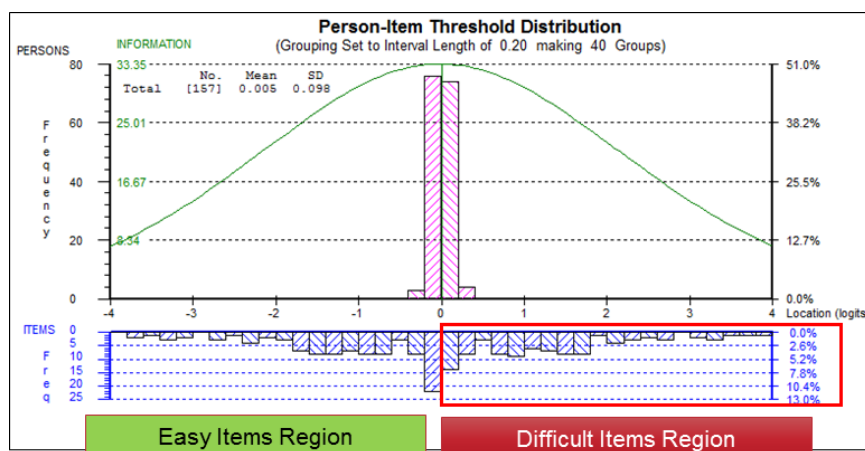


Fig. 5 Person-item distribution for analysis of current data in which individual pieces of confectionery were treated as a separate facet.

5. CONCLUSION

This work demonstrates the viability of using Rasch analysis to derive linear measurements of affective response from paired comparisons of products, although the challenges remain. If the products are too different and participants find it too easy to discriminate the products along the affective dimension of interest, then it is likely that the data will be a poor fit to the Rasch model. Participants in the research found it much easier to make paired comparisons than to evaluate the products separately against Likert statements. Although the resulting measures of specialness of the confectionery from paired comparisons were similar to those derived by the use of Likert statements within measurement error, the data were a poor fit to the Rasch model. Future research should apply the use of paired comparisons in a less-contrived context like the quality of materials for vehicle interiors.

ACKNOWLEDGMENTS

This work was partially funded by The Ministry of Rural and Regional Development of Malaysia (MARA).

REFERENCES

- Andrich, D., Sheridan, B. E., & Luo, G. (2012). *RUMM2030: Rasch unidimensional models for measurement*. RUMM laboratory, Perth, Australia.
- Borsboom, D., (2006). When does measurement invariance matter. *Medical Care*, 44(11), 176–181.
- Bradley, R. A. & Terry, M. E. (1952). Rank analysis of incomplete block designs: The methods of paired comparisons. *Biometrika*, 39(3/4): p. 324-345.
- Camargo, F. R., & Henson, B. (2011). Measuring affective responses for human-oriented product design using the Rasch model. *Journal of Design Research*, 9(4): 360-375.
- Heise, D. R. (1969). Some methodological issues in semantic differential research. *Psychological Bulletin*, 72(6) ,406–422.
- Linacre, J.M. (1989). *Many-facet Rasch measurement*. Chicago: Mesa Press.
- Linacre, J.M. (1997). Paired comparisons with standard Rasch software. *Rasch Measurement Transactions*, 11(3), 584-585.
- Mordkoff, A.M. (1963). An empirical test of the functional antonymy of semantic differential scales. *Journal of Verbal Learning and Verbal Behavior*, 2(5 – 6), 504–508.

Nagamachi, M. (1995). Kansei engineering: a new ergonomic consumer-oriented technology for product development. *International Journal of Industrial Ergonomics*, 15, pp.3–11.

Osgood, C.E. (1971). Exploration in semantic space: A personal diary. *Journal of Social Issues*, 27, 5-63.

Osgood, C., Suci, G., & Tannenbaum, P. (1957). *The Measurement of Meaning*. University of Illinois Press, Urbana.

Rasch, G. (1980). *Probabilistic models for some intelligence and attainment tests*, (Copenhagen, Danish Institute for Educational Research), expanded edition (1980) with foreword and afterword by Wright, B.D. Chicago: The University of Chicago Press.

Stevens, S.S. (1946). On the theory of scales of measurement. *Science*, 103, 677-680.

Thurstone, L.L. (1927). Psychophysics Analysis. *The American Journal of Psychology*, 100(3/4), 587-609.

Train, K. E. (2009). *Discrete choice methods with simulation*. 2nd edition. Cambridge University Press.

Wauthier, F. L., & Jordan, M. L. (2013). Efficient ranking from pairwise comparisons. *Proceedings of the 30th International Conference on Machine Learning (ICML)*, Atlanta, Georgia USA, June 2013.

Wright, B.D., & Linacre, J.M. (1989). Observations are always ordinal; measurements, however, must be interval. *Archives of Physical Medicine and Rehabilitation*, 70(12), 857–860.

AN INVESTIGATION ON THE LIFE-STYLE AND DIET AND COOKING OF SINGLE YOUNG HOUSE-RENTER —CASE STUDIES OF CITIES IN GUANGDONG AND TAIWAN

Ching YANG^a, Gui-Qi HE^b

a Department and Graduate School of Industrial Design, National Yunlin University of Science & Technology, Taiwan, R.O.C., yangj@yuntech.edu.tw

b Department and Graduate School of Industrial Design, National Yunlin University of Science & Technology, P.R. China, 478045550@qq.com

ABSTRACT

This research, mainly conducted by questionnaire, aims at discussing the relationship between the ways of renting houses, kitchen appliances, diet and cooking behavior and the life styles of the young office workers who work far away from home in Guangdong Province, such as Guangzhou, Shenzhen, Foshan, Zhuhai, and Taiwan Province, such as New Taipei, Taipei, Taoyuan, Taichung, Tainan, and Kaohsiung. The questionnaire survey is open to the network platform. 320 valid questionnaires are collected in Guangdong, 150 in Taiwan with the total of 470 valid questionnaires, and the recovery rate is 68.1%. The survey results will be analyzed by SPSS software. The results of this study reveal that, as for the way of renting houses for young tenants in the two provinces, it is more common for young tenants in Guangdong to live in single suites and shared apartments with kitchen appliances. Meanwhile, young tenants in Taiwan mainly live in single suites with 90 percent of the suites without kitchen appliances. In terms of the eating lifestyle, about 70% of the young tenants in Guangdong have rice as their staple food while only 40% of the young tenants in Taiwan have rice with 45% having no fixed staple food. It can be known from the results that significant differences exist between young singles in Guangdong and those in Taiwan due to different social environments and food cultures. The factor analysis of life style are 1) casual and outgoing, 2) frugal and conservative, 3) active and aggressive, 4) clean and tidy, 5) studious and positive, 6) busy and tired, 7) online consumption, 8) healthy diets and 9) generous and playful, etc. According to factor scores on these factors, the respondents can be grouped into six clusters. The six clusters and their proportions are groups of ordinary and playful (25.3%), Lazy and thrift (18.1%), casual and generous (17.4%), toil and tidy (16.8%), busy and outgoing (13%), aggressive and hard-working (9.4%). This result shows most of the young people in Guangdong and Taiwan are not striving for work. They prefer a playful and lazy life style. Group characteristics influence eating life style.

The groups of casual and generous have a high proportion of having meals outside while groups of lazy and thrifty prefer to cook by themselves.

Keywords: *Guangdong, Taiwan, young single people, urban rental housing, life style*

1. INTRODUCTION

1.1. Research Background and Motives

Guangdong Province is located in the Pearl River delta region, the southern end of China, which has been one of the most important ports of foreign trading since ancient times. Taiwan Province is located between the Ryukyu Islands and the Philippine Islands with Fujian Province in the west separated by the Taiwan Strait. Since 50 years ago, Guangdong Province and Taiwan Province have had a rapid growth in industry and commerce, gathering a large number of migrants with a variety of ethnic groups and cultural lives. Today, both Guangdong Province and Taiwan Province have sustained well-developed economy, which attracts young talents from all over the world to get employed. People gather together in urban areas leading to the high housing prices and rental prices, laying financial burden on the young people. Most young people who work in cities are striving for their lives and their lives are not stable, so most of them choose to rent houses. And due to their busy works, they mainly eat outside. Thus, renting houses and the eating life styles of young single groups becomes a phenomenon of cluster that cannot be ignored in cities. From the point of view of designing, the urban young single tenants have their unique life styles. The environments of rental houses, daily routines, as well as cooking and diets are all worth discussing. Therefore, this study aims at discussing the current status of the life styles, cooking and diets as well as kitchen appliances of young single tenants in urban areas from the aspect of cooking and diets and analyzing the differences and similarities of life styles and cooking and diets of young single tenants between Guangdong and Taiwan.

1.2. Definition of Research Scope

The subject of this study is young single tenants, who are unmarried office workers aged between 20 to 40 years old excluding students. In terms of the definition of research scope, this study refers to the partition of urban areas, economic development, population distribution, floating population and current status of renting houses, taking Guangzhou City, Shenzhen City, Foshan City, and Zhuhai City in Guangdong as well as New Taipei City, Taipei City, Taoyuan City, Taichung City, Tainan City and Kaohsiung City in Taiwan which are municipalities directly under the central government as the study areas.

1.3. Research Purpose

This research, mainly conducted by questionnaire, aims at discussing the differences and similarities of the young office workers' ways of renting houses, kitchen appliances and cooking and diet behavior in Guangdong Province, such as Guangzhou, Shenzhen, Foshan, Zhuhai, and Taiwan Province, such as New Taipei, Taipei, Taoyuan, Taichung, Tainan and Kaohsiung. The analysis results of life style scale factors and cluster denomination will be extracted from the

SPSS statistical analysis. Meanwhile, the differences of needs for cooking and diets, eating habits during working days and holidays between the life style clusters in Guangdong and Taiwan will be analyzed inductively, whose study results will be provided for reference of further studies and design.

2. LITERATURE REVIEW

2.1. Current Status of Urban Rental Housing in Guangdong and Taiwan

According to the results of the fifth population census (2008) of the National Bureau of Statistics of mainland China, this study points out that at present, residential houses used for renting in Guangdong accounts for 12.3% with residential occupancy rate of 49.2% in Shenzhen City, 24.5% in Guangzhou, 18.5% in Foshan and 23.7% in Zhuhai City. The data was collected almost 10 years ago. With the development of regional economy, the residential occupancy rate should have been improved. What's more, "Summary Analysis of 1999 Overall Population and Residential Census Report" issued by Directorate-General of Budget, Accounting and Statistics, Executive Yuan points out that residential houses used for renting today accounts for 10.9% in Taiwan, 18.1% in Taipei City, 12.7 % in New Taipei City, 11.2 % in Hsinchu City, 9.3% in Taoyuan City, 13.0% in Taichung City, 9.7% in Tainan City and 10.5% in Kaohsiung City.

2.2. The Food Cultures of Guangdong and Taiwan

Since ancient times, the food cultures of Guangdong and Taiwan possess characteristics in southern China with rice as the staple food. But due to the differences in geographical environments and historical and cultural development, both have developed their own unique food cultures. Guangdong food culture is famous for its Cantonese cuisine with emphasis on various natural, delicious fresh food. Tea and soup are characteristics of Cantonese cuisine. Taiwan food culture is mainly originated from the diets of southern Fujian and the Hakkas immigrated since the Qing Dynasty in the early stage. And then after the Japanese Occupation War, the national government moved to Taiwan with various cuisines from the mainland, including northeast cuisine, northern noodles, Sichuan cuisine, Hunan cuisine and Taiwan's aboriginal food culture, gradually forming the diverse and comprehensive food culture in Taiwan.

2.3. Life Style

The concept of life style was originated from psychology and sociology. The study of life styles was originally applied in business from the aspect of life styles to understand consumers. Including the study of life styles as part of the design system, designers can plan the users' living cultures in terms of culture, economy, society and psychology. As for the way to measure life styles, Plummer (1974) pointed out that life styles include activities, interests, opinions and demographic variables (gender, age, income, etc.), namely AIOs life style scale. This study refers to the seven steps about life style study proposed by Wind & Green (1974), and reduces the seven steps to five step: 1) define the research scope, 2) design the questionnaires, 3) distribute the questionnaires, 4) collect, summarize and analyze, 5) discuss the current status of life style as well as cooking and diets.

3. RESEARCH DESIGN AND IMPLEMENTATION

3.1. Research Design and Content

This study is designed as two stages. The first stage is a case study. According to different types of renting house, groups of young men and women working in various occupations are interviewed and surveyed. The second stage is the questionnaire survey. The questionnaire content is divided into five parts, 1) personal basic information, including the subjects' gender, age, educational background, profession, monthly income; 2) the information of the renting houses, including the subjects' cities, the ways of renting, the types of renting houses; 3) the type and appliances of kitchen, including the types, cooking appliances and the non-cooking kitchen appliances; 4) food life, including the staple food, daily meals for working days and holidays, frequency of cooking, cooking problems; 5) life style scale, including 31 life style AIOs multi-item, measured by the degree of agreement with the Likert scales of five sections.

3.2. Field Survey Results of Kitchen Appliance

From October to December in 2016, this study aims at carrying out a field survey of different cases and interviews about the young single tenants in cities of Guangdong and Taiwan. There are 5 cases of Taiwan and 15 cases in Guangdong. Because of the limited length of this research, the results of interviews will not be discussed and analyzed in this study. In accordance with the inductive analysis from the field survey of kitchen appliances, this study shows that the number of single rented houses without kitchen appliances in Taiwan is more than that in Guangdong. The single tenants are using existing tables and cabinets for placement of simple heating appliances and utensils, which may be laid anywhere in the house (figure 1). Most of the renting houses in Guangdong are well-equipped than in Taiwan. Kitchen appliances include: 1) system cabinets (figure 2); 2) simple cabinets; 3) cement and ceramic tile hearths (figure 3).



Figure1: Renting house without kitchen equipment, from Guangdong G06, 2016



Figure2: System cabinet, from Taiwan T05, 2016



Figure 3: Cement and ceramic tile hearth, from Guangdong G03, 2016

3.3. Basic Information and Situations of Renting Housing of the Interviewees

The questionnaire of this study takes the young single tenants in the cities of Guangdong and Taiwan as the research subject and the questionnaires are distributed through "Sojump" web system. Surveying time starts from March to April in 2017 with the total recovery of 690 questionnaires and 470 valid questionnaires after selection, including 320 of Guangdong, 150 of Taiwan. The valid recovery rate is 68.1%.

The basic data of the subjects shows that in terms of gender, 53.8% are women and 46.3% are men in Guangdong while 62.7% are women and 37.3% are men in Taiwan. The number of women is more than men as a whole. In terms of age, subjects from 25 to 29 years old account for 51%, which is the highest proportion. In terms of educational background, subjects who own the bachelor's degree stand at 67%, which is the highest percentage. In contrast, the education level of subjects in Taiwan is obviously higher than that in Guangdong. In terms of profession, subjects working in business service industry account for the highest percentage of 31.2%, followed by 26.8% in design and art industry and 24% in professional technology industry.

The statistics about the ways of renting houses show independent renting houses and shared houses have higher percentages of 54.9% and 43.2% respectively in Guangdong and Taiwan. In Guangdong, the shared houses account for 33.4%, which is higher than the percentage of 32.8% of independent rented houses. In Taiwan, the independent rented houses stand at 22.1%, which is significantly higher than 9.8% of the shared houses. In terms of the types of houses in Guangdong and Taiwan, houses with 2 rooms and 1 hall and houses with 1 room are in the majority, standing at more than 38.3% and 38.1% respectively. However, the proportion of houses with 1 room is higher than that with 2 rooms and one hall in Taiwan, while the proportion of houses with 2 rooms and 1 hall in Guangdong is much higher than that in Taiwan. The tenancy term that is within one year and 1-3 years are in the majority, accounting for 56.2% and 37.0%, respectively.

3.4. Analysis about Styles and Appliances of Kitchen

The statistics of the styles of kitchens show that in the overall sample, the simple cabinet and cement and ceramic tile hearths are in the majority, standing at 29.8% and 28.9% respectively. In Guangdong, nearly 90% of the houses rented by the young single tenants are equipped with kitchens. While in Taiwan, 56.7% of the renting houses are not equipped with kitchens. This result has been verified with the results of the field survey. With the landlords' consideration of the dangers and pollution of cooking fire in Taiwan, single independent renting houses are not equipped with kitchens generally. On the contrary, landlords in Guangdong have no such concern, so the kitchen's configuration is relatively well-equipped.

The result of cooking appliances in the kitchen shows that the types of kitchen appliances are similar both in Guangdong and Taiwan. The higher percentage of the kitchen appliances are mainly used to meet the demand of basic cooking in daily life. According to the statistics of kitchen appliances, the top three are refrigerators, fans and smoke lampblack machines respectively; the top four heating appliances are electric pots, hot kettles, induction cookers and gas furnaces. The proportion of kitchen appliances in Guangdong is higher than that in Taiwan.

3.5. Statistical Analysis of the Staple Food and Cooking and Diet Behavior

According to the statistics of staple food, most of the staple foods in both provinces is rice or there is no fixed staple food. However, 70.3% of the young tenants in Guangdong have rice as the staple food with 21.3% have no fixed staple food while 40% of the young tenants in Taiwan

have rice as the staple food, the number of which is smaller than that of the young tenants who have no fixed staple food with the percentage of 45.3%, which reflects the diversity of Taiwan food culture. There are more eating options for people to choose. The statistics of diet behavior during working days show that both in Guangdong and Taiwan, eating at the restaurants for young people represents the highest percentage followed by eating at the company's cafeteria, ordering take-away and cooking by themselves. However, the percentage of young people who cook by themselves during working days in Taiwan is higher than that in Guangdong while the percentage of young people who eat at the company's cafeteria in Guangdong is higher than that in Taiwan. The statistics of diet behavior during holidays show the percentage of young people who cook by themselves in Guangdong is the highest, followed by eating outside and ordering take-away. In Taiwan, ordering take-away ranks the first, followed by eating outside and cooking by themselves. Hence, the percentage of subjects who cook by themselves in Guangdong is higher than that in Taiwan. Therefore, mutual confirmation can be achieved by the results that the kitchens in Guangdong are well-equipped than that in Taiwan which has been discussed in 3.4 and the above results.

In addition, the most obvious problem that the subjects often encounter when cooking in Guangdong and Taiwan is the inconvenience to dispose kitchen garbage. The percentage of subjects encountering this problem in Taiwan is much higher than that in Guangdong, which is directly related to Taiwan's strict garbage collection system. The second problem is the troubles of cleaning in kitchens and the cooking lampblack. The percentage of subjects encountering this problem in Guangdong is higher than that in Taiwan, which is related to the high frequency of cooking by themselves. Besides, there also exist other cooking problems, such as the inconvenience of buying and storing the ingredients, the difficulties in controlling the portion of staple food.

4. ANALYSIS OF LIFE STYLE CLUSTERS AND COOKING AND DIETS

This study includes 470 subjects in Guangdong and Taiwan in AIOs scale questionnaire survey. The life style factors are extracted from the SPSS statistical analysis and the single tenants are analyzed. Finally, cross analysis and chi-square tests are conducted among the single tenants and styles and appliances of kitchens as well as cooking and diet behavior.

4.1. Analysis of Life Style Factors

This research conducts SPSS statistical analysis about AIOs scales of 470 subjects in Guangdong and Taiwan. The result shows that the KMO value is 0.723 and Bartlett spherical test statistic is 2850.795. When the freedom degree is 465, $p = 0.00 < 0.05$, which shows the significance level has been achieved and factor analysis is suitable to be carried out. Then, factors are extracted by the principal component analysis and the biggest difference of matrix transpose orthogonal rotation. 9 life style factors are extracted through the test of steep slope figure. The cumulative variance is 54.9% after the rotation of its shaft, and the result is as shown in Table 1. The denomination of the life style factors are 1) casual and outgoing, 2) frugal and

conservative, 3) active and aggressive, 4) clean and tidy, 5) studious and positive, 6) busy and tired, 7) online consumption, 8) healthy diets and 9) generous and playful, etc.

Table 1. Factor analysis and denomination

Content/Factor	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8	Factor9
13 Like taking outdoor activities during holidays	0.809	0.065	0.040	0.069	0.121	-0.082	-0.069	0.081	0.065
23 Like travelling during holidays	0.713	0.100	0.099	0.302	0.130	0.031	-0.036	-0.064	0.066
11 Like staying at home during holidays	-0.626	0.226	0.001	0.176	0.144	0.126	0.040	-0.084	0.294
14 Like having parties with friends in spare time	0.604	0.060	0.176	0.201	0.128	0.004	-0.157	-0.098	0.308
25 Life is hard due to recession	-0.116	0.710	-0.162	0.004	0.069	0.144	-0.137	0.042	0.104
24 Attach much importance to money	0.094	0.604	0.212	0.126	0.002	-0.032	0.164	0.184	-0.153
28 Be unsatisfactory with current salary	0.020	0.555	0.213	-0.196	0.037	0.033	-0.080	-0.182	0.088
31 Hope to work in the hometown	0.132	0.499	-0.346	0.117	0.130	0.072	-0.258	0.068	0.025
05 Make every cent count and shop around	0.215	0.466	-0.096	0.218	0.006	-0.080	0.363	0.265	-0.166
19 Like watching movies and TV plays online	-0.126	0.388	0.067	0.206	-0.081	-0.090	0.149	-0.223	0.310
27 Like working in big cities	0.089	-0.025	0.695	-0.052	-0.017	-0.120	0.232	0.185	0.155
30 Like jobs which are challenging and have an opportunity of promotion	0.175	0.122	0.564	0.093	0.318	0.093	-0.045	-0.187	-0.147
29 Can develop talent in current work	-0.053	-0.040	0.511	0.255	0.231	-0.001	-0.184	-0.118	-0.210
26 Be good at adjusting to unfamiliar environment	0.231	-0.062	0.453	0.055	0.184	0.135	-0.014	0.413	0.025
17 Check mobile phone messages at any time	0.026	0.224	0.431	0.291	-0.181	-0.105	0.061	-0.005	0.310
08 Attach importance to the environmental sanitation of the residence	0.077	0.112	0.085	0.782	0.051	-0.041	0.001	0.083	0.000
09 Arrange the rented house carefully	0.223	-0.021	0.069	0.686	0.237	-0.015	0.039	0.014	0.083
21 Like watching news to know about current events	-0.006	0.179	0.093	0.038	0.673	-0.097	-0.015	0.067	0.135
20 Learn new knowledge in spare time	0.036	-0.100	0.239	0.372	0.579	0.018	0.014	0.100	-0.142
22 Like taking part in public benefit activities	0.396	-0.068	-0.110	0.188	0.541	0.086	0.114	0.052	0.062
12 Be in the habit of exercising regularly	0.344	0.052	0.139	-0.117	0.444	-0.196	-0.002	0.238	0.115
01 Have an irregular diet	-0.047	0.130	-0.149	0.065	-0.052	0.719	-0.051	0.114	0.072
16 Have a regular schedule for work and life	0.107	0.053	0.200	0.091	0.122	-0.663	-0.098	0.264	0.071
18 Be occupied with work and often work overtime	0.082	-0.050	0.277	0.025	-0.035	0.647	-0.018	0.113	0.046
10 Hope that someone could help clean the rented house	-0.126	0.150	0.046	-0.224	0.212	0.393	-0.023	-0.056	0.193
04 Like shopping online	-0.043	0.086	0.032	0.205	0.032	0.026	0.791	-0.086	0.078
06 Like shopping in physical stores	0.212	0.214	-0.075	0.234	-0.037	0.017	-0.695	0.062	0.058
03 Be not particular about food as long as it is convenient and enough	-0.090	0.063	0.035	0.018	0.040	0.078	-0.129	0.768	0.057
02 Have a lite and healthy diet	0.142	0.020	-0.094	0.167	0.308	-0.290	0.073	0.488	-0.096
07 Buy whatever is desirable	0.136	-0.221	0.006	0.124	0.090	0.089	-0.030	-0.092	0.678
15 Like playing computer games	0.036	0.230	-0.038	-0.120	0.048	0.088	0.019	0.164	0.620
Feature value	2.581	2.198	2.014	1.979	1.830	1.811	1.558	1.528	1.522
Explained variance %	8.325	7.091	6.497	6.385	5.904	5.842	5.024	4.929	4.910
Cumulative variance %	8.325	15.416	21.913	28.298	34.202	40.044	45.068	49.998	54.908
Factor denomination	casual outgoing	frugal conservative	active aggressive	clean tidy	studious positive	busy tired	online consumption	healthy diets	generous playful

4.2. Cross Analysis between Single Tenants and Basic Information

This research conducts cluster analysis about 9 life style factors as discussed above by K - Means Cluster method. According to factor scores on these factors, the respondents can be grouped into six clusters, and each cluster takes top 3 to 4 factors that the average absolute value is greater than 0.38 as the basis for cluster analysis and denomination. The six clusters and their proportions are groups of ordinary and playful (25.3%), Lazy and thrift (18.1%), casual and generous (17.4%), toil and tidy (16.8%), busy and outgoing (13%), aggressive and hard-working (9.4%) as shown in Table 2.

Then, the cross analysis of the basic information of six clusters are conducted. The results show that there are significant differences among regions, genders and professions. In terms of regional differences, the number of people in the group of aggressive and hard-working stands at the highest percentage in Guangdong, followed by casualness and ordinary and playful. The number of people in the group of busy and outgoing stands at the highest percentage in Taiwan, followed by toil and tidy. In terms of gender differences, the number of women in the group of toil and tidy, aggressive and hard-working and lazy and thrifty accounts for a higher percentage while the number of men in the group of casualness and busy and outgoing stands at a higher percentage. As for professional differences, the number of administrative officers and educational and scientific research personnel in the group of ordinary and playful accounts for a higher percentage; the number of design and art workers in the group of toil and tidy accounts for a higher percentage; the number of design and art workers as well as professional and technical personnel in the group of aggressive and hard-working accounts for a higher percentage; the number of professional and technical personnel in the group of casual and generous accounts for a higher percentage; the number of business service personnel, design and art workers together with professional and technical personnel in the group of lazy and thrifty accounts for an average percentage with the number of art and design workers in the group of busy and outgoing accounts for a higher percentage.

Table 2. Cluster analysis and denomination

Cluster/ Factor	1)ordinary and playful	2)lazy and thrifty	3)casual and generous	4)toil and tidy	5)busy and outgoing	6)aggressive hard-working	F Value	P Value
	Average	Average	Average	Average	Average	Average		
1) casual and outgoing	-0.20603	-0.05748	-1.51632	0.20473	0.41652	0.71450	46.164	0.000
2) frugal and conservative	0.26957	-0.22336	-0.49456	-0.65686	0.59091	0.17972	22.153	0.000
3) active and aggressive	-0.71817	-0.00451	0.81468	0.11471	0.38170	0.13315	26.810	0.000
4) clean and tidy	0.06269	0.52128	0.00520	-0.96661	0.25746	0.13948	26.891	0.000
5) studious and positive	0.16371	0.42526	-0.68920	0.35530	-0.30871	-0.42043	15.631	0.000
6) busy and tired	-0.14355	0.61714	0.32486	-0.32111	-1.03916	1.12613	78.406	0.000
7) online consumption	0.34551	0.35641	0.46156	-0.53862	-0.11426	-0.58528	18.915	0.000
8) healthy diet	0.58459	-1.00410	0.38636	0.01514	-0.37950	0.38975	42.960	0.000
9) generous and playful	0.38269	0.41968	-0.47575	0.14364	-0.43175	-0.53839	18.092	0.000
Times	119	79	44	82	85	61		
percentage (%)	25.3%	16.8%	9.4%	17.4%	18.1%	13.0%		

p<0.05 represents a significant

4.3. Cross Analysis between Young Tenants and Cooking and Diets

This study conducted cross analysis and chi-square tests about the statistics collected from the analysis results of six clusters of young single tenants, the appliances and styles of kitchens, cooking and diets. The results show that there is no obvious difference in the styles and cooking appliances of kitchens, the staple food and cooking problems. Therefore, the above four issues will not be discussed in this study. However, there are significant differences in the diet behaviors and cooking frequency during working days and holidays among various clusters.

In terms of diet behaviors, people in the group of ordinary and playful, toil and tidy as well as aggressive and hard-working have meals during working days by ways of going outside, ordering take-away, going to the company's canteen and cooking by their own with an average percentage. During holidays, the ways of cooking by themselves and ordering take-away are in the majority. People in the group of casual and generous mainly have meals outside and in the company's canteen during working days while having meals outside is still the main way of eating during holidays, followed by cooking by themselves. People in the group of lazy and thrifty mainly have meals by the ways of going outside, cooking by themselves and going to the company's cafeteria during working days, while cooking by themselves remains the main way of having meals during holidays.

In terms of cooking frequency, the overall sample shows that occasional cooking stands at the highest percentage of 56.8%. Often cooking ranks second with the percentage of 19.6% followed by never cooking with the percentage of 14.5% and cooking everyday with the percentage of 49.1%. In terms of cooking frequency of different groups, people in the group of ordinary and playful as well as toil and tidy take the percentage of 10.1% in never cooking, which shows people in the two groups have a higher percentage of cooking by themselves. According to the higher percentage of their cooking in between the two groups. The value distribution of the group of casual and generous as well as aggressive and hard-working is close to the average value of the overall sample. The distribution of lazy and thrifty group is special featuring never cooking takes the highest percentage of 20%, occasional cooking takes the lowest percentage of 40% and cooking everyday takes the highest percentage of 22.4%.

5. CONCLUSION AND SUGGESTIONS

This research mainly aims at analyzing the rental housing forms of young office staff, taking 470 young single tenants in cities of Guangdong and Taiwan as subjects by questionnaire survey. In view of analysis of the kitchen equipment, diet cooking, lifestyle and different groups, conclusions are put forward as follows:

1. The results of this study show that the independent suites and shared houses with 2 rooms and 1 hall take a higher percentage in the ways of renting houses in Guangdong and Taiwan with a few people living in the company's dormitories. There is a significant difference of the styles of kitchens among different renting houses. Nearly 90% of the renting houses in Guangdong are equipped with kitchens while less than 50% of that in Taiwan is equipped with kitchens. The kitchen appliances are mainly used to meet the demands of basic cooking. The kitchens in Guangdong are well-equipped with higher frequency of cooking by the

tenants themselves. Most of the renting houses Taiwan are not equipped with kitchens, but the food culture is diverse with more choices of snacks and higher percentage of having meals outside.

2. In this research, 9 life style factors are extracted through the SPSS factor analysis and the cluster analysis is carried out to analyze the group of ordinary and playful, toil and tidy, aggressive and hard-working, casual and generous, lazy and thrifty as well as busy and outgoing. The cross analysis is conducted to analyze the six clusters, which shows there are significant differences among regions, genders and professions.
3. Young people in Guangdong and Taiwan have the same diet idea featuring healthy, clean, fresh, delicious and fast. But there are significant differences between the staple foods in Guangdong and Taiwan. 70% of the young people in Guangdong have rice as their staple food, while in Taiwan, 50% of the young people do not have fixed staple food with nearly 40% of the young people having rice as their staple food. In terms of diet behaviors, this research reveals that the characteristics of different clusters influence the diet lifestyle. People in the group of ordinary and playful, toil and tidy along with aggressive and hard-working mainly have meals outside during working days while they prefer to cook by themselves during holidays. People in the group of casual and generous as well as busy and outgoing would like to have meals outside both during working days and holidays. The distribution of diet behaviors for people in the group of lazy and thrifty during both working days and holidays is special with non-cooking, often cooking together with cooking everyday standing at the highest percentage at the same time.
4. This research mainly discusses the correlation between the life style clusters of young single tenants in urban areas of Guangdong and Taiwan and their diet behaviors. The results of this study will be able to provide reference for the further academic researches about the comparison of lives between Taiwan and mainland China, providing reference for the product development and design of kitchen utensils and appliances used by the singles.

REFERENCES

- Yang, C., Chen, Y. P., Huang, Y. J. (2013). The investigation of the young gender differences and the mode of automobile usage in Taiwan. *IASDR 2013, 5rd Conference*, No.1780-2, Tokyo, Japan. NSC101-2629-E-224-001.
- Plummer, J. T. (1974). The concept and application of life style segmentation. *Journal of Marketing*, 38(1), 33-37.
- Yoram Wind & P.E. Green (1974). Some Conceptual, Measurement and Analytical Problems in Life Style Research, in *Life Style and Psychographics*. Chicago: American Marketing Associationpp, 106-122.
- National Bureau of Statistics of China (2000). Statistics of the fifth population census of the People's Republic of China. Source website:
<http://www.stats.gov.cn/tjsj/ndsj/renkoupucha/2000jiedao/html/J44.htm>.
- Wang, R. Q. (2013). *A Preliminary Study of Urban Young Singles Temporary Rental Housing Design—Shanghai as an example*. (Unpublished, master's thesis) National Dong Hwa University, Hualien. Tapei, Taiwan.
- Directorate General of Budget, Accounting and Statistics of Executive Yuan (2011). *2010 summary analysis of preliminary statistics of population and residential census*. Source website:
<http://www.dgbas.gov.tw/public/Attachment/111171361171.pdf>.

Wu, M.L. (2010). The practice of quantitative analysis of questionnaire data—SPSS operation and application. Chongqing: Chongqing University Press.

INCREASING THE INTERGENERATIONAL INTERACTIONS BETWEEN THE ELDER AND THE CHILD - TAKING LIFE EXPERIENCE AS EXAMPLE

You-Zhen Lu ^{*a}, Prof. Min-Yuan Ma^a and Prof. Chun-Heng Ho^b

^{*a} *Department of Industrial Design, National Cheng Kung University, Taiwan
(R.O.C.), ruby83626@gmail.com*

^a *Department of Industrial Design, National Cheng Kung University, Taiwan
(R.O.C.), mamy@mail.ncku.edu.tw*

^b *Department of Industrial Design, National Cheng Kung University, Taiwan
(R.O.C.), hoch@mail.ncku.edu.tw*

ABSTRACT

With the changing population structure, “aging” and “declining birth rate” have become hot topics in recent years. Much attention has been paid to the interactions between the old generation and the young generation. In order to bridge the gap between them, the idea of intergenerational learning is applied in activities to realize the goal. With an in-depth study on the relationship between a group of elder and a group of the child, this paper finds out their satisfaction on the intergenerational learning activities and feelings about each other based on Likert Scale. Moreover, the paper determines interview outlines with semi-structured interview method, and in-depth interviews are made to understand opinions and feelings of participants. Next, the results are analyzed. The nonverbal behaviors and actions of the elder and the child are observed, recorded and analyzed, which is integrated into a form. In addition, verbal data are collected and analyzed to discuss the feasibility of intergenerational activities, and how the elder and the child feel about each other.

This study has four results. First, intergenerational activities help shorten the distance of the elder and the child. Second, the child can change their views on the elder and they become friends. Third, such intergenerational learning activities can bridge the gap between two generations. Fourth, the fact that the child learns from life experiences of their elder gives the latter a sense of accomplishment. The results of this study can be used as a reference for intergenerational interaction in industrial planning, and point out effects of intergenerational learning activities.

Keywords: *Aging, Intergenerational learning, Interaction, Life experience activities*

* Corresponding author.

1. INTRODUCTION

With the progress of science, technology, and medical treatment, the average life expectancy of the human being has been gradually extended, and the fertility rate has been decreasing year by year. Thus, much attention has been paid to declining birthrate and aging in recent years. Since 1993, Taiwan has officially become an “aged society”. According to the investigation from Taiwanese Ministry of Interior, there have been 3,139,397 people aged 65 or above by the end of February 2017, 13.33% of the total population. As a result, due to changes in the population structure and the family structure, there are fewer interactions between the elder and the child, who may become farther away from each other. With limited interactions between them, the child fails to learn from life experiences and wisdom of the elder and the latter will miss the vitality of the former and opportunities of contributing to the society (Schwalbach & Kiernan, 2002). To make the two generations closer, intergenerational activities provide a platform for them to learn and change views from each other and increase their self-worth.

“Intergenerational learning” means the child and the elder are equal partners who share experience, learn from each other and change their views on each other (Granville, 2002). Huang Fushun (2004) defines that Intergenerational learning means the elder and the child take part in learning activities, during which they communicate and interact with each other, share their ideas and feelings, and improve their relationship and complete meaningful tasks so that both of them learn and grow together. “Intergenerational learning” is an interaction between the elder and the child, including sharing knowledge, teaching skills and face-to-face contacts, all of which are of special value for both the elder and the child (Wang & Yang, 2009). Specifically, there are several forms, such as teaching-style learning, digital experience, learning by doing, and social learning. In the “learning by doing”, the elder and the child take part in activities together, during which the former guide the latter with their rich social experience in such four stages as experience, reflection, induction, and application, so as to grow together. The famous philosopher John Dewey (1938) raised the concept of “learning by doing”, stressing that learning is a process where experience is constantly accumulated and improved, point out the meaning of learning by doing. Therefore, this research adopts the style of learning by doing as a platform, where the child participate in the life experience of the elder, so as to create more common topics between them, shorten their distance and show more care to each other.

There are five types and application of intergenerational learning: recreation, education, public service, personal development and health promotion (Figure 1). In this study, education was applied for the experiments. Originally, the child was the target of the education system. However due to the aged society, the elder is now becoming the target of the education as well. During educational courses and activities, the elder can impart social experience and skills to the child, while the latter can share their experience and creation with the former, such as how to use 3C products. In this way, the two generations can communicate with, learn from and know more about each other, so as to present diverse and rich results.



Figure 1: Ames & Youatt (1994). Model for selecting appropriate intergenerational education and service activities, p.760.

Based on intergenerational learning, the paper studies how the elder and the child shorten the distance, feel the care from each other and find common topics between them during the activities.

Specific objectives:

- (1) How to design one-day life experience activity to explore the feasibility of interactions between the elder and the child.

2. RESEARCH METHODS

Based on the method of intergeneration learning to design a "life experience" activity for the elder and the child. In order to understand the satisfaction and interactive experience of elder and the child, questionnaires by using Likert scale were conducted in this study. Furthermore, the semi-structured interview method was applied to understand the feeling and thought of the participants.

2.1. Participants

An intergenerational learning study was conducted on a group of the elder over 65 and primary school student aged between 7 and 12. Through life experience activities, it is possible to discuss interactions between the two generations, who are expected to provide the most assistance and data to the study.

2.2. Method of collecting data

The data collecting methods used in this study were semi-structured interview and questionnaires, which are described below:

2.2.1. Questionnaire survey

In order to measure the satisfaction and feelings of participants, the elder and the child give scores with the Likert scale from 1 to 5, with 1 meaning "strongly disagree" and 5 "strongly agree".

2.2.2. Semi-structured interview method

This study is conducted with the semi-structured interview, with outlines previously determined so that interviews are more effective and focused on the topic. Here are interview outlines for the elder and for the child. The structure of Interviews for the elder and the child are as follow below:

(1) Interview outline for the elder

What are their preferred conditions when they like to have activities?

What are their views on interactions with the child during intergenerational learning? What are their feelings about talking with the child?

What are their views on intergenerational learning?

What are their views on taking part in activities with the child?

What are their feedbacks on and suggestions about activities?

What are their willingness of being involved in another activity?

(2) Interview outline for the child

What are their reasons for loving such activities?

What are their views on taking part in activities with the elder?

What are their views before and after intergenerational activities?

What are their differences between before they take part in activities with the elder and after?

What are their feelings of talking with the elder?

What are their willingness of being involved in another activity?

3. RESEARCH RESULTS AND ANALYSIS

Interview data is collected as the basis of the study. The whole interview is recorded and all verbal data are transmitted into text. For nonverbal messages like facial expressions and body movements that cannot be recorded, images can make up and help further data analysis.

3.1. Basic information of participants

A group of the elder and the child are selected for the study, with their basic information as follows.

3.1.1. Basic information for the elder

It is of necessity to understand, from related literature, the age of the elder, family status, recreational activities and participation in similar activities. The study is conducted on an elder person, aged over 70, living with the spouse, with farming as recreation and not yet involved in intergenerational activities (Table 1).

Table 1: Basic information of the elder

Object of study	Gender	Age	Family Structure	Recreation	Participating in related activities or not
The Elder	F	Over 70	Living with spouse	Planting Crops	No

3.1.2. Basic information of the child

It is essential to learn about the age of the child, siblings, whether they live with grandparents and frequency of visiting grandparents. The study is conducted on the child, aged between 7 and 10, having a sister, not living with grandparents, and visiting them at least once a month (Table 2).

Table 2: Basic data of the child

Object of study	Gender	Age	With siblings or not	Living with grandparents or not	Frequency of visiting grandparents
The Child	M	7-10	Yes	No	At least once a month

3.2. Design intergenerational activities

This study focuses on intergenerational learning activities between the elder and the child as well as benefits from their interactions. According to Ames and Youatt (1994), there are five types including recreation, education, health promotion, public service and personal development, first with education as the theme to design activities, during which the child learn professional skills from the elder. This is not only inheritance, but they can learn from each other.

3.2.1. Activities

Related literature is referred to conduct educational activities. Based on daily activities of the elder, it is feasible to have activities like picking, washing, cooking and eating vegetables, in which the elder and the child take part together. The main purpose is to shorten their distance, help the child know about and eat vegetables and understand the importance of a balanced diet to the body. Through the activity, the child joins the elder in their daily activities, which will not only enable the child to understand new knowledge but also give the elder a sense of achievement because of the child's participation. The activity lasts two hours (Table 3).

Table 3: Activities

Type	Name of activity	Details	Purpose	Time
Education	Best Cooperation	1. Picking vegetables. 2. Washing vegetables. 3. Stir-frying vegetables. 4. Eating vegetables.	1. Shorten their distance. 2. Develop a balanced diet. 3. Know about vegetables of the season. 4. Understand the importance of a balanced diet to body.	120

3.2.2. Analysis of questionnaire

Based on the questionnaire of intergenerational activities, both the elder and the child are quite satisfied and enjoy the company of each other, willing to take part in similar activities again. Through these activities, they will know about each other and improve their relationship. After activities, they will discuss what happened in the process, which increases common topics between them.

(1) Analysis of questionnaire for the elder

The elder is quite satisfied with the activities in the study because it is their first time to take part in such activities with the child and they can build a strong relationship from strangers to friends. As the elder teach the child professional skills, they begin to have common topics. During the activities, the elder can feel care and warmth from the child. In the end, the former will ask the latter about the activities and time of other ones. For the elder, intergenerational learning is a great platform where they can have a sense of achievement from teaching professional skills and feel the vitality of the child (Table 4).

Table 4: Analysis of questionnaire for the elder

No.	Question	Purpose	Score
1	Do you like today's activity?	To understand about satisfaction.	5
2	Do you have fun with the child?	To understand about the feeling of participating in activities with the child.	4
3	Do you feel closer to the child through the activity?	To understand about whether intergenerational learning has improved their relationship.	5
4	Are you willing to take part in similar activities?	To understand about the feasibility of intergenerational learning.	5
5	Are you going to discuss what happened today after the activity?	To increase common topics.	4
6	Do you care about each other in the activity?	To shorten their distance.	5

(2) Analysis of questionnaire for the child

The child has great satisfaction with activities in the study. The child usually plays with peers, with little time spent with the elder. Therefore, they are satisfied and impressed when they complete many tasks with the elder for the first time. During the activities, the child thought the elder was slow moving, but are surprised by their fast speed in picking and cutting vegetables, which changes the child's views on the elder. Generally speaking, the child has positive comments and are much impressed by the activities, what happened in the process and dialogues with the elder after activities (Table 5).

Table 5: Analysis of questionnaire for the child

No.	Question	Purpose	Score
1	Do you like today's activities?	To understand about satisfaction.	4
2	Do you have fun with the elder?	To understand about the feeling of participating in activities with the elder.	5
3	Do you change views on the elder?	To understand about their views on the elder.	5
4	Do you feel closer to the child through the activity?	To understand about whether intergenerational learning has improved their relationship.	5
5	Are you willing to take part in similar activities?	To understand about the feasibility of intergenerational learning.	5
6	Are you going to discuss what happened today after the activity?	To increase common topics.	4
7	Do you care about each other in the activity?	To shorten their distance.	4

3.3. Activity record

According to the record, the elder is delightful, energetic, and flexible in communicating with the child or teaching them skills, without limits of old age and they keep positive and share their own experience. Besides, the child is also in a good mood, curious about behaviors of the elder and in much joy when finding what they are interested in.

In terms of feedbacks and advice, participants are highly satisfied with the processes and arrangements for the activities, and willing to participate in similar activities. As for language expression, the elder speaks Hakka. Though they can speak Mandarin, Hakka can shorten the distance between the two generations and realize effective communication. The reason why there are many positive feedbacks is that the elder actively shares their skills with the child and the former are infected by the latter's vitality. Therefore, the activities help share experience and promote interactions between each other (Table 6).

Table 6: Details of observation record

Aspect	Detail	Record Description
Emotions	Happy	1. The elder are happy when the child are surprised by their fastness and skillfulness in throwing away old leaves of cabbage. 2. The elder have a sense of achievement from showing the child beautiful farmland. 3. The child are happy pulling up radish with the elder. 4. The child come back loaded with eight kinds of vegetables. 5. The child can eat what is cooked by the elder and them together.
	Excited	1. The child cannot wait to go into farmland. 2. The child can feel much water when washing vegetables.
	Strange	1. The child go into farmland for the first time. 2. The child use a turning shovel for the first time.
	Confident	1. The elder teach the child how to trim vegetables for cooking. 2. The elder tell the child what needs attention when washing vegetables. 3. The elder put washed vegetables into the pot.
	Fond	1. The child see cabbageworm on vegetables. 2. The elder discuss cabbageworm with the child.
	Expecting	1. The elder help the child know about vegetables of the season next time they meet each other. 2. The child will be assistants to the elder next time they meet each other.
Social Interaction	Good Interaction	1. The elder will pass washed vegetables to the child and let them put into the basket. 2. The elder use tools to pick bottle gourd and the child push aside leaves to pick vegetables together. 3. The elder and the child pull up radish together. 4. The child turn down the tap when there is much water. 5. The child listen to the elder to add salt when stir-frying Chinese cabbage.
	Sharing Experience	1. The elder teach different skills for picking different vegetables. 2. The elder tell the child the differences between vegetables that are ripe and not. 3. The elder tell the child skills of choosing radish. 4. The elder tell the child steps of stir-frying Chinese cabbage.
Attention	Concentration	1. The elder are careful in saying every sentence. 2. The child are focused on picking vegetables and stir-frying Chinese cabbage. 3. Both the elder and the child are focused on activities.
Performance	Imitation	1. The child will imitate the elder to pick vegetables with tools.
	Highly Involved	1. The child will want to pick crown daisy chrysanthemum when they master the skill. 2. The elder are enthusiastic in taking part in these activities and willing to try with the child next time.

3.4. Analysis of interactions between the elder and the child

Through intergenerational interactions based on life experience, the study has detailed analyses from three aspects, including shortening the distance between each other, increasing common topics and caring for each other.

3.4.1. Shortening the distance between each other

During the process, the elder will pass the selected vegetables to the child, making them closer to each other. When pulling up radish, the child can not only know more about vegetables but also unite with the elder to experience the strength of unity. In the process of picking, washing, cooking to eating vegetables, everyone accompanies each other with talking and laughing (Table 7).

3.4.2. Increasing common topics

As the activity is to go into farmland, it is necessary to change shoes. The elder tells the child they have to wear suitable shoes in farmland, which is the start of their dialogues. During the activity, the elder teaches the child to know about vegetables and how to pick them. While picking vegetables, they will see many tiny cabbageworms, which will also become their common topic. In the process of stir-frying vegetables, the elder will teach the child related skills and methods, and the child will ask many questions out of curiosity. Such a question-and-answer step gradually increase interactions and common topics. After the dish is done, they will talk about the activity while eating vegetables stir-fried by them together. Throughout the process, the elder plays the role of a teacher, imparting experience to the child, and the child learns a lot of knowledge and skills in growing, picking, cleaning and cooking vegetables. Therefore, both sides have increased not only many interactions and but also common topics (Table 7).

3.4.3. Caring for each other

Dangerous tools are used in selecting vegetables, so the elder will exhort the child to be careful. Before going into farmland, they need to take the stairs because of horizontal differences, and they will tell each other to walk carefully. Besides, as stove and turning shovels are used in cooking, they will remind each other to be cautious. Throughout the process, the elder is concerned about the child, and the child is concerned about the elder walking in farmland. Thus, it is found that both sides care about each other and can feel warmth in their heart (Table 7).

Table 7: Details of shortening distance, increasing common topics and caring about each other

Shortening distance	Increasing common topics	Caring about each other
Go to the vegetable garden hand in hand.	Prepare before going into farmland-change shoes.	Use tools.
Pick vegetables and pass them to each other.	Know about vegetables.	Take the stairs.
Pull up radish together.	How to pick vegetables.	Walk in farmland.
Wash vegetables together.	Cabbageworms on vegetables.	Don't get wet when washing vegetables.
Stir-fry vegetables together.	Steps of stir-frying vegetables.	Use the turning shovel.
Eat vegetables together.	Feelings after cooking and eating vegetables.	Be careful with the high temperature when cooking.
		Be careful with the high temperature when eating.

4. CONCLUSION

Due to changes in family structure, the elder and the child have fewer chances to interact with each other, creating estrangement between them. Through intergenerational learning, they can get to know each other once again and change their fixed views on each other, so as to build a friendly relationship.

In this study, intergenerational learning activities provide chances for the elder to interact with the child and for the child to change fixed views on the elder, in order to establish the friendship. Besides, the child can learn from the elder, not only how to communicate with the elder but also professional skills. During intergenerational learning activities, interactions are both verbal and nonverbal. As the elder speak Hakka dialect in the process, they can teach the child how to say different vegetables in Hakka, which is language learning. For nonverbal communication, there are facial expressions and movements in which people can feel their attitudes towards each other. Overall, intergenerational learning is a good platform that can increase interactions between each other.

In order to increase the emotional relationship between elder and child, three principal emphases was generated through the “life experience” activity: shorten the distance between each other, increasing common topics, and increasing common topics. Elder and child behave emotions, social interaction, attention, and performance to each other through this activity. For example, the first time of child contact with crop and experience the feeling of farming which makes them feel both strange and excited (emotional). Under the leadership of elder and child hand in hand (social activity), make child full of security, be brave to experience the feeling of walking in the fields (performance). The child is very attentive to each of the harvesting skill conveyed by the elder (attention).

At the end of the study, the two generations become closer, care about each other, have smooth communication and enjoy a harmonious relationship. These activities not only help the elder to find new roles, get a sense of achievement and review the whole life but also satisfy their emotional needs as they age.

The study has the following four results:

- (1) Intergenerational activities in this study help shorten the distance between the elder and the child.
- (2) The child can change views on the elder and become close friends.
- (3) Intergenerational learning activities can bridge the gap between the two generations.
- (4) The child learns from the elder's life experience, giving the elder a sense of accomplishment.

REFERENCES

- Ames, B. D., & Youatt J. P. (1994). Intergenerational education and service programming: a model for selection and evaluation of activities, *Educational Gerontology*, 20, pp. 755-764.
- Chu, W.-L. (2008). *The Record of the Intergenerational Program Conducted in a Kindergarten Environment-The example of Creative Art Activities* (unpublished Master thesis). Ming Chuan University, Taipei, Taiwan (R.O.C.).
- Chen, Y.-C. (2014). Learning Process and Effects of Incorporating Intergenerational Learning in a Social Gerontology Course. *Journal of research in education sciences*, 59(3), pp. 1-28.
- Davis, L., Larkin, E., & Graves, S.B. (2002). Intergenerational learning through play. *International Journal of Early Childhood*, 34(2), 42.
- Dewey, J. (1938) *Experience and education* (New York: MacMillan).
- Granville, G. (2002). A review of intergenerational practice in the UK. *Beth Johnson Foundation*. Retrieved October 21, 2016. Retrieved from <http://www.centreforip.org.uk/Libraries/Local/67/Docs/Review%20of%20IP%20in%20UK.pdf>
- Huang, F. (2004). *Elder Learning*. Wu-Nan Book Inc., Taipei, Taiwan (R.O.C.).
- Ministry of the Interior Department of Statistics. (2016). Demographic structure. Retrieved October 21, 2016, from http://www.moi.gov.tw/files/news_file/week10530.pdf
- Schwalbach, E., & Kiernan, S. (2002). Effects of an intergenerational friendly visit program on the attitudes of fourth graders toward elders. *Educational Gerontology*, 28, pp. 175-187.
- Wang, P.-H., & Yang, K.-T. (2009). An research of intergenerational learning interaction between elders as transmitters and young learners. *Journal of Pingtung University of Education: Education*, 34, pp. 149-176.

EVALUATING HUMAN- ROBOT INTERACTIONS FROM INSIDE AND OUTSIDE: COMPARISON BETWEEN FIRST-PERSON AND THIRD- PERSON PERSPECTIVES

Kazuki YANAI^a, Aiko MURATA^{a,c}, Ryota MIZUTANI^b, Akira ICHIBOSHI^b, Kazunari
KOMATSUZAKI^b, Roshan THAPLIYA^b, Katsumi WATANABE ^{*a, d}

^a Waseda University, Japan, katz@waseda.jp

^b Research & Technology Group, Fuji Xerox Co., Ltd., Japan

^c Japan Society for the Promotion of Science, Japan

^d The University of Tokyo

ABSTRACT

Evaluating the quality of human-robot interactions is essential for designing social robots. To design an integrated system with robots and people working together in an office or school, it is important to consider not only how a person feels when directly interacting with a robot (first-person perspective), but also how people evaluate the interaction from a third-person perspective. In this study, we aim to identify the factors in human-robot interaction that improve communication from the first-person and the third-person perspectives and examine the relationship between these factors. First, we asked participants to interact with a robot and videotaped their interactions. After the interaction session, the participants completed questionnaires for evaluating the interaction from a first-person perspective. Next, we showed this video to another group of participants and asked them to evaluate the robot-participant interactions. This was done to get a third-person perspective. The third-person perspective evaluations were mostly consistent among the evaluating participants. On the other hand, the third-person evaluations did not necessarily match those from the first-person perspective. However, several factors in the first-person evaluations correlated with how people would have a good impression toward the observed interaction. The results suggest that certain factors contribute to forming consistent impressions of human-robot interactions from the third-person perspective.

Keywords: Human-robot interaction, Interaction evaluation, Third-person perspective

* Corresponding author.

1. INTRODUCTION

There are growing needs for robots that are capable of not only assisting physical manipulation (e.g., precise motion in manufacture), but also supporting and being involved in human social life by facilitating and/or mediating social interactions (Tahir et al., 2014). There is a high demand for such robots to develop an integrated system with robots and people working together in an office (Asoh et al., 2001), school (Kanda et al., 2007), and other situations. To design robots working with groups of people, it is important to consider not only how a person feels when directly interacting with a robot (first-person perspective) but also how people evaluate the interaction from a third-person perspective. This is because one of expected functions of such social robots working with groups of people is to motivate participations and facilitate smooth group interaction/communication. Although some studies have assessed the impression of human-robot interactions from first-person perspective (e.g., Kanda, Ishiguro & Ishida, 2001; Ogata & Kanno, 2000), there are few studies investigating how a third-person observing the communication between the human and the robot feels about that interaction. However, the feelings for the communication might have a profound impact on the motivation of a third-person observer to join and enjoy the conversation with the robot.

Given that there might be mismatches between the evaluation from a third-person perspective and the feelings of the person in a first-person interaction in the context of human emotion recognition (Busso & Narayanan, 2008), the interaction with the robot could form different impressions in the first-person perspective and the third-person perspective. Therefore, in this study, we aim to identify factors in human-robot interaction that improve communication from the first-person and the third-person perspectives and examine the relationship between the factors.

In Experiment 1, we asked participants to interact with a communication robot and videotaped their interactions. After the interaction session, they completed the questionnaires regarding their impressions of the robot and the quality of the communication (i.e., the first-person perspective). In Experiment 2, we showed the interaction videos to another group of participants and asked them to answer a questionnaire about the impression of the robot/participant and the quality of the communication in the video (i.e., the third-person perspective).

2. EXPERIMENT 1

2.1. Methods

2.1.1. Participants

A total of 24 people (21 males and 3 females; age ranging from 28 to 50) participated in Experiment 1. They provided written, informed consent, and agreed to having their behavior videotaped during the experiment.

2.1.2. Robot

We used the robot “Pepper” (SoftBank Corp.) for the experiment. The robot spoke to the human and behaved based on one of two scenarios. The two scenarios were made to manipulate impression of the robot. One scenario was designed to provide an extroverted impression, while the other was designed to provide an introverted impression (see Table 1). The characteristics of Pepper were designed and deployed by Fuji Xerox as a part of study of next generation UIs in office deployment.

Table 1: Introvert scenario and extravert scenario

Introvert scenario	Good morning Mr.xxx. I have been waiting for you. Did you sleep well last night? I see. It is very important to have a good quality sleep. Hey, why not do a complexion check? Could you please show me your face? You look well. I look forward to working with you today.
Extravert scenario	Good morning Mr.xxx! How are you feeling today? I see. Your smile is very popular among others. Hey, why not do a smile check? Please smile at me. Nice! Ok then, keep up the good work with that smile!

2.1.3. Procedure

Each participant was asked to enter the room where the robot was setup. After the participant moved closer to the robot, the robot started to speak to the human based on one of the two scenarios (extroverted scenario or introverted scenario). The participant was asked to interact with the robot freely. When the scenario ended, each participant was required to leave the room and complete the questionnaire outside the room. All participants interacted with the robot in both scenarios (extrovert and introvert) sequentially. The order of the scenarios was counterbalanced across participants.

2.1.4. Questionnaire

In order to evaluate how the scenarios would influence the impression of the robot, we included the following items for the evaluation: (1) the degree of extroversion of the robot, (2) ease of talking to the robot, (3) the occurrences of eye contact with the robot, (4) friendliness of the robot, (5) the degree of satisfaction while communicating with the robot, (6) smoothness of the communication with the robot, (7) desire to ask something of the robot, and (8) desire to meet the robot again. Additionally, we measured the extroversion/introversion score of each participant by using the Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1994).

2.2. Results

As expected, the mean of the evaluation of extroversion of the extrovert robot from the first-person perspective was higher than that of the introvert robot ($t_{23} = 5.10, p < .0001$, Figure 1). This indicates that the scenarios provide the intended effects on the impression of the robots.

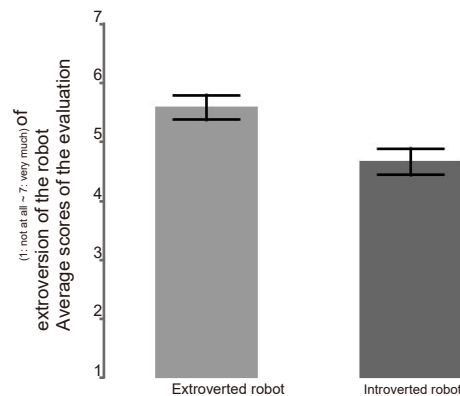


Figure 1: Average scores of the evaluation of extroversion of the robot. The bars represent the standard errors of the means.

Figure 2 shows the average scores of the impressions for each robot (extrovert/introvert) from the first-person perspective. Compared with the extrovert robot, the introvert robot gave the impression that the eye contact was more frequent ($t_{23} = 2.55, p = .018$) and that the communication was smoother ($t_{23} = 2.74, p = .012$). Further, the degree of satisfaction with the communication tended to be higher with the introvert robot than with the extrovert robot ($t_{23} = 1.86, p = .076$)

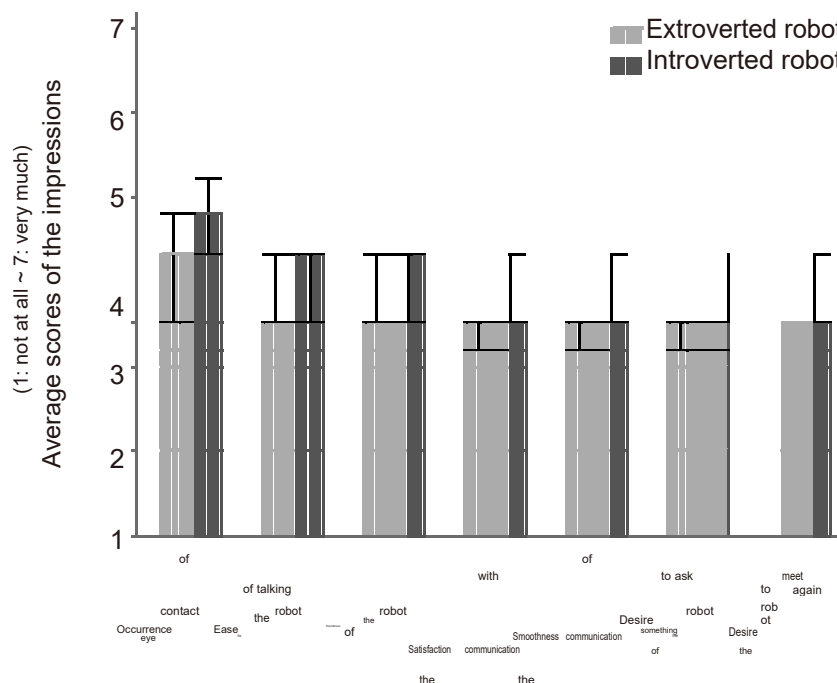


Figure 2: Average scores of the impressions from the first-person perspective for each robot (extrovert/ introvert). The bars represent the standard errors of the means.

3. EXPERIMENT 2

3.1. Methods

3.1.1. Participants

A total of 15 participants, different from those in Experiment 1, participated in Experiment 2 (6 males and 9 females; age ranging from 18 to 24). They provided written, informed consent before the experiment.

3.1.2. Stimuli

As 24 participants of Experiment 1 interacted with the two kinds of the robot sequentially, a series of videos were used in Experiment 2. It consisted of 48 video clips in which each participant was present in two videos. The video stimuli were divided into two stimulus sets so that the same person does not show up in a single stimulus set twice. The two stimulus sets were presented to the participants of Experiment 2 sequentially. Within the stimulus set, the video stimuli were shuffled randomly and the order of the presentation of the stimulus-sets was counterbalanced across the participants. Participants had a chance to rest after watching the first stimulus set.

3.1.3. Procedure

Video stimuli and following questions were presented on the computer-monitor of MacBook Pro (Retina, 15-inch, Mid 2015, Apple Inc.). At the beginning of every trial, each video clip was presented for up to about 40 s (from beginning to end of the conversation). Then, nine questions about the impression of the communication were asked sequentially (Figure 3). The next trial started after participants answered the questions.

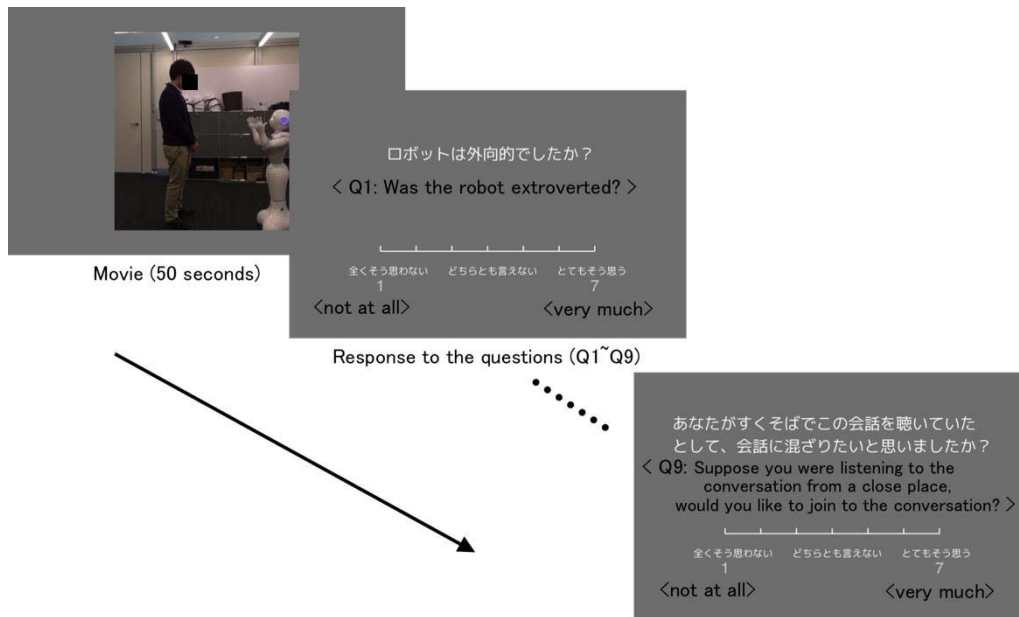


Figure 3: A sequence of events in a single trial in Experiment 2. The questions were as follows: (1) Was the robot an extrovert? (2) Was the person in the video an extrovert? (3) Did the person feel that the robot was easy to talk to? (4) Did the robot seem friendly to the person? (5) Was the communication unnatural? (the score was reversed and treated as the score of smoothness), (6) How frequently did the person have eye contact with the robot? (7) Did the person seem satisfied with the communication? (8) Was the communication good from the third-person perspective? (9) Suppose you were listening to this conversation, would you like to join to the conversation?

3.2. Results

3.2.1. Effect of the scenarios on the impression of the robots

As shown in the impression from the first-person perspective in Experiment 1, the mean evaluation of extroversion of the extrovert robot from the third-person perspective was higher ($M = 5.71$, $SD = 0.144$) than that of the introvert robot ($M = 4.36$, $SD = 0.211$) ($t_{23} = 28.25$, $p < .0001$).

Figure 4 shows average scores of the impressions for each robot (extrovert/introvert) from the third-person perspective. In contrast to the results of Experiment 1, the degree of satisfaction estimated from the third-person perspective tended to be higher for communication with the extrovert robot as compared to that with the introvert robot ($t_{23} = 1.84$, $p = .079$). Furthermore, the participants reported a greater desire to join the communications and perceived that the communications with the extrovert robot were better when compared with the communications with the introvert robot ($t_{23} = 2.45$, $p = .022$, $t_{23} = 1.84$, $p = .079$).

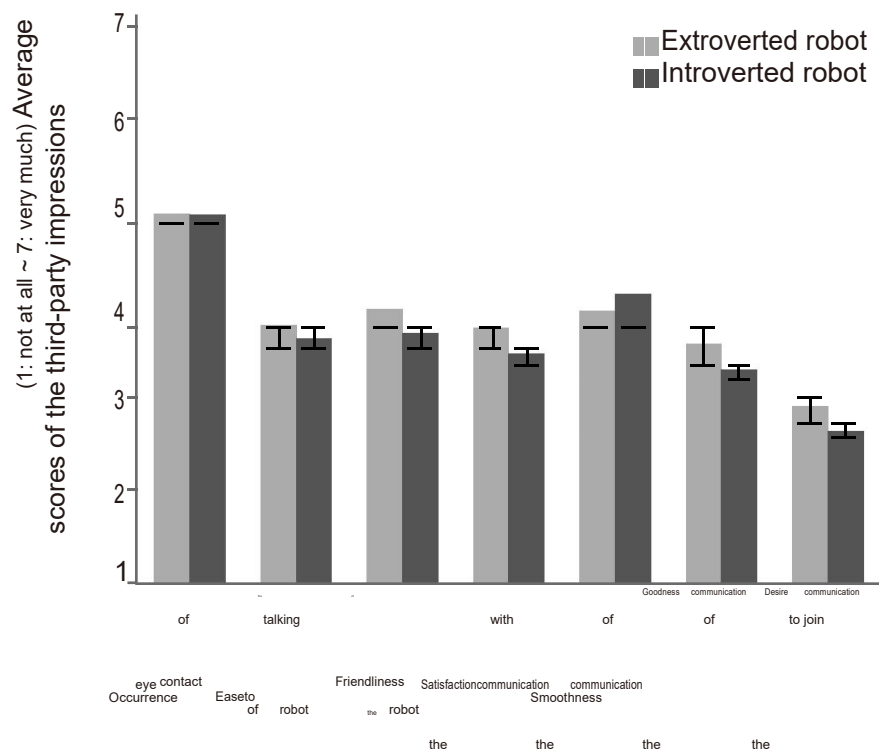


Figure 4: Average scores of the impressions from the third-person perspective for each robot (extrovert/introvert). Bars represent the standard errors of the means.

3.2.2. Consistency of the evaluations among the evaluating participants

The consistency of the evaluations among the participants in Experiment 2 were sufficiently high for all questions (Table 1), indicating that the impressions of each video was common among the third-person viewers. Thus, we calculated the average score of the responses to each question for each video and treated it as a single parameter called “the impression from the third-person perspective”

Table 2: Chronbach's alpha of the scores for each question

Questions	Chronbach's alpha
Extroversion of the person	0.94
Extroversion of the robot	0.90
Occurrence of eye contact with the robot	0.74
Ease of talking to the robot	0.88
Friendliness of the robot	0.90
Satisfaction of the person with the communication	0.89
Smoothness of the communication	0.78
Goodness of the communication	0.91
Desire to join the communication	0.87

3.2.3. Correlations between first-hand impressions and third-person evaluations

Table 2 and Table 3 show the Pearson's correlation coefficients between the impressions from the first-person perspective and those from the third-person perspective for the extrovert robot and introvert robot, respectively. If the third-person evaluations are consistent with the first-person impressions, the correlation coefficients in the boxed cells will be high. As shown in Table 2 and Table 3, the third-person evaluations did not necessarily match with those from the first-person perspective, while a few third-person evaluations correlated with the first-person impressions (Ease of talking to the extrovert robot: $r = .53, p < .01$, Friendliness of the introvert robot: $r = .44, p < .01$).

However, several factors in the first-person evaluations correlated with how people would have a good impression toward the observed interaction. For both the extrovert robot and introvert robot, subjective impression of extroversion of the robot significantly correlated with the evaluation of goodness of communication from the third-person perspective ($r = .71, p < .001, r = .70, p < .001$, respectively), and the desire to join the conversation ($r = .66, p < .001, r = .63, p < .001$, respectively). Further, subjective ease of talking to the robot and the desire for the first persons to ask the robot for favor were correlated with the evaluation of goodness of communication from the third-person perspective and the desire to join the communication (see Table 2, 3).

Table 3: Pearson's correlation coefficients between the impressions from the first-person perspective (columns) and those from the third-person perspective (rows) for the extrovert robot.

	Extroversion (EPQ score) of participants and the impressions reported from first-person perspective in the Experiment 1								
	Extroversion of the person (EPQ score)	Extroversion of the robot	Eye contact	Ease of talking to the robot	Friendliness of the robot	Satisfaction	Smoothness	Desire to ask	Desire to meet again
Extroversion of the person	.27	.72***	.14	.52**	.38†	.44*	.37†	.59**	.31
Extroversion of the robot	-.11	.04	-.03	-.10	.38†	.27	.25	.15	.01
Eye contact	.28	.45*	.13	.38†	.28	.22	.17	.52**	.22
Ease of talking to the robot	.30	.72***	.16	.53**	.41*	.46*	.34†	.62**	.36†
Friendliness of the robot	.35†	.66***	.16	.55**	.38†	.40*	.31	.63**	.32
Satisfaction	.29	.68***	.07	.56**	.35†	.39†	.29	.60**	.28
Smoothness	.34	.60**	-.01	.46*	.36†	.39†	.21	.61**	.29
Goodness	.34	.71***	.14	.52**	.38†	.46*	.32	.68***	.27
Desire to join	.36†	.66***	.03	.43*	.34	.39†	.22	.60**	.24

Table 4: Pearson's correlation coefficients between the impressions from the first-person perspective (columns) and those from the third-person perspective (rows) for the introvert robot.

	Extroversion (EPQ score) of participants and the impressions reported from first-hand perspective in the Experiment 1								
	Extroversion of the person (EPQ score)	Extroversion of the robot	Eye contact	Ease of talking to the robot	Friendliness of the robot	Satisfaction	Smoothness	Desire to ask	Desire to meet again
Extroversion of the person	.23	.69***	.19	.47*	.43*	.17	.32	.44*	.34
Extroversion of the robot	-.07	.14	.30	.22	.16	.10	.24	.37†	.37†
Eye contact	.11	.81***	.28	.70***	.58**	.32	.54**	.46*	.23
Ease of talking to the robot	.20	.67***	.23	.39†	.45*	.10	.35†	.36†	.33
Friendliness of the robot	.13	.68***	.30	.41*	.44*	.21	.45*	.38†	.33
Satisfaction	.13	.68***	.39†	.47*	.47*	.12	.40†	.49*	.28
Smoothness	.16	.25	.07	.02	.06	-.17	-.05	.07	.08
Goodness	.14	.70***	.34	.50*	.53**	.17	.45*	.41*	.27
Desire to join	.25	.63***	.40†	.51*	.59**	.17	.41*	.53**	.33

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

4. DISCUSSION

In this study, the participants directly interacting with the robot had a positive impression of the introvert robot (e.g., they reported greater satisfaction and smoothness of communication) as compared to the extrovert robot. However, the participants observing the interactions from a third-person perspective had a positive impression (e.g., good communication) and higher motivation to join the interactions with the extrovert robot as compared to the introvert robot. These results indicate that the robot's behavior different impressions when observed from the first-person perspective and when observed from the third-person perspective.

The correlation analysis revealed that the third-person evaluations did not necessarily match those from the first-person perspective, while the impressions of each interaction from third-person perspective was common among observers. However, we found that several factors in the first-person impressions could predict how people would have a good impression and a motivation to join the observed interaction. Taken together, the evaluations of human-robot interactions from the third-person perspective may differ those from the first-person perspective. These findings are partly in line with the study on the mismatches between the evaluation from third-person perspective and the feelings of the participant in the first-person in context of human emotion recognition (Busso & Narayanan, 2008) and the functional evaluation of robots from the third-person perspective (Haring et al., 2015). Nevertheless, there exist several factors in evaluations from the first person-perspective that predict better impression of human-robot interaction from the third-person perspective that may be useful in developing social robots that work with people.

REFERENCES

- Asoh, H., Motomura, Y., Asano, F., Hara, I., Hayamizu, S., Itou, K., Kurita, T., Matsui, T., Vlassis, N., Bunschoten, R., & Krose, B. (2001). Jijo-2: An office robot that communicates and learns. *IEEE Intelligent Systems*, 16(5), 46-55.
- Busso, C., & Narayanan, S. S. (2008). The expression and perception of emotions: comparing assessments of self versus others. *In Interspeech 2008-Eurospeech*, 257-260.
- Eysenck, H. J., & Eysenck, S. B. G. (1994). Manual of the Eysenck Personality Questionnaire:(EPQ-R Adult). *EdITS/Educational and Industrial Testing Service*.
- Haring, K.S., Silvera-Tawil, D., Velonaki, M., Takahashi, T., & Watanabe, K. (2015). Changes in perception of a small humanoid robot. *In Proceedings of the 6th International Conference on Automation, Robotics and Applications*. 83-89.
- Kanda, T., Sato, R., Saiwaki, N., & Ishiguro, H. (2007). A two-month field trial in an elementary school for long-term human-robot interaction. *IEEE Transactions on robotics*, 23(5), 962-971.
- Kanda, Ishiguro & Ishida. (2001). Psychological Evaluation on Interactions between People and Robot. *Transactions of the Institute of Systems, Control and Information Engineers*, 19(3), 362-371.

Ogata & Kanno. (2000). Experimental Evaluation of the Emotional Communication between Robots and Humans. *Transactions of the Institute of Systems, Control and Information Engineers*, 13(12), 566-574.

Tahir, Y., Rasheed, U., Dauwels, S., & Dauwels, J. (2014). Perception of humanoid social mediator in two-person dialogs. *In Proceedings of the 2014 ACM/IEEE international conference on Human-robot interaction*. 300-301.

PRELIMINARY RESEARCH ON THE METHOD OF FOOD PRESERVATION

Chin-Lai WU^a, Bao-Yan CHEN^b, Tung-Long LIN^c and Shu-Ming WU^d

^a*Institute of Cultural and Creative Design, Tung Fang Design of University, Taiwan (R.O.C.),
wu2644907@yahoo.com.tw*

^b*Department of Tourism and Leisure Management, Tung Fang Design of University, Taiwan
(R.O.C.), baochen056@gmail.com*

^c*Department of Industrial Design, National Kaohsiung Normal University, Taiwan (R.O.C.),
j46008@msa.hinet.net*

^d*Institute of Cultural and Creative Design, Tung Fang Design of University, Taiwan (R.O.C.),
chief@mail.tf.edu.tw*

Abstract

Taiwan is an island surrounded by the sea that experience an annual natural disaster that is known as the typhoon where damages caused by the disaster could not be estimated. As soon as the government issues the typhoon alert, the price of fruits and vegetables rise thirty percent immediately every time. Hence, consumers tend to restrict their expenses or change their usual eating habit which leads to the belief of an incompetent government. There is a saying: When a typhoon comes, the people and the government will suffer in life but someone called “vegetable insect” will get rich. Ethylene is the main factor that causes problems in the preservation of fresh fruits and vegetables. The method for this research is using a questionnaire survey conducted by interviewing experts in the frozen food industry. The result confirms that the effects of ethylene on the preservation of fruits and vegetables. The Taiwan guava is used as the preservation experiment material. The hardness of the fruit and the ripening degree to determine the effect of ethylene is tested. The purpose of this research is to extend the shelf life of fruits and vegetables by effectively preventing ethylene contamination. This is all done under the premise that the fruits and vegetables are able to maintain its original flavour and serves as a reference for designing a new refrigerator.

Keywords: *fruits and vegetables, cold storage, ethylene*

¹ Corresponding author.

1. INTRODUCTION

1.1 Research background and motivation

Taiwan is an island surrounded by the sea and the typhoon season comes every year where damages caused could not be estimated. The island of Taiwan has a self-sufficient food supply system that includes all related industries such as animal husbandry, aquaculture, agriculture and fisheries mainly meet the needs of the island. However, damages inflicted by the disaster have affected people's daily life is more direct and severe. The livestock and aquaculture (seafood) can be kept by refrigeration for a long period of time. The Executive Yuan Agricultural Committee demanded the relevant industry players to release the frozen meat products in order to stabilise the market price. Although the fruits and vegetables grow rapidly, but it is still in short supply. The price increases comprehensively. It leads to a distraught population of consumers.

1.2 Purpose of the research

Since cold temperature changes meat products, resulting the oxidation of the meat products and hence, resulting in decay. Therefore, the import and export of meat products, domestic wholesale, retailers, the traditional vegetable market all use the frozen method for meat storage. However, this is not suitable for the preservation of fruits and vegetables as the process of ripening will naturally produce a maturing catalyst - ethylene. It depends on the level of maturity of the different fruits and vegetables, and the quantity of ethylene released also differs. Ethylene is difficult to calculate. Once the fruits and vegetables become infected by ethylene, the preservation time will be reduced greatly. The purpose of this research is to extend the shelf life of fruits and vegetables by effectively preventing ethylene contamination. This is all done under the premise that the fruits and vegetable can maintain its original flavour and serves as a reference for designing new refrigerators.

2. LITERATURE DISCUSSION

2.1 Classifications of frozen food

The classifications of refrigerated household food items, Xinjie Lin (2016) refers to the US health magazine "Prevention", categorises 23 different types of food, each with their own specific preservation methods. According to the "World Magazine" 2013, an average Taiwanese produces approximately 96kg of food waste, and approximately 6,100 tonnes of food waste per day for the entire country. As a matter of fact, a lot of easily rotten food could still be consumable if stored properly even after its recommended expiry date. It also points out the following guidelines for prolonging its shelf life:

1. Protein (Table 2-1)

Ingredients	Do's	Don'ts
egg ,milk	Place the eggs in the original box, and place them on the colder shelves in the fridge.	Most fridge has a designated holder on its door, however the constant opening and closing of the fridge doors makes the temperature fluctuate, thus making them perish faster.
Hard	Wrapping the cheese in foil or	When dealing with mouldy cheese, just remove the

cheese	plastic will prolong its shelf life for 2-4 months.	mouldy area ½ inch in. There is no need to throw the whole thing away.
yogurt	The temperature is best to be set at 4° C for yogurt, it can extend its shelf life for 10-15 days.	Yogurt generate separate liquids, it is not spoiled, just a little stir, it can still be eaten.

Source of the materials: organized from web (08.04.2016)

2. Vegetables (Table 2-2):

Ingredients	Do's	Don'ts
shallot, onion, garlic	Placed in a warm and dry place.	Onion should avoid placing in the fridge because the cold and humid air will cause them to rot or germinate.
mushrooms	Mushrooms remain dry and cold to prevent bacteria growth. The paper bags can reduce moisture loss.	Do not wash the mushroom before storage.
leafy vegetables	Wrap the vegetables in dry paper towels before placing them in a plastic bag and into the vegetable preservation room of the refrigerator.	Avoid placing leafy vegetables near water that will release ethylene
tomato	The unripe tomatoes can be kept at room temperature to avoid discolouration, taste and nutrient lost. The ripe tomatoes can be stored in the refrigerator.	Mature tomatoes should be not be placed near leafy vegetables because tomatoes will release ethylene.
potatoes	Larger potatoes can be placed in a cool and dark place. Smaller potatoes can be placed in the fridge.	Potatoes should avoid placing together with apples or pears to reduce the transfer of the smell of dirt.
asparagus	The tip is placed upright and the bottom is wrapped in wet tissue and a plastic bag.	Do not soak the asparagus tip, this is to avoid bacteria growth and deterioration.
carrot	The removal of carrot leaves can prolong its preservation time. The larger carrots with peel is very susceptible to ethylene.	Larger carrot should not be placed next to fruits because the release of ethylene from the fruits will make the carrot bitter and unbearable after 1-2 weeks.

Source of the materials: organized from web (08.04.2016)

3. Fruits (Table 2-3):

fruits	Do's	Don'ts
watermelon	According to a USDA study, keeping the watermelon on the kitchen counter for about a week to mature will increase the lycopene of the watermelon and β carrot to double. The watermelon can be placed into the refrigerator a day before eating.	Watermelon should not be placed next to other fruits. Because the watermelon will release ethylene to ripen other fruits quickly.
stone fruits (cherry, Plum, Peach, ...)	Store at room temperature to ripen and then be placed into fridge.	If the fruit isn't mature yet and directly put into the refrigerator, they will not be able to mature.
grapes, berries	It had better to remove injured or mouldy fruit in order to avoid other fruits rot.	Do not wash it until consuming, otherwise it would easily spoil.
apple	Wrapped in plastic bags and placed in the fridge to avoid moisture lost.	Apple will release ethylene so avoid placing near leafy vegetables.
banana	To avoid banana maturing too fast, you can separate each banana and cover each banana tip with plastic wrap.	Low temperatures will make bananas hard to mature but the skin will still turn black. Hence, banana should not be put into the refrigerator.

Source of the materials: organized from web (08.04.2016)

4. Other Categories (Table 2-4):

Ingredients	Do's	Don'ts
Nuts	The preservation time is extended up to a year when placed in the refrigerator.	Keep away from heat to avoid the oil contents in the nut to deteriorate.
Cereals and flour	The frequently consumed cereals can be placed at room temperature in a drier and cooler place.	Unfinished cereals should be sealed and preserved.
oil	Avoid contact with air, light or heat.	Placing the oil next to the stove or oven will accelerate deterioration.
leftovers	Put it in the refrigerator within two hours of cooking.	The leftovers should not be kept more than five days.

Source of the materials: organized from web (08.04.2016)

2.2 Fruit ripening system

According to Jinghui Gao (1987), "the main difference between the climacteric fruit and non-climacteric fruit is the ability to self-catalyse with ethylene (ie, whether it can form a lot of ethylene), rather than the change in respiration rate (in fact, after the treatment of ethylene the respiration rate of the non-climacteric fruit can also increase)". The classification of fruit ripening system is listed as follows (Figure 2-1):

Figure 2-1: The non-climacteric fruit and The climacteric fruit

The non-climacteric fruit (it will not continue to mature after harvest)	The climacteric fruit (it will continue to mature after the harvest)	
cherry, Citrus (lemon, lime, orange, grapefruit), cucumber, grape, pineapple, pomegranate, berry (cranberry, strawberry), watermelon	apple, apricot, avocado, banana, blueberry, Fig, guava, melon, Kiwi fruit, mango,	nectarine, papaya, passion fruit, peach, pear, persimmon, plantain, plum, tomato

Source of the materials: scientists in the kitchen, National Daily News. (07.30.2017)

2.3 Fruit ripening agent – ethylene

Kaohsiung City Agricultural Improvement Centre (2015) replies to food security issues such as: "Usually the ripening agent used in the fruit ripening process is "ethylene" or other similar gas compounds and ethylene is the plant hormones, which is produced by the fruits itself during the ripening process. So it is harmless to the human body and it is widely used in fruit ripening treatment. However, it is not necessary for some fruits, such as guava, lotus fog and Indian jujube, etc. These fruits need to avoid ethylene. The discovery of ethylene for the garden produce industry is very important. It is also confirmed to be harmless."

According to ethylene research, another example as Weilun Li (2008) said: "The main source of ethylene comes from the tissues of fruits and vegetables, such as microbial fermentation, or thermal cracking of hydrocarbons. Ethylene is a plant hormone that can induce a variety of physiological reaction that consists a series of decomposition and synthesis effects". "The chemical element of ethylene can be countered by - potassium permanganate, and is broken down into carbon dioxide and water, but potassium permanganate itself is highly toxic, and is not suitable for direct input in the fridge". Therefore, based on food security issues, the infusion of any toxic chemical elements, or any unstable gas such as ozone is not considered.

Weilun-Li 's main research is on the isolation of ethylene by vacuum packaging but didn't discuss much on the issue of ingredients keeping by controlling the fridge temperature and humidity.

3. CONDUCTING INTERVIEW SURVEY

3.1 Interview object

The methods of this research are based on literature investigation, and the methods of collecting information includes querying network-related data and finding books related to plant physiology. Then, expert interviews are conducted to understand the specific effects of ethylene in terms of fruits and vegetables preservation. The view from professionals' perspective are sorted as follows:

1. The assembly of the refrigeration industry
2. The person in charge of fruits and vegetables marketing in the Farmers' Association
3. The Fruit Marketing Industry

3.2 Interview questionnaire design is as follows:

Table3-1 Questionnaire form

1.Name of corporation and how many years of undertaking?
Answer:
2.What is your job description and related field?
Answer:
3.Please list the types of fruits and vegetables and its recommended temperature for refrigeration.
Answer:
4. Please describe what do you know about the natural ripening agent; ethylene. List the items that contains ethylene.
Answer:
5.How to overcome and extend the shelf life of fruits and vegetables?
Answer:

3.3 Interview results

Table3-2 The assembly of the refrigeration industry is as follows:

1. Name of corporation and how many years of undertaking?
Answer: Ming Emblem frozen air conditioning Technology Co., Ltd. / contractor: Ye Rongzhang/ undertaking years of 30 years.
2. What is your job description and related field?
Answer: Responsible for the condensing unit equipment, maintenance, construction. Operating a variety of freezer assembly, as well as troubleshooting and other issues related to customer troubleshooting.
3. Please list the types of fruits and vegetables and its recommended temperature for refrigeration.
Answer: 1. The vegetables can be divided into two major categories of leafy vegetables and rhizomes, leafy vegetables, the best temperature of 2 °C, humidity from 85 ° to 90 °, rhizome, the best temperature of + 2 ° C, humidity of 70 °. 2. Fruits due to different types the temperature and humidity control is different, such as the apple temperature of -1.2° ~ -1.5°C, the humidity of 80 ° to 85 °; the banana temperature of + 13 ° to + 15 ° C, the humidity of 70 °; the grape temperature of -2 °,the humidity is 85°.

3. The above mentioned about the current cold storage, for different temperature settings, have a corresponding humidity control function.
4. Please describe what you know about the natural ripening agent; ethylene. List the items that contains ethylene.
Answer: Fruits and vegetables allow the release of ethylene, the industry generally known as odour emissions, naturally produced, do not need human factors to place chemical substances, such as: electrical soil.
5. How to overcome and extend the shelf life of fruits and vegetables?
Answer: The main purpose of the control of cold storage temperature is to let fruits and vegetables remain dormant, and the corresponding function of the humidity is to slow down the growth of its fruits and vegetables. The cold storage for example: one scale as a unit, the best way to extend the preservation of the quantity (1 ~ 10 scale) is to keep in a single type or species refrigerated at one time.

Source: Minghui Refrigeration Air Conditioning Technology Co., Ltd. `Ye Rongzhang (09.04.2016.).

Table3-3 The person in charge of fruits and vegetables marketing in the Farmers' Association is as follows:

1.Name of corporation and how many years of undertaking?
Answer: Kaohsiung City Alian District Farmers' Association / In charge of Insurance Director and Fruit and Vegetable Marketing : Huang Junjie / working years up to 29 years
2. What is your job description and related field?
Answer: As the Kaohsiung Alian District Farmers Insurance Department Director, and contractors fruit export business and all kinds of fruits and vegetables, such as: candied dates, dried candied dates, guavas, tomato, lotus fog, mango, longan, melon, Xiaoyu watermelon, honey and so on..
3. Please list the types of fruits and vegetables and its recommended temperature for refrigeration.
Answer: The main Frozen fruits are guavas, candied dates. The export temperature is controlled at 5°C, and the domestic temperature is control at 8° to 10°C.
4. Please describe what you know about this natural ripening agent ethylene. And list the items that have it.
Answer: Through the relevant units of farmers, ethylene is a ripening chemical agent, has been used in fruit ripening but not often used. The apple naturally contains much ethylene, but compared to the apple the other fruits isn't much.
5. How to overcome and extend the shelf life of fruits and vegetables?
Answer: 1. Take a single packing method to keep. 2. Antioxidant pack provided by the trader (the contents are granular). 3. Cold storage to maintain temperature settings.

Source: Kaohsiung City Alian District Agricultural Association / Huang Junjie (08.07.2016).

Table3-4 The Fruit Marketing Industry is as follows:

1.Name of corporation and how many years of undertaking?
Answer: Ami Asia fruit firm / company representative: Huang SuMei/ practicing in Tainan City night market 22 years.
2. What is your job description and related field?
Answer: Fruits purchase, cutting and operating seasonal fruit trafficking
3. Please list the types of fruits and vegetables and its recommended temperature for refrigeration.
Answer: On average, 8 kinds of seasonal fruits are frozen daily in the cold storage. In addition to guavas the other types of fruits other are in the co-exist way of cold storage, the annual temperature set at 8° C~ 11°C, because the cold storage switches often daily, the temperature control is more difficult, with very power consumption
4. Please describe what you know about the natural ripening agent; ethylene. List the items that contains ethylene.
Answer: The loss of guavas to maturity has happened many times and ethylene is the factor that accelerates the ripening. Therefore, we avoid putting the guavas together with the other fruits in the same cold storage, to avoid cross contamination by other high Ethylene fruits. We won't accumulate too many fruits in the same cold storage to avoid unnecessary losses. The fruits contain ethylene as we have known such as : papaya, apple, banana, guavas, mango, melon, watermelon.
5. How to overcome and extend the shelf life of fruits and vegetables?
Answer: We have tried to use oxygen-absorbing drugs (antioxidant), but since the cold storage are often switched off, it is ineffective in extending fruit preservation. It's a big problem to extend the preservation time using cold storage. Even with the consideration of packaging, it takes more manpower, so generally to calculate the fruit sales to the sales projection, it is not viable. The general cold storage could only preserve fruits not more than 3 to 4 days in principle. In terms of fruits sales, the relevant industry is informed that the fruits should not be too ripe where colour checking to distinguish maturity is done and fruits maturing at 70 to 80 percent is perfect. This is by completely sealing the packing of one kind of fruit to keep in the fridge provided by the Farmers' Association, the highest preservation time is about 7 days or so.

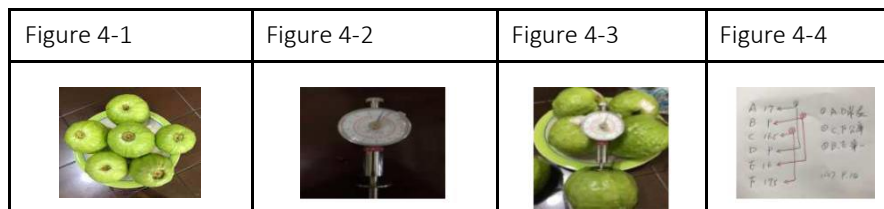
Source: Ami Asia Fruit Firm / Huang Su Mei (08.07.2016).

4. EXPERIMENT ANALYSIS

4.1 Methods of the experiment

Referring to the basis of the above comprehensive investigation regarding the inventory of frozen food, it is confirmed that ethylene is the main factor affecting the maturity of fruits and vegetables. Therefore, guava is taken as an example where it can be harvested locally throughout all four seasons and is known as the national fruit of Taiwan. According to years of experience, the maximum refrigeration period is 7 days. Hence, 7 days is used as a reference value to carry out the experiment and try to test the hardness and the acceptable maturity of the fruit. The method used in this experiment is shown below:

- 1, Using guavas that were harvested on the same day as the experimental object (Figure 4-1)
- 2, Using the hardness tester as the base of the hardness rating (Figure 4-2)
- 3, Carrying out the hardness test on each guava (Figure 4-3)
- 4, The hardness data recorded of the guavas (Figure 4-4)



Source of the materials: photographing by this research (09.14.2017)

4.2 Process of the experiment

In the first hardness test and in order to avoid producing chemical change, a wound is created by peeling the specimen. This creates the derivative of acid infection, thereby causing inaccuracy in the hardness test. Therefore, this process is not to pare the guavas and carry out the hardness test in the softest region (tail) parts of the guavas. The first measured record is shown in the above figure (Figure 4-4). Six guavas, A-17°, B-9°, C-16.5°, D-9°, E-16°, F-17.5°, will be divided into three groups. The first group (A / D) was placed in a cool place at room temperature, the second group (C / F) was placed with several kinds of fruits together in the fridge, and the third group (B / E) was placed a single kind of fruit which is the guava, in the fridge. The second hardness test was conducted after 7 days (106/09/21), the test on the hardest part of the guavas (the middle part), the measured values were: A-8.1°, B-10.2°, C-4.2°, D-rot (bad cannot test) , E-10.1°, F-4° (Table 4-1).

Table 4-1 The results of the experiment

classification	place at room Temperature		several kinds of fruits together in the fridge		isolated single type of fruit (guava) in the fridge	
Group	The first group		The second group		The third group	
code	A	D	C	F	B	E
the hardness (the first test)	17	9	16.5	17.5	9	16
the hardness (the second test)	8.1	Rot	4.2	4	10.2	10.1
the picture of the guava after 7 day frozen						

Source of the materials: photographing and organizing by this research (09.21.2017)

4.3 Result of the experiment

This experiment found that the higher hardness value of the guava is numbered A, C, E, F. The average hardness at 17°, and the number: B, D average hardness of 9°. According to the above-mentioned interviewer Huang Su-mei's statement, the colour of the guava can be used to identify the maturity, such as the number A, C, E, F the appearance of the peel was dark green, the maturity degree is about 70 percent. The appearance of peel is relatively light green where the degree of maturity is about 80 percent. The classification of the maturity, the hardness and the frozen classification are discussed as follows:

1. The first group:

Guava A: The hardness of A from 17° went down to 8.1°, according to the hardness and the peel appearance, it is still available for eating, but the freshness is doubted; maybe it is suitable for making juice. It is not good for selling directly.

Guava D: acid serious infection, pressing it will be clearly into fruit mashup or puree, has been completely difficult to use the hardness tester.

2. The second group

Guava C: the hardness from 16.5° down to 4.2°, the other fruits in the storage produced ethylene and it infects Guava C, resulting in rapid ripening of the pulp, the appearance obviously turn to yellow-green. It cannot be sold as whole, fresh fruit.

Guava F : The hardness from 17.5° down to 4°, it concaved immediately after being pressed by the fingers. It cannot be sold. The actual softened situation as shown in the following figure (Figure 4-5):



Figure 4-5 softened Guava F

Source of the materials: photographing by this research (09.21.2017)

3. The third group

Guava B: the hardness changed from 9° to 10.2°; 7 days of freshness is extremely successful. The hardness has risen, and the reason is: In order to avoid damage caused by fruit acid infection and test inaccuracy, the first test uses the softest part of the guava, and then the second test uses the hardest part of the guava itself, so the results of the hardness do not drop, but rise.

Guava E: the hardness from 16° down to 10.1°, the peel appearance has become light green. Therefore, in order to determine its freshness whether it can be sold or not, the industry is referred to inspect the product. Guava B and Guava E is cut for inspection. The industry verified that a single kind of fruits can be stored in the refrigerator and can be kept fresh up to seven days. As shown in the following figure (Figure 4-6):



Figure 4-6 fresh cutting Guava B and Guava E

Source of the materials: photographing by this research (09. 21. 2017)

5. CONCLUSION

The result of this research found that ethylene has a significant impact on the preservation of fruits and vegetables. The analysis of this experiment confirms that the third group where the fruit is isolated shows the best ethylene prevention and thus maintaining the fruit at its best state. Therefore, it will serve as a reference when designing new cold storage / refrigerator. Ethylene is the main factor that causes problems in the preservation of fresh fruits and vegetables. In order to effectively prevent the contamination of ethylene, refrigeration operators and common users can exercise simple guidelines of ingredient classification. Based on this experiment, it is learnt that it is crucial to increase the awareness of refrigerating different types of fruits and vegetables separately. This will largely extend its shelf life. Since the price of fruits and vegetables rise immediately after the typhoon alert issued by the government on an annual basis, this paper proposed food preservation as follows:

1. For the fruits and vegetables business operators, it is necessary to develop a new type of cold storage, used to prevent the production of ethylene in order to slow down the oxidation of fruits and vegetables.
2. In the future, there should be an attempt to find another type of gas that could prevent the production of ethylene where it could be injected into the cold storage effectively to promote the formation of the fruits' false hibernation phenomenon. Therefore, the shelf life of the fruits and vegetables are "naturally" extended. It will also stabilise the market price of fruits and vegetables as well as making it through the wind and drought rehabilitation period.

REFERENCES

Gao, J. (1987). *Plant growth and differentiation*. Taipei: National Institute of Translation and Compilation, 611-613.

Li, W. (2008). Research on packaging to delay the climacteric fruit by the removal of ethylene. New North City: Fu Jen University Master's thesis.

Tang, J. T. (1997). *Effect of low-oxygen and ethylene treatments on postharvest yellowing of green vegetables*. Taipei: Department of Horticulture, National Taiwan University Master's thesis.

Lai, C. Y. (2010). *Studies on postharvest physiology and technology of water*. Convolvulus (Ipomoea aquatica Forsk.) Cultivated by Hot Spring. National Ilan University. Master thesis.

Lin, X. (2016). *Good morning health*. Retrieved from <https://www.everydayhealth.com.tw/article/12042>

The Executive Yuan Agricultural Committee, Website:
http://www.coa.gov.tw/faq/faq_view.php?id=139 (07.23.2017)

Mandarin Daily, a scientist in the kitchen. Website:
<http://www.mdnkids.com/kitchenscience/index7.shtml> (07.23.2017)

Wikipedia, Website: <https://www.wikipedia.org/zh-tw/Ozone>,

Ozone can cause potential systemic effects, such as induced lymphocyte chromosomal aberrations, more than a certain concentration, it is harmful to the human body and plant growth. Ozone can also make rubber products brittle and crack. Ozone on the human body is also teratogenic, mother exposure to ozone during pregnancy can lead to increased incidence of neonatal blepharophimosis.

HOW COOL IS BEBOP JAZZ? SPONTANEOUS CLUSTERING AND DECODING OF JAZZ MUSIC

Antonio RODÀ^{*1}, Edoardo DA LIO^a, Maddalena MURARI^b, Sergio CANAZZA^a

^a Dept. of Information Engineering, University of Padova,
Italy roda@dei.unipd.it

^b Dept. of Pharmaceutical and Pharmacological Sciences, University of Padova, Italy

ABSTRACT

Music is able to arouse and heighten listener's emotions and sensations. However, experimental studies on the connotative meaning of particular music repertoires, such as jazz music, are still scarce. The study uses 20 subjects to evaluate and describe verbally 25 pieces of jazz music that belongs to *cool* jazz and *bebop* sub-genres. Three clusters have emerged, which can be related to the well-known valence-arousal emotional space. A further analysis of the acoustic features of the tracks revealed that *bebop* tracks are mainly associated with low valence values that were characterized by a high degree of roughness.

Keywords: *music expressiveness, kansei and music, musical features, cool jazz, bebop*

1. INTRODUCTION

Various experiments have demonstrated that music can arouse the listener's sensations, such as images, colours, feelings, or emotions (Juslin & Sloboda, 2011) (Murari, Rod, Canazza, De Poli, & Da Pos, 2015). In particular, literature on the affective aspects of music describes the¹relations between musical content and specific affective models such as the discrete emotions

¹ Corresponding Author

approach and the valence-arousal plan (Eerola & Vuoskoski, 2011) (Roda, Canazza, & De Poli, 2014). In addition to that, Kansei models were used to study the connotative meaning of music like Sugihara, Morimoto, & Kurokawa, (2004) that have characterized 12 music pieces from various repertoires although not including Jazz, to 40 pairs of Kansei words. Other works tried to find how emotions are related to a specific acoustic and/or musical features or a combination of them as depicted by Yang & Chen, (2012) where it was found that minor mode usually arouses affective states with low valence such as sadness or melancholy, however it is not yet clear whether this is a cross-cultural phenomenon or not.

Despite the large number of studies on this subject, very few are related to the repertoire of jazz music, and most of them are concerned towards the automatic recognition of discrete emotions using machine learning techniques, e.g. (Tao Li & Ogihara, 2004), without discussing if and which state of the art models of emotions in music are investigated. Moreover, since most studies are developed in relation to Western classical repertoire or pop/rock music, it is very difficult to hypothesise which model are more suitable to analyse jazz music.

This paper presents the first experiment of a project that aims at collecting experimental data to characterise jazz music from an affective and sensorial point of view. The objectives of this exploratory study are: a) to find the main categories which listeners apply to differentiate the emotional content of jazz pieces; b) to verify if the well-known valence-arousal model is still suitable to describe emotions in jazz music; c) to find musical-acoustic (computable) features that significantly characterise the different categories and/or dimensions. The experimental approach was proposed by Bigand, Vieillard, Madurell, Marozeau, & Dacquet, (2005), and detailed in the next section, was applied to foster a spontaneous clustering of the musical stimuli, without conditioning it by means of a predetermined list of words, such as in the semantic differential approach. Music stimuli are well-known jazz pieces chosen from the two most important and revolutionary styles since early 1940s as stated by Kernfeld, (2002):

- i) *Bebop* (i.e., *bop* or *rebop*, non-sense syllables which were commonly used in *scat* singing): represents a marked increase in complexity and is mostly characterised by a highly diversified texture created by the bass player and elaborated by the drummer, with a variety of on- and off-beat punctuation added by the piano.
- ii) *Cool* (i.e., *cool players*, often white musicians, named for their light, clear touch): jazz style played almost with no vibrato, placing great emphasis on simplicity and lyricism in improvisation and avoiding the upper register of the musical instruments.

2. EXPERIMENT

2.1. Participants

The experiment involved a total of 20 participants (14 males and 6 females). Of these, 11 did not have any musical training and are referred to as non-musicians; 9 had been music students for at least five years and are referred to as musicians. The participants were from 18 to 30 years old, with an average of 22 years.

2.2. Material

25 musical excerpts[†] were chosen as follows: 12 pieces were taken from the bebop genre; the other 13 pieces were chosen from the cool genre. The excerpts were chosen to be representative of various compositional styles and musical ensembles. Differently from their usual characteristics, some bebop pieces were chosen in order to convey a melancholic and relaxing mood (e.g., *Delilah*, by Clifford Brown, 1954, from *Brownie: the Complete Emarcy Recordings* – 1989) and some cool tunes were chosen in order to convey a happy and dynamic mood (e.g., *Jazz of Two Cities*, by Warne Marsh, 1956, from *Jazz of Two Cities, Complete 1956-1957 sessions* – 2004): in this sense, a verbal description would be very complex although a spontaneous clustering should achieve the objectives (a), (b) and (c) listed in Sect. 1. The excerpts correspond either to the beginning of a musical movement, or to the beginning of a musical theme or idea, and their average duration is 30s. The overall amplitude of each stimulus was adjusted by normalizing the maximum RMS value, in order to ensure a uniform and comfortable listening level across the experiment.

2.3. Procedure

A software interface (see Figure 1) has been developed to conduct the experiment. Participants were presented with a visual pattern of 25 loudspeakers, representing the 25 excerpts in a random order, automatically changed for each subject, in order to avoid biasness due to order effect. Participants were first required to listen to all these excerpts and to focus their attention on the affective quality of each piece. Then, they were asked to look for excerpts that induced a similar emotional experience and drag the corresponding icons in order to group these excerpts. They could listen to the excerpts as many times as they wished, and to regroup as many excerpts as they wished.

After the grouping task, participants were asked to spontaneously describe the affective characteristics of each group, by means of one or two words that were annotated on a questionnaire. This spontaneous decoding task is intended to help and guide the following clusters interpretation. The overall duration of the test was 30 minutes on average and the nature of the stimuli which are real music recordings and not artificial stimuli and ensure that fatigue effect is negligible, as confirmed by previous studies (Bigand et al., 2005) and by informal post-test interviews.

[†] A detailed list of the pieces with the relative audio files can be found at <http://dei.unipd.it/~roda/emojazz/index.html>

		25 8 9 15 11			
1 22	23		10 13 12	18 5 7	
	24 3 6 17	14 16 4		21 20 2 19	

Figure 1: A screenshot of the GUI developed for the experiment.

3. RESULTS AND DISCUSSION

Participants formed an arbitrary number N of groups. Each group G_k contains the stimuli that a subject thinks similar that induces a similar affective experience. The dissimilarity matrix A is defined by counting how many times two excerpts i and j are not included in the same group:

$$A[i, j] = \begin{cases} A[i, j] + 1 & \text{if } i \in G_k \wedge j \notin G_k \\ A[i, j] & \text{otherwise} \end{cases}$$

$$\forall i, j = 1, \dots, 25 \text{ and } \forall k = 1, \dots, 20.$$

Initially, two different matrices, one for the musicians and the other for the non-musicians subjects, have been calculated. The two matrices present a high correlation value ($r = .56$, $df = 298$, $p < .001$), implying a high agreement between musicians and non-musicians. Then, the following results are based on a unique matrix that includes the responses of both groups.

The dissimilarity matrix was analysed by using the Multidimensional Scaling (MDS) method. In particular, given the non-metric nature of the dissimilarity matrix, the Kruskal's Non-metric Multidimensional Scaling method is adapted where a widely used ordination technique is applied. The quality of the fit of the regression was used to determine the number of dimensions to be considered. According to literature, a Kruskal's *Stress 1* greater than 0.2 indicate an insufficient adaptation of the data in relation to the number of selected dimensions. In our case, a *Stress 1* = 0.17 was obtained with two dimensions, indicating that two axes are sufficient for a good representation of our experimental data. The location of the 25 excerpts along the two principal dimensions is represented in Figure 2. The excerpts that are close in this space are those evaluated by the subjects to be more similar from an affective point of view.

The MDS solution was compared with a cluster analysis performed on the same dissimilarity matrix. The k -medoids algorithm was adapted and compared to the more common k -means

algorithm, is more robust to noise and outliers, and is able to work with an arbitrary matrix of distances between data points. Therefore, in order to decide the appropriate number of clusters and the reliability of the clustering structure, a set of values called *silhouettes* was computed. The average values of the silhouettes S , calculated for k (number of clusters) from 2 to 7, show that three clusters obtained the greatest value ($S = 0.28$) and is therefore the best choice (Figure 2).

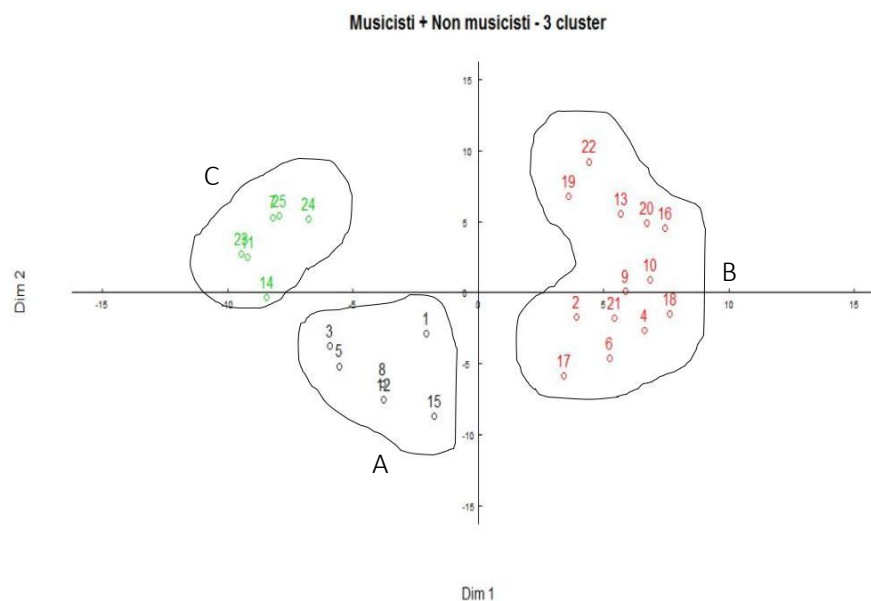


Figure 2: MDS analysis on experimental data. The colours that represents the result of the cluster analysis (black = A; red = B; green = C).

Furthermore, in order to investigate the affective meaning of the three clusters of Figure 2, the verbal responses given during the spontaneous decoding task were analysed. Data preparation of spontaneous free report terms to describe groups was based on the procedure adopted by (Augustin, Wagemans, Carbon, 2012). Spelling errors were corrected, articles for nouns and qualifiers were removed, different spellings and same-stemmed words were pooled. The word count was conducted separately for each cluster and the three most frequent terms are listed in Table 1.

Table 1: list of the three most frequent labels associated by the subjects to the three clusters (in brackets the number of occurrences).

cluster A	cluster B	cluster C
relaxing (29)	happiness (72)	melancholy (19)
happiness (16)	dynamism (57)	relaxing (15)
background (13)	empathy (34)	annoyance (13)

These data can be quite directly related to the valence-arousal plan, widespread in the study of emotions: descriptions of cluster A are related to the quadrant defined by low arousal and high valence (LAHV); cluster B is related to high arousal and high valence (HAHV); cluster C to low arousal and low valence (LALV). Observing the position of the clusters in the plan of Figure 2, it is possible to infer that x-axis is directly related to arousal and y-axis is inversely related to valence.

As the concern of the subdivision between cool and bebop pieces, cluster A is characterised by a predominant presence of cool pieces (5 cool and only 1 bebop). On the contrary, the other clusters are a mixture of the two genres (5 cool and 8 bebop for cluster B, and 3 cool and 3 bebop for cluster C). Moreover, according to the Mann-Whitney test, cool pieces have values on the y-axis (inversely related to valence) significantly lower than the bebop pieces ($U = 36$, $p < .05$). On the contrary, no significant difference can be found along the x-axis (related to arousal). Therefore, following the subjects' responses, the main affective aspect that differentiates bebop from cool pieces is valence, bebop being associated with a more negative valence than cool.

Finally, to correlate the subjects' answers to the musical features of the 25 pieces, a detailed acoustic analysis of the musical stimuli was conducted. A set of acoustic features were computed for each excerpt using the Matlab MIR Toolbox (Lartillot & Toivainen, 2007). The set was chosen among the features that in previous listening experiments conducted by Juslin, (2001) and Rodà, (2010) were found to be important for discriminating different musical qualities. Table 2 shows the values of the features computed on the 25 pieces of the dataset. An analysis of the variance was carried out to find significant relation between features, clusters, and dimensions. Regarding the clusters subdivision, only *rolloff* (a feature related to the balance between high and low spectral frequencies) has mean values significantly different ($F(2,22) = 4.17, p < .05$) between clusters A (5129Hz) and B (5618Hz) and cluster C (2563Hz). Moreover, a significant correlation exists between the position of the pieces along the x-axis and *rolloff* ($r = 0.44, t(23) = 2.365, p < .05$) and *eventDensity* ($r = 0.40, t(23) = 2.113, p < .05$); and between the position along the y-axis and *tempo* feature ($r = -0.50, t(23) = -2.79, p < .05$). Regarding the subdivision between cool jazz and bebop, there is a significant difference ($F(23) = 9.58, p < .01$) in the mean value of *rms* ($rms_{cool} = 0.10, rms_{bebop} = 0.14$), and in the mean value of *roughness* ($F(23) = 3.37, p < .10$), having the bebop pieces a higher roughness ($1.11 \cdot 10^6$) than the cool pieces ($0.61 \cdot 10^6$).

Table 2: features computed on the 25 excerpts used in the experiment.

	brightness	rms	rolloff [Hz]	roughness	zerocross [s ⁻¹]	eventDensity [s ⁻¹]	lowEnergy	tempo [bpm]
1	0.53	0.09	7314	4.10E+05	812	2.35	0.53	151
2	0.63	0.19	5393	7.57E+05	1241	2.42	0.53	179
3	0.47	0.09	2529	2.57E+05	750	1.67	0.40	181
4	0.57	0.11	6134	1.10E+06	1052	1.29	0.53	109
5	0.53	0.13	5873	7.97E+05	973	2.84	0.55	118
6	0.52	0.10	5812	1.85E+05	908	4.16	0.55	119
7	0.77	0.15	2866	4.79E+05	1277	1.78	0.52	107
8	0.48	0.11	2686	6.52E+05	786	2.67	0.58	132
9	0.61	0.10	6988	2.77E+05	941	1.91	0.55	183
10	0.46	0.17	6085	3.03E+06	942	2.60	0.56	178
11	0.39	0.07	2751	6.81E+05	502	1.91	0.58	119
12	0.55	0.11	9113	7.12E+05	1402	2.74	0.58	162
13	0.50	0.09	8417	4.50E+05	1053	3.29	0.54	115
14	0.52	0.16	3546	5.73E+05	696	1.36	0.49	125
15	0.42	0.09	3257	8.01E+05	765	2.34	0.52	186
16	0.59	0.15	3945	1.81E+06	923	3.33	0.50	133
17	0.47	0.07	7370	2.94E+05	932	3.90	0.53	153
18	0.46	0.07	2464	3.64E+05	715	3.82	0.55	119
19	0.33	0.09	2417	5.16E+05	401	1.83	0.54	103
20	0.62	0.10	7845	3.86E+05	1081	3.28	0.55	129
21	0.34	0.12	1866	1.79E+06	695	3.34	0.55	191
22	0.53	0.19	8295	2.31E+06	1331	1.88	0.57	113
23	0.22	0.15	1197	1.44E+06	485	3.74	0.56	141
24	0.29	0.12	1861	9.80E+05	516	1.96	0.58	119
25	0.62	0.08	3157	1.80E+05	870	1.14	0.67	119

4. CONCLUSION

An experimental study was carried out to gain a deeper insight on the relation between jazz music and emotions. Results show that listeners tend to group the proposed songs according to three expressive categories. The first is described by words such as relaxing and happiness; the second by the words happiness and dynamism; the third by melancholy and relaxing. All these adjectives are directly related to the affective dimensions of valence (melancholy vs happiness) and arousal (relaxing vs dynamism), supporting the hypothesis that the valence-arousal plan could be a good model for this kind of stimuli, although further analysis is needed to confirm this hypothesis. Among the four quadrants of the plane, the one defined by high arousal and low valence is not represented in the data. This result differs from an analogous experiment with stimuli belonging to Western classic repertoire (Bigand et al., 2005). Further experiments are needed to verify if it is a characteristic of jazz music, or if it depends on the specific chosen stimuli. *Rolloff*, *rms*, *eventDensity*, *tempo* and *roughness* are the features that characterise the different affective categories identified by listeners' answers. These results are able to guide the design of systems for automatic emotion recognition of jazz music or can foster the development of affective multimodal interfaces, e.g. (Turchet & Rodà, 2017) and (Turchet et al., 2017). Finally, it is interesting to note that *bebop* pieces are perceived with a lower valence than cool pieces. The relationship between cool-positive valence and bebop-negative valence is consistent with the origin of the two subgenres. As mentioned above, *bebop* was born as a reaction to American musicians of European origin who were getting closer and closer to orchestral jazz. The *bebop* is therefore burdened with feelings of resentment and is generally harsh for the ears of culturally strange people. Future studies could extend the experiment to African-American culture subjects to verify to what extent the bebop-negative valence association has a cross-cultural basis.

REFERENCES

Augustin, M. D., Wagemans, J., & Carbon, C. (2012). All is beautiful? generality vs. specificity of word usage in visual aesthetics. *Acta Psychologica*, 139(1), 187-201.

Bigand, E., Vieillard, S., Madurell, F., Marozeau, J., & Dacquet, A. (2005). Multidimensional scaling of emotional responses to music: The effect of musical expertise and of the duration of the excerpts. *Cognition & Emotion*, 19(8), 1113-1139.

Eerola, T., & Vuoskoski, J. K. (2011). A comparison of the discrete and dimensional models of emotion in music. *Psychology of Music*, 39(1), 18-49.

Juslin, P. N. (2001). Communicating emotion in music performance: A review and a theoretical framework. In P. N. Juslin & J. A. Sloboda (Ed.), *Series in affective science. Music and emotion: Theory and research*. (pp. 309-337) Oxford University Press.

Juslin, P. N., & Sloboda, J. (2011). *Handbook of music and emotion: Theory, research, applications* Oxford University Press.

Kernfeld, B. (2002). *The new grove dictionary of jazz* Grove; London: MacMillan.

Lartillot, O., & Toiviainen, P. (2007). A matlab toolbox for musical feature extraction from audio.

Paper presented at the *International Conference on Digital Audio Effects*, 237-244.

Murari, M., Rodà, A., Canazza, S., De Poli, G., & Da Pos, O. (2015). Is vivaldi smooth and takete? non-verbal sensory scales for describing music qualities. *Journal of New Music Research*, 44(4), 359-372.

Rodà, A. (2010). Perceptual tests and feature extraction: Toward a novel methodology for the assessment of the digitization of old ethnic music records. *Signal Processing*, 90(4), 1000-1007.

Rodà, A., Canazza, S., & De Poli, G. (2014). Clustering affective qualities of classical music: Beyond the valence-arousal plane. *IEEE Transactions on Affective Computing*, 5(4), 364-376.

doi:10.1109/TAFFC.2014.2343222

Sugihara, T., Morimoto, K., & Kurokawa, T. (2004). An improved kansei-based music retrieval system with a new distance in a kansei space. 141-146. doi:10.1109/ROMAN.2004.1374745

Tao Li, & Ogihara, M. (2004). Content-based music similarity search and emotion detection. *In Proc of ICASSP 2004*.

Turchet, L., Zanotto, D., Minto, S., Rodà, A., & Agrawal, S. K. (2017). Emotion rendering in plantar vibro-tactile simulations of imagined walking styles. *IEEE Transactions on Affective Computing*, 8(3), 340-354. doi:10.1109/TAFFC.2016.2552515

Turchet, L., & Rodà, A. (2017). Emotion rendering in auditory simulations of imagined walking styles. *IEEE Transactions on Affective Computing*, 8(2), 241-253.
doi:10.1109/TAFFC.2016.2520924

Yang, Y., & Chen, H. H. (2012). Machine recognition of music emotion. *ACM Transactions on Intelligent Systems and Technology (TIST)*, 3(3), 1-30. doi:10.1145/2168752.2168754

STUDY OF THE EFFECT OF BACKGROUND MUSIC TEMPO ON A REST PHYSIOLOGICAL EVALUATION USING A MENTAL STRESS TASK

Masashi MURKAMI^{*a}, Takashi SAKAMOTO^b and Toshikazu KATO^c

^a Chuo University, Faculty and Industrial Engineering,
Japan, masa_m@indsys.chuou.ac.jp

^b National Institute of Advanced Industrial Science and Technology,
Japan, takashi-sakamoto@aist.go.jp

^c Chuo University, Department of Industrial and System Engineering,
Japan, kato@indsys.chuo-u.ac.jp

ABSTRACT

This research examined the effect of background music genre on the biological information of the worker. Participants were Four (4) non-English-speaking (Japanese) male university students. The e-Learning English test that focus on vocabulary and grammar as well as calculation is used as a mental stress task. The ratio of low- to high- frequency heartrate via power spectral analysis (LF/HF) as a physiological index for evaluation is also used. As a result of a two-way variance analysis, it is found that there is a significant difference between the tempo in Classical music and Jazz music. It revealed that the ratio of low- to high- frequency heartrate via power spectral analysis in playing classical music environments was smaller than in the Jazz music environment. It is suggested that classical music used in this evaluation has the effect of reducing the ratio of low- to high-frequency heartrate that is measured via power spectral analysis, and Classical music had the more effect of relaxing than Jazz music in rest environment.

Keywords: Environment, Music, LFHF ratio...

1. INTRODUCTION

This study examined the effect of Beats per Minute (BPM) of background music on the biological information of workers and explored which music genre have these effects.

In daily living environments—for example, at the office, at home, and at commercial space like shopping mall or restaurant—it is too often that music is played in the background. It is known that background music is an important fact that complements the design of the spatial effect in those environments [1]. Especially in a commercial space, Milliman [2] showed that the customer's comfort or positive feeling that is caused via listening to the background music managed to improve the satisfaction and purchasing desire. If background music has a positive effect on efficiency and comfort, background music can be utilised to improve and enhance productivity and comfort. Such an effect can also be used to improve commercial facilities and the service industry. Presently, there are several studies on the effects of background music on work efficiency, but these studies did not show the distinct causal relationship between the two, and there is insufficient relational data.

Kampfe and Renkewitz [3], investigated 97 researches that have examined background music and work efficiency and analysed that the number of the result of specific effect was not very high compared with the result of non-specific effect.

Several studies depicted that the effects of background music are able to elevate the feeling of comfort and pleasant feelings at a home environment. Studies in psychology and social welfare have examined the structure of music, audio machines, and listening environment as factors leading to relaxation [4] [5]. These studies used physiological data given as biological information from the participants as an objective index. This study used the ratio of low- to high-frequency heart rates (LF/HF) as a physiological index for evaluation.

In this study, the effect of background music in a rest environment is examined. In addition to that, the difference of music genre whether Classical music and Jazz music is used is also examined. For an evaluation of background music effect in rest environment, the data acquisition is set after the mental stress task is held. As an index of evaluation, the ratio of low to high frequency heart rate via power spectral analysis (LF/HF) is used. Therefore, two mental stress task differences were evaluated between tasks.

2. METHOD

2.1. Participants

A number of Four(4) male participants (3 right-handed, 1 left-handed) were selected. These participants were non-English-speaking (Japanese) university students. The questionnaire revolves around topics pertaining to participants' expertise in music or the opportunity to learn about music including any instruments.

2.2. Apparatus

The Data that was acquired in the listening room. A lighting system that provided variable illumination and colour temperature is used to regulate explanatory variables aside from the music. The experimental sequence is considered the living environment. Therefore, the luminance is set at 1100lx, colour temperature at 3900 K, and room temperature at 20 degrees Celsius. In the experimental sequence, participants are attached to an electrocardiograph. The electrocardiograph used is the MEG-6108 (NIHON KODEN). Whereas, the Vital Recorder (KISSEI COMTEC) for data acquisition and the BIMUTAS2 (KISSEI COMTEC) are used for data analysis.

Music was played from a digital audio music player whereas a digital audio component system (SONY) is used for the music loudspeaker. 1 Classical music piece and 1 Jazz music from the Real World Computing Music Database (RWC-MDB) were selected [6]: Popular, Classical and Jazz music database [7]. A piano solo instrument composition music for regulation is also selected. Hence, the change in BPM and music length is measured using Audicity (Audicity Team). The format of the file uses a WAV formatted file for the evaluation experiment. The SL-4023SD (SATO TECH) is used as a sound level instrument. The average decibel level was set at 40.83 dB in the no music environment.

Table 1: Information about the music used in the present study

Title	Genre	Length	Category	BPM
Suite <Ma Mère l'Oye>	Classical Music	6 minutes 45 seconds	Piano Solo	60
For Two	Jazz Music	6 minutes 15 seconds	Piano Solo	58

2.3. Mental Stress Task

In this study, the aim is to evaluate a mental stress in the practical work environment, therefore 2 types of mental stress task are examined. At first, the subtraction task is used. Participants were calculated three columns of subtraction that is displayed on the PC monitor. A time limit of 10 seconds is set regardless whether all participants have answered or not. Second, the English e-Learning examination for non-native English speakers are used and participants who answered the English grammar questions displayed on PC monitor.

2.4. Procedure

The Data was acquired in the listening room (Figure 1). In the experimental sequence, the participants loaded the electrocardiograph and sat on the sofa. In order to avoid effects from the autonomic nervous system, participants were told not to eat or smoke within 2 hours prior to the experiment.

Type-2 electrocardiograph induction was used for right-handed participants and Type-3 for left-handed participants. Before the data acquisition, the electrocardiograph waveforms were monitored and confirmed that what was observed is a normal isotonic R waveform. In the acquisition sequence, after loading the electrocardiograph and adjusting for 1 minute, the resting state is measured in 5 minutes where the participants did not listen to music without a task and the state in which the participants did not listen to music with a 10 minutes subtraction task, and 30 minutes in E-learning task in succession and resting state 10 minutes in which participants listened to music with task. A 1 minute interval is set for each measurement.

From the electrocardiograph data, it is detected that the peak time of the R waveform and calculated the RR intervals. The RR interval data was resampled with 1.2 Hz via cubic spline interpolation. The Fast Fourier Transform (FFT) is used in order to resample the RR interval data and calculated power spectral density. Finally, the integrated value of Low Frequency (0.05 Hz~0.15 Hz) and High Frequency (0.15 Hz~0.4 Hz) and the LF/HF ratio were calculated as the index of the sympathetic nervous system. The lnLF/HF ratio was analysed and with a repeated 2 way ANOVA between 6 conditions (2 genre and 3 BPMs) and time series (3 points).

Table 2 Data acquisition sequence with subtraction task

Time (minutes)	Status
0 – 5	Pre Task
6 – 16	Task
17 – 27	Rest with listening Music Genre: Classical or Jazz BPM: 60, 120, 180

Table 3 Data acquisition sequence with E-learning task

Time (minutes)	Status
0 – 5	Pre Task
6 – 36	Task
37 – 47	Rest with listening Music Genre: Classical or Jazz BPM: 60, 120, 180

3. RESULTS

Figure 1 showed the LF/HF ratio in subtraction task with 6 conditions (2 genres and 3 BPMs). Every graph showed the lnLF/HF ratio within data acquisition sequences Pre Task, Task and Rest with listening music with 6 conditions. The result of repeated 2 way ANOVA between 6 conditions and 3 points of time series, there was a significant difference within conditions ($F(5, 54) = 2.38, p < 0.05$), also there were not significant differences within time series and interaction. Figure 2 showed the LF/HF ratio in E-learning task. The result of repeated 2 way ANOVA between 6 conditions and 3 points of time series, there were no significant differences within conditions and time series.

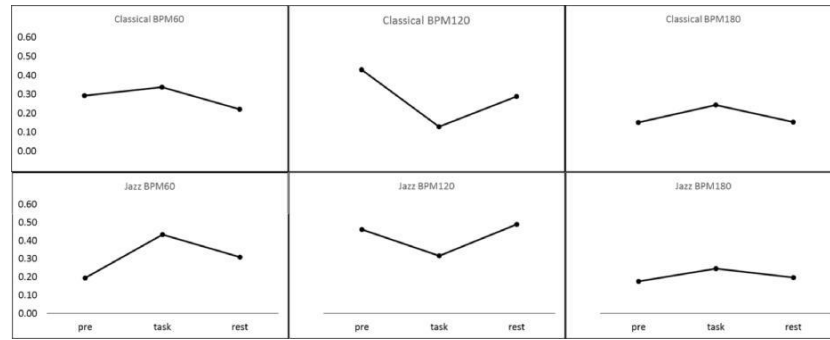


Figure 1: lnLF/HF ratio with subtraction task

(Pre = before task, Task = during task, Rest = after task. (n=4))

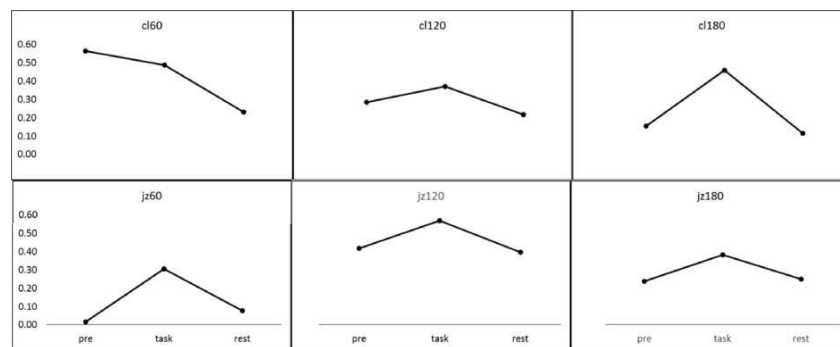


Figure 2: lnLF/HF ratio with E-Learning task

(Pre = before task, Task = during task, Rest = after task. (n=4))

4. DISCUSSION

This study examined the effect of background music on the LF/HF ratio of participants during rest with listening music after a mental stress task. The aim is to investigate the differences between genres; Classical music and Jazz music. The results while subtraction task was examined, there was a significant difference within 6 conditions (2 genre and 3 BPMs), on the other situation while E-learning task, there was no significant differences between conditions and time series. Also the LF/HF ratio during rest with a Classical music environment and Jazz music environment was lower than before the mental stress task-environment was held, and that especially in Classical music environment, the LF/HF ratio was a lot lower than Jazz music environment. Therefore, we suggest that the Classical music and Jazz music has the effect of reducing the LF/HF ratio.

Therefore, in order to regulate the features regardless of genre, the similar BPM (60) and an instrument composition which is a piano solo was used, but we did not regulate the musical rhythm and pitch, melody, and more musical features in this study. Therefore, there is a possibility of the impact of BPM is caused by other musical features.

Acknowledgments

This work was partially supported by JSPS KAKENHI grants, “Effective Modeling of Multimodal KANSEI Perception Processes and its Application to Environment Management” (No. 24650110), “Robotics modeling of diversity of multiple KANSEI and situation understanding in real space” (No. 19100004), and a TISE Research Grant of Chuo University, “KANSEI Robotics Environment.”

REFERENCES

- Kolter, P. (1974). Atmospherics as a Marketing Tool. *Proc. Journal of Retailing*, 49(4), 48-64.
- Milliman, R. E. (1986). The influence of background music on the behavior of restaurant patrons. *Proc. Journal of Consumer Research*, (13), pp. 286-289.
- Kämpfe, J., Sedlmeier, P., Renkewitz, F. (2010). The impact of background music on adult listeners. A meta-analysis. *Proc. Psychology of Music*, 39(4), pp. 424-448, 2010.
- Nagano, K., Matsubara, N., Kurazumi, Y., Gassho, A., Ito, K., & Narumi, D. (1996). Basic considerations on evaluation of the combined environment of environmental sound, ambient temperature and illuminance: A relationship between specific evaluation and non-specific evaluation. *Proc. Journal of Architecture and Planning*, (490), 55–61.
- Takahashi, K. (2006). Effects of color temperature and illuminance of room lighting upon the evaluation to the residential living space. *Proc. Aichi Shukutoku University*, 2.
- Real World Computing Music Database: <https://staff.aist.go.jp/m.goto/RWC-MDB/> (2017/07/22 accessed)
- Goto, M., Hashiguchi, H., Nishimura, T., & Oka, R. (2002). RWC Music Database: Popular, Classical, and Jazz Music Databases. *Proc. The 3rd International Conference on Music Information Retrieval (ISMIR2002)*, 287-288, 2002.

INVESTIGATION OF PLEASANTNESS IN THE MANIPULATION OF DEFORMABLE INTERFACES FOR MUSICAL EXPRESSION

Yuichiro KINOSHITA^a, Masato NISHIO^a, Shota SHIRAGA^b and Kentaro GO^a

^a University of Yamanashi, Japan, {ykinoshita, t13cs041, go}@yamanashi.ac.jp

^b University of Yamanashi, Japan, shota.shiraga@ttmuh.org

ABSTRACT

Currently, deformable user interfaces are a popular topic in the Human Computer Interaction (HCI) community. These interfaces enable intuitive manipulation for users. Deformable interfaces are also reported in the field of musical expression, such as sound controllers. However, the user experience of the manipulation of these interfaces is not well studied so far. This paper therefore focuses on the clarification of *pleasantness* in the manipulation of deformable interfaces for musical expression. First, evaluation experiments were conducted to investigate the pleasantness and user impressions of deformable interface manipulation using 36 dissimilar interface mockups. The evaluation results explained that the impressions related to the activity factor particularly correlate with pleasantness. Also, Hayashi's quantification theory type I revealed the relationship between the physical features of the interfaces and pleasantness. Based on the findings, the ideal deformable interface design for pleasant musical expression was finally proposed. The design was with medium deformation and squashing manipulation.

Keywords: *deformable interface, user experience, interface for musical expression, pleasantness, impression*

1. INTRODUCTION

Deformable user interfaces currently are popular topic in the HCI (Human-Computer interaction) community. Key applications of deformable interfaces include a flexible handheld display that allows deformation-based interactions (Steimle et al., 2013). These interfaces enable

intuitive manipulation for users. Applications of deformable interfaces are also reported in the field of musical expression, such as a sound controller in which sounds are controlled by bending or stretching deformation of the interface (Chang & Ishii, 2007). Therefore, by means of mapping the deformation to sound change, these controllers enable intuitive control of sounds not only discretely but also continuously. However, the user experience and *pleasantness* in the manipulation of these controllers is basically designed for taking pleasure in the expression of sounds, are not well studied so far.

This study therefore focuses on *pleasantness* in the manipulation of deformable interfaces for musical expression and investigates how the physical features of the interfaces affect *pleasantness* based on the Kansei engineering approach (Nagamachi, 1995). The study also investigates user impressions of deformable interface manipulation and discuss the relationship between the impressions and *pleasantness*. Based on the findings, this study finally proposes a prototype of the ideal deformable interface design that provide more pleasant user experience.

2. EVALUATION OF PLEASANTNESS AND IMPRESSIONS

2.1. Deformable Interfaces

Evaluation experiments that employ deformable interface mock-ups were conducted to quantify user impressions and *pleasantness* in the manipulation of deformable interfaces for musical expression. For preparing mock-ups, various types of deformable interfaces were collected from previous studies (Kinoshita et al., 2014; Dezfouli & van der Heide, 2013; Singer, 2003; Chang & Ishii, 2007; Kiefer, 2010; Jensenius & Voldsund, 2012; Grierson & Kiefer, 2013; Wikström et al., 2013; Alberto, 2014; Milczynski et al., 2006; Watanabe et al., 2007; Henriques, 2012; Bisig & Schiesser, 2013; Marier, 2014; Kildal et al., 2012; Raphael & Patrick, 2011; Vanderloock et al., 2013; Herkenrath, 2008; Troiano et al., 2014; Bacim et al., 2012; Sugiura et al., 2012; Burstyn et al., 2013; Lahey et al., 2012). Based on the collected interfaces, 36 dissimilar interfaces were selected and their mock-ups are shown in Figure 1 were finally prepared for the target of the evaluation experiments. The materials of the mock-ups include paper, wood, rubber tube, elastic cloth, sponge, cotton wool, silicone rubber, latex, metal spring, metal wire, clay, plastic sheet and a rubber ball. Although some of the mock-ups allow two or more types of deformation, this study only focuses one representing deformation for each mock-up since user impressions and *pleasantness* in the interface manipulation may depend on deformation types. The representing deformation for the mock-up Nos. 1, 2, 5, 6, 14, 18, 19, 26, 29 and 31 are *stretching*; Nos. 3, 11, 13 and 21 employ *twisting* manipulation; Nos. 4, 10, 15–17, 23–25, 32, 33 and 36 employ *bending*; Nos. 7–9, 20, 22 and 34 employ *squashing* while Nos. 12, 27, 28, 30 and 35 employ *pushing*.



Figure 1: Mockups of deformable interfaces for musical expression

2.2. Adjective Words

This study employed adjective words in pairs to express user impressions in the manipulation of deformable interfaces. First, 271 adjectives related to interface manipulation were collected from dictionaries and previous studies. Therefore, it is by combining similar adjectives and pairing them with those having opposite meanings, a total of 19 adjective pairs are refined and shown in Table 1.

Table 1: Adjective pairs for the evaluation of user impressions

No.	Adjective Pairs	No.	Adjective Pairs
1	cold - warm	11	biological - mechanical
2	poor - rich	12	difficult-to-understand - easy-to-understand
3	rough- delicate	13	unapproachable - approachable
4	cramped- spacious	14	ordinary - unique
5	styleless - stylish	15	dark - bright
6	heavy – light	16	undependable - dependable
7	uncomfortable - comfortable	17	quiet - lively
8	unfavourable - favourable	18	conservative - flashy
9	fuzzy – clear	19	conventional - unconventional
10	chancy – secure		

2.3. Methods

A total of 12 university students that comprised of nine males and three females aged 21–27 years with a mean age of 22.58 (standard deviation = 1.44) years took part in the experiment. Six of them had one or more years of experience of playing musical instruments. The participants received one of the 36 mock-ups and its instruction as a video clip. The video clip lasts approximately 20 minutes and shows the way of manipulating modulation, pitch and volume of sounds by the representing deformation of the mock-up. After watching the video, the participants used the mock-up as if they were actually manipulating sounds and checked the sense of the manipulation. The participants were then asked to evaluate the impressions of the

manipulation using the 19 adjective pairs with five-point Semantic Differential (SD) scale. They also evaluated *pleasantness* of the manipulation using the statement ‘I felt pleasant with the mock-up manipulation and a five-point Likert scale where ‘1’ and ‘5’ represents disagree and agree, respectively. The set of evaluations was followed by an interview in which the participants responded to the question ‘What kinds of features were pleasant/unpleasant in manipulating the mock-up?’ Each participant executed the aforementioned evaluation procedure for all the 36 mock-ups. The order of mock-up presentation was balanced between participants.

2.4. Results and Remarks

Figure 2 shows the evaluation results of *pleasantness* in the manipulation of each deformable interface mock-up. The best-rated mock-ups were Nos. 6, 2 and 1, and their average scores were 4.50, 4.08 and 4.00, respectively. All these mock-ups were with manipulation resistance, manipulated by stretching deformation and recovered to their original form by themselves after the deformation. Their deformation scale was neither too small nor too large. Meanwhile, the mock-ups Nos. 19, 31 and 34 were worst rated with the average score of 1.50, 1.75, 1.83, respectively. The deformation scale of these mock-ups was commonly small.

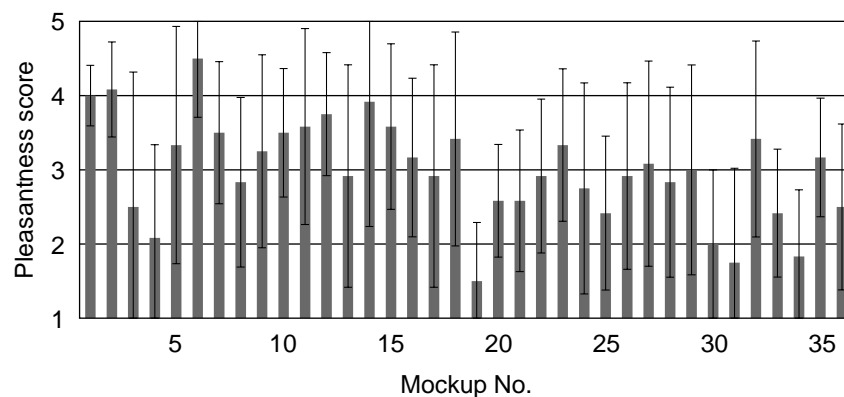


Figure 2: Evaluation results of pleasantness in the manipulation of each mock-up

The evaluation scores of the six participants with the experience of playing musical instruments are compared with those of the remaining six participants without the experience. The results of the *t*-test explained that no significant difference exists between the two groups in relation to all the mock-ups except mock-up No. 3. The average pleasantness scores for the mock-up No. 3 were 1.33 and 3.67 because the participants involved are a mixture of between experienced and inexperienced, respectively. An inexperienced participant commented that ‘The unexpected movement was fun.’ in the interview. However, a participant with musical experience commented ‘Adjusting the sound was difficult due to the unexpected movement.’ These results suggested that the unexpected movement was one of the contributing factors that decrease pleasantness for users with musical experience. The difference of the evaluation scores between the participants with and without the musical experience was not significant except for the one mock-up, the effect of the musical experience was not considered in the after-mentioned analyses.

3. INVESTIGATION OF PLEASANT MANIPULATION

3.1. Relationship between Impressions and Pleasantness

In order to analyse the relationship between user impressions and *pleasantness* in the manipulation of deformable interfaces for musical expression, the semantic space of the impressions was simplified. A Factor Analysis with the principal factor method was performed using the average impression evaluation scores for all participants. Four factors were extracted where the eigenvalue was over 1.0. Table 2 shows the result of factor matrices rotated by the Varimax method. Note that the result is sorted in descending order of the absolute value of factor loadings with respect to each factor. The factor loadings in the table indicate that Factors 1, 2, 3 and 4 are considered as the factors of activity, amenity, stability and clarity, respectively. The accumulated contribution ratio was 73.7%. This value indicates that most characteristics of user impressions for the manipulation can be expressed by these four factors.

Based on the extracted four factors, the relationship between user impressions and pleasantness was analysed. Figure 3 illustrates the relationship between the factor scores and the average pleasantness scores. A statistically significant correlation was observed between Factor 1 (activity) and *pleasantness* (two-sided test: $t(34) = 5.26, p < 0.01$) with the correlation coefficient of $r = 0.67$. The pleasantness scores also correlated with the scores of Factor 2 (two-sided test: $t(34) = 3.27, p < 0.01$) and Factor 4 (two-sided test: $t(34) = 2.70, p < 0.05$) with the correlation coefficients of $r = 0.49$ and $r = 0.42$, respectively. Meanwhile, no correlation was observed for Factor 3 (two-sided test: $t(34) = 0.45, p = 0.65$).

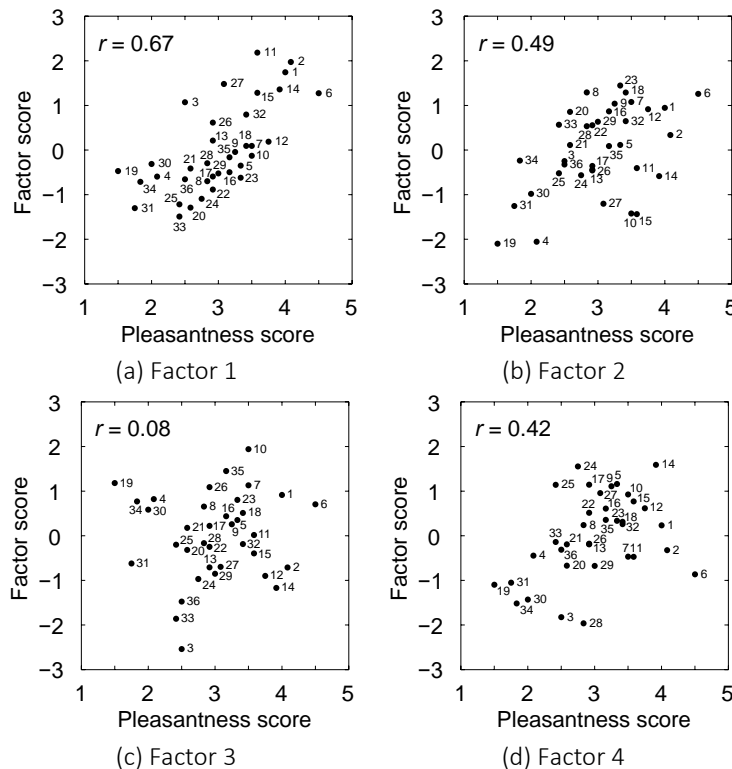


Figure 3: Relationship between factor scores and the evaluation scores of pleasantness

Table 2: Result of factor analysis

Adjective Pairs	Factor 1	Factor 2	Factor 3	Factor 4
conservative – flashy	0.916	-0.161	-0.162	0.056
poor – rich	0.862	0.078	-0.028	0.301
styleless - stylish	0.859	0.171	-0.014	0.038
quiet – lively	0.814	-0.159	-0.192	0.122
rough- delicate	0.783	0.135	0.066	-0.011
dark – bright	0.715	0.350	0.044	0.216
ordinary – unique	0.667	-0.127	0.294	-0.413
conventional – unconventional	0.654	-0.139	0.295	-0.517
cramped- spacious	0.625	0.488	0.021	0.405
heavy – light	-0.088	0.873	-0.348	0.078
uncomfortable – comfortable	0.273	0.741	0.140	0.286
cold – warm	-0.083	0.677	0.360	0.013
unapproachable – approachable	-0.004	0.626	0.358	0.514
unfavourable – favourable	0.520	0.582	0.183	0.408
chancy – secure	-0.343	0.269	0.844	0.034
undependable – dependable	0.103	-0.145	0.773	0.191
biological – mechanical	0.201	-0.136	0.544	-0.157
difficult-to-understand - easy-to-understand	0.093	0.291	0.292	0.794
fuzzy – clear	0.446	0.118	0.046	0.583
Contribution Ratio (%)	32.1	16.9	12.5	12.2

3.2. Relationship between Physical Features of Interfaces and Pleasantness

In order to clarify the relationship between the physical features of deformable interfaces for musical expression and *pleasantness* of their manipulation, an analysis based on quantification theory type I (Hayashi, 1952) was conducted using the average pleasantness evaluation score for all participants. The analysis used the seven items with up to five categories shown in Table 3 to express the physical features.

Table 4 shows partial correlation coefficients between *pleasantness* and each item. The first and second highest coefficients explained that the items of deformation scale and deformation type strongly affected pleasantness. Meanwhile the items of shape recovery and manipulation resistance were explained that they were hardly related to pleasantness. Figure 4 shows the category scores regarding to pleasantness. The scores represent how the physical features of the interfaces affect pleasantness in the manipulation. The scores represented that medium deformation increased pleasantness in the manipulation though too large deformation scale resulted in decreasing pleasantness. Some of the participants commented, 'Because the limit of deformation was unclear, I felt afraid of how far I can operate.' and 'I will get tired because of the

large deformation amount.’ in the interview. These comments accorded with the results. The scores also indicated that pleasantness increased by using the squashing manipulation while it decreased by using the twisting manipulation. Several participants commented, ‘It is easy to understand that the more I squash this, the more the sound changes.’ and ‘I cannot imagine the twisting manipulation to control the sound.’ The comments also corresponded with the results.

Table 3: Items and their categories for the analysis of quantification theory type I

Item	Categories				
deformation type	pushing	squashing	stretching	bending	Twisting
deformation scale	large	medium	small		
manipulation resistance	large	medium	small		
shape recovery after manipulation	yes	no			
held in hand when manipulated	yes	no			
hand region used for manipulation	fingertip	palm	palm+arm		
number of hands used for manipulation	one-handed	two-handed			

Table 4: Partial correlation coefficient for each item

Item	PCC
deformation type	0.508
deformation scale	0.757
manipulation resistance	0.126
shape recovery after manipulation	0.010
held in hand when manipulated	0.298
hand region used for manipulation	0.342
number of hands used for manipulation	0.331

4. PROTOTYPE OF DEFORMABLE INTERFACES FOR MUSICAL EXPRESSION WITH PLEASANT MANIPULATION

Based on the findings throughout this study, a prototype design of the ideal deformable interface for pleasant musical expression is finally presented. In order to realise pleasant musical manipulation, the interface needs manipulation resistance and to be recovered to its original form after the manipulation as mentioned in Section 2.4. It is also important to adopt a medium deformation scale and squashing manipulation as described in Section 4.2. A prototype of deformable interface that satisfies these attributes was implemented as shown in Figure 5. This prototype is made out of a sponge cuboid covered with elastic cloth with a width of 10 cm, a depth of 10 cm and a height of 20 cm. Sound attributes like modulation and pitch can be controlled by using a single-hand squashing of the prototype. A 12 cm bending sensor is connected to a microcontroller (Arduino Uno) that is installed alongside the sponge cuboid so that the amount of squashing can be detected. The sensor value is transmitted to a PC through

the microcontroller and converted into MIDI data using PC software running on the Pure Data programming environment. The MIDI data is finally sent to a synthesiser.

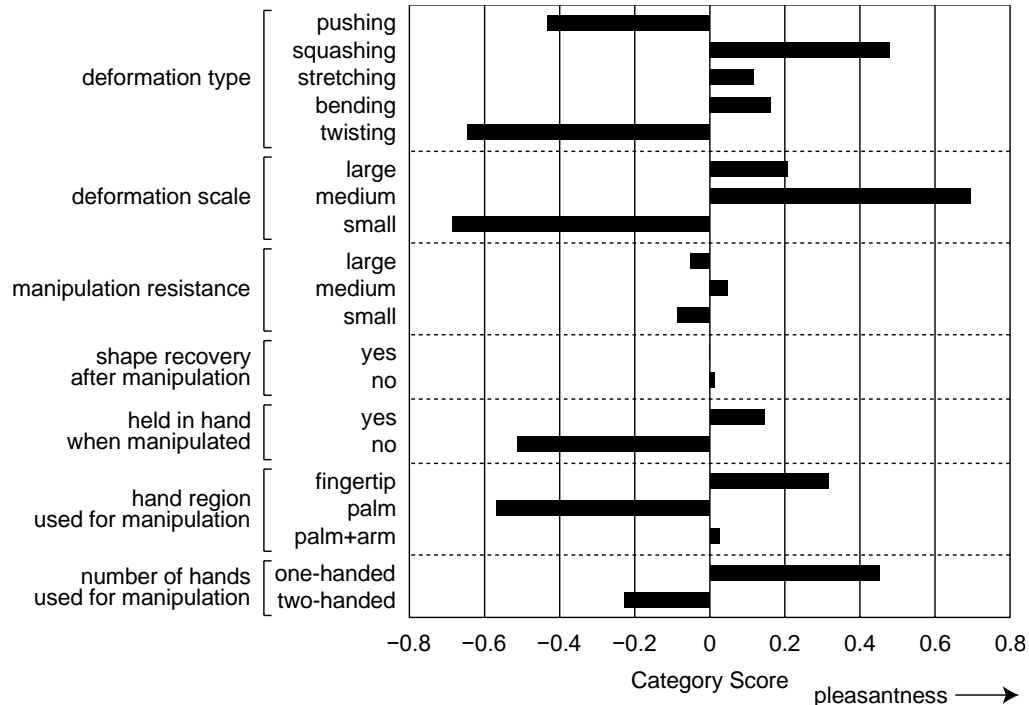


Figure 4: Category scores regarding to pleasantness in the manipulation

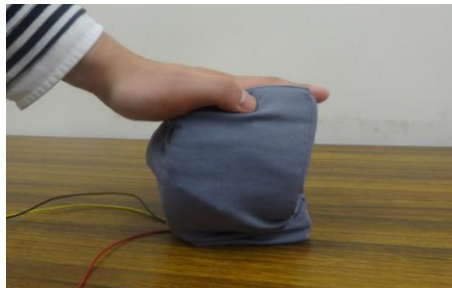


Figure 5: Prototype of the proposed deformable interface for musical expression

5. CONCLUSION

This paper focused on *pleasantness* in the manipulation of deformable interfaces for musical expression and investigated the ideal deformable interface design for pleasant musical expression. In the investigation process, a set of evaluation experiments was conducted to quantify user impressions and *pleasantness* in the manipulation. The results clarified the relationship between the impressions and pleasantness as well as the relationship between the physical features of the interfaces and pleasantness. This study provided the following findings regarding to *pleasantness* in the manipulation of deformable interfaces for musical expression.

1. User impressions in the manipulation of deformable interfaces are expressed by mainly four factors which are activity, amenity, stability and clarity.

2. The factor most related to *pleasantness* in the manipulation is the activity factor.
3. The physical features of the interface are strongly related to *pleasantness* in the manipulation are the scale and the type of deformation. The attributes of medium deformation scale and squashing manipulation respectively contribute to increase *pleasantness*.

These findings can be used as a guideline to create future deformable musical interfaces that provides a heightened pleasantness user experience. This study is focused on *pleasantness* with respect to the manipulation. Further investigations upon the effects of the physical appearance of deformation from the approach of user experience should be expedited.

REFERENCES

- Steimle, J., Jordt, A. & Maes, P. (2013). Flexpad: Highly flexible bending interactions for projected handheld displays. *Proc. CHI 2013*, 237–246.
- Chang, A. & Ishii, H. (2007). Zstretch: A stretchy fabric music controller. *Proc. NIME 2007*, 46–49.
- Nagamachi, M. (1995). Kansei engineering: A new ergonomic consumer-oriented technology for product development. *International Journal of Industrial Ergonomics*, Vol. 15, No. 1, 3–12.
- Kinoshita, Y., Go, K., Kozono, R., & Kaneko, K. (2014). Origami tessellation display: Interaction techniques using origami-based deformable surfaces. *Ext. Abstracts CHI 2014*, 1837–1842.
- Dezfouli, E. A. & van der Heide, E. (2013). Notesaaz: A new controller and performance idiom. *Proc. NIME 2013*, 115–117.
- Singer, E. (2003). Sonic Banana: A Novel Bend-sensorbased MIDI Controller. *Proc. NIME 2003*, 220–221.
- Kiefer, C. (2010). A malleable interface for sonic exploration. *Proc. NIME 2010*, 291–296.
- Jensenius, A. R. & Voldsund, A. (2012). The music ball project: Concept, design, development, performance. *Proc. NIME 2012*, 4 pages.
- Grierson, M. & Kiefer, C. (2013). NoiseBear: A wireless malleable instrument designed in participation with disabled children. *Proc. NIME 2013*, 122–126.
- Wikström, V., Overstall, S., Tahiroğlu, K., Kildal, J. and Ahmaniemi, T. (2013). MARSUI: Malleable audioreactive shape-retaining user interface. *Proc CHI 2013*, 3151–3154.
- Alberto, B. (2014). SCULPTON: A malleable tangible interface for sound sculpting. *Proc. ICMC 2014*, 737–743.
- Milczynski, M., Hermann, T., Bovermann, T., & Ritter, H. (2006). A malleable device with applications to sonification-based data exploration. *Proc. ICAD 2006*, 69–76.

Watanabe, E., Hanzawa, Y., & Inakage, M. (2007). Clay tone: a music system using clay for user interaction. *Proc. SIGGRAPH 2007*, Posters No. 156, 1 page.

Henriques, T. (2012). Sonik Spring, Ext. Abstracts CHI 2012, 1019–1022.

Bisig, D. & Schiesser, S. (2013). Coral - A physical and haptic extension of a swarm simulation. *Proc. NIME 2013*, 385–388.

Marier, M. (2014). Designing mappings for the sponge: Towards spongistic music. *Proc. NIME 2014*, 525–528.

Kildal, J., Paasovaara, S., & Aaltonen, V. (2012). Kinetic device: Designing interactions with a deformable mobile interface. *Proc. NIME 2012*, 1871–1876.

Raphael, W. & Patrick, B. (2011). Modular and deformable touch-sensitive surfaces based on time domain reflectometry. *Proc. UIST 2011*, 517–526.

Vanderloock, K., Abeele V. V., Suykens J. A. K., & Geurts, L. (2013). The skweezee system enabling the design and the programming of squeeze interactions. *Proc. UIST 2013*, 521–529.

Herkenrath, G. (2008). *Deformable user interfaces: An explorative study of malleable input devices in mobile applications*. RWTH Aachen University, Master's Thesis.

Troiano, G. M., Pedersen, E. W., & Hornbæk, K. (2014). User-defined gestures for elastic, deformable displays. *Proc. AVI 2014*, 1–8.

Bacim, F., Sinclair, M., & Benko, H. (2012). Challenges of multitouch interactions on deformable surfaces. *Proc. ITS 2012*, 225–234.

Sugiura, Y., Inami, M., & Igarashi, T. (2012). A thin stretchable interface for tangential force measurement. *Proc. UIST 2012*, 529–535.

Burstyn, J., Banerjee, A., & Vertegaal, R. (2013). FlexView: an evaluation of depth navigation on deformable mobile devices. *Proc. TEI 2013*, 193–200.

Lahey, B., Girouard, A., Burleson, W., & Vertegaal, R. (2011). PaperPhone: Understanding the use of bend gestures in mobile devices with flexible electronic paper displays. *Proc. CHI 2011*, 1303–1312.

Hayashi, C. (1952). On the prediction of phenomena from qualitative data and the quantification of qualitative data from the mathematico-statistical point of view. *Annals of the Institute of Statistical Mathematics*, 3(2), 69–98.

THE EFFECTS OF MUSICAL PIECES COMPOSED BY HIROYUKI SAWANO

A STUDY USING THE ANIME, ATTACK ON TITAN

Ruiji SASAKI ^{*a}, Naoto HAYASHI ^{*b}, Masashi YAMADA ^{*c}

** Graduate School of Engineering, Kanazawa Institute of Technology, Japan*

{^ab1339080@planet, ^bb1223334@planet, ^cm-yamada@neptune } .kanazawa-it.ac.jp

ABSTRACT

HiroYuki Sawano's musical pieces have the following common structure with videos where the musical sound fades out preceding the most exciting scene in a video, and silence comes for several seconds. Then, a loud solo vocal starts at the beginning of the most exciting scene, and the accompaniment follows the vocal. This structure was typically used in a musical piece in the anime, "Attack on Titan". In Experiment 1, Sawano's musical pieces composed for other anime replaced the original piece in "Attack on Titan" and participants continuously indicated their emotions. The results showed that the degrees of the arousal and congruency drastically increased at the most exciting scene when the pieces possess the same structure. However, a musical piece for a drama also showed low levels of arousal and congruency, in spite of the piece possessing the structure. In Experiment 2, the excerpt of "Attack on Titan" was consistently used for the preceding scene before the most exciting scene and the music is switched to one of various pieces for the most exciting scene. The results showed that the arousal and congruency degrees have drastically raised when the original piece was switched to the pieces that contains the same structure. This suggested that the silence preceding the exciting scene weakened the link between the different pieces. In the case of the drama piece, the degrees of the arousal and congruency were at low levels. This implies that the musical features other than the structure are also important for arousal and congruency.

Keywords: *continuous measurement, emotion, congruency, Sawano Hiroyuki, Attack on Titan*

1. INTRODUCTION

Hiroyuki Sawano is a popular composer who produces music for anime and dramas. His musical pieces have the following common structure with videos where the musical sound fades out proceeding the most exciting scene in a video, and silence comes for several seconds. Then, a loud female solo vocal starts at the beginning of the most exciting scene, and the accompaniment follows the vocal.

In western popular music, most pieces are constructed by “verse” and “chorus” parts. In Japanese popular music, the verse is often divided into an A-melody and a B-melody, and the chorus is called “sabi”. The part where a loud female vocal solely starts and the accompaniment follows the vocal corresponds to the “chorus” or “sabi” in Sawano’s pieces. The structure described above was typically used in a musical piece in a fighting scene in the Japanese anime, “Attack on Titan”. In the present study, whether the musical structure described above emphasizes viewers’ emotional excitement is tested using musical and video materials of “Attack on Titan”.

2. EXPERIMENT 1

2.1. Experimental Methods

The anime, “Attack on Titan” was first produced as a TV programme. Then, the series episodes were remixed into two theatre movies. The first one was entitled “Attack on Titan: Wings of Freedom”. In this movie, the climax scene showed two titans battling. In the TV series, the musical piece “ət'æk ON táɪtn” which contains the structure described above and was used for the scene. However, in the movie, another piece which did not contain the structure has replaced “Attack on Titan”. In Experiment 1, a part of the video of the movie “Attack on Titan: Wings of Freedom” was excerpted (Chapter 8, 1:44:08 ~ 1:46:07). The video started at a couple minutes before the climax battle scene. In the 5.1 channel audio tracks of the movie, the voices and sound effects were separately recorded from the music track.

Table 1 shows the list of excerpts of musical pieces used in Experiment 1. Hiroyuki Sawano composed many musical pieces for various anime and dramas using the same structure to “ət'æk ON táɪtn”. Eleven pieces composed by Sawano were prepared (#1A-#9A in Table 1). They contained the aforementioned structure. Ten of them were composed for anime, and the other one was composed for a drama entitled “ma-re” (#7A). Additionally, two pieces were composed by Sawano were also prepared (#10A and #11A in Table 1). They did not contain similar structures. Those pieces were synthesized with the video excerpted from the movie and eleven audio-visual stimuli were constructed.

Table 1: Musical pieces used in Experiment 1

Stimulus ID	Musical pieces
#1A	ymniam-Mkorch
#2A	MKAlieZ
#3A	BRE@TH//LESS
#4A	βios
#5A	KABANERIOFTHEIRONFORTRESS
#6A	Before my body is dry
#7A	Because of you (used in the drama, “ma-re”)
#8A	StarRingChild -English ver-
#9A	Uncontrollable
#10A	Wild war Dance
#11A	DOA

Russell (1980) showed that the emotions were illustrated by a two-dimensional plane spanned by valence and arousal dimensions, in the simplest way. Using this two-dimensional plane, E. Schubert (1999) measured musical emotions continuously. In the present study, a continuous measuring system of emotions like Schubert was prepared. The plane on a tablet showed an uncomfortable - comfortable axis and a calm – arousal axis (Fig. 1). A participant continuously indicated instantaneous emotions while drawing a pen on the plane, while an audio-visual stimulus was presented. The values of the emotions ranging from -10.0 to +10.0 were recorded in the computer system. The videos were presented through the 27.1-inch display (EIZO, ColorEdge CX271) and music was presented through the headphone (STAX SR-407) in $L_{Aeq} = 66.5$ to 68.5 dB. Fifteen students of the Kanazawa Institute of Technology (21-22 years old) participated in the experiment.

In the another session, the participants continuously rated the degree of congruency between the music and video while each stimulus was presented using the vertical axis of the tablet. After the continuous rating of the congruency, the participants rated the overall impressions for each stimulus, using seven-step scales of arousal, coolness, impressiveness, joy, preference, amusement and congruency between the music and video. The stimuli were re-presented in a random order for each participant.

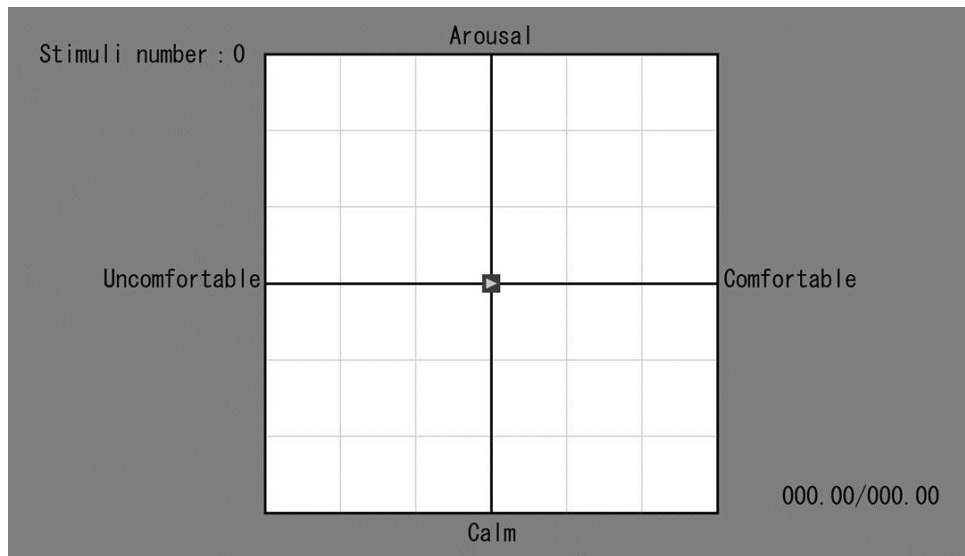


Figure 1: The plane of the tablet for the continuous measuring of emotions

2.2. Results and Discussion

Figure 2 shows the arousal degree for each stimulus as a function of time. Figure 2 shows that the arousal degrees reach to a high level for all pieces in the most exciting scene. However, the arousal degrees are quite different in the verse for different pieces. Especially, the piece which does not contain the structure (#10A) which showed a high arousal degree even in the verse. As a result, the increase of the arousal at the most exciting scene is smaller than the other pieces. In the case of the piece for the drama “ma-re” (#7A), the arousal degree is quite lower than the other pieces both in the verse and chorus parts. This piece was used in the climax scenes where the heroine’s father sobbed passionately in the drama, “ma-re”. Therefore, the piece might contain a low level of arousal.

Figure 3 shows the comfort degree. Figure 3 shows that the comfort degree is raised in the most exciting scene. However, the increase in the degree of comfort are different among the different pieces. Especially, the piece that does not contain the structure (#10A) is found to not increase largely. Figure 4 shows the congruency between the music and video. The congruency was raised in the most exciting scene. However, the piece for “ma-re” contains a low level of arousal which led to a low level of congruency for both the verse and chorus. Figure 5 shows the mean values of overall rating for each stimulus. Figure 5 shows that the overall ratings are lower in the case of the pieces for “ma-re”, than in the other pieces. These results implied that the emotional congruency between the music and the video is also important other than the structure.

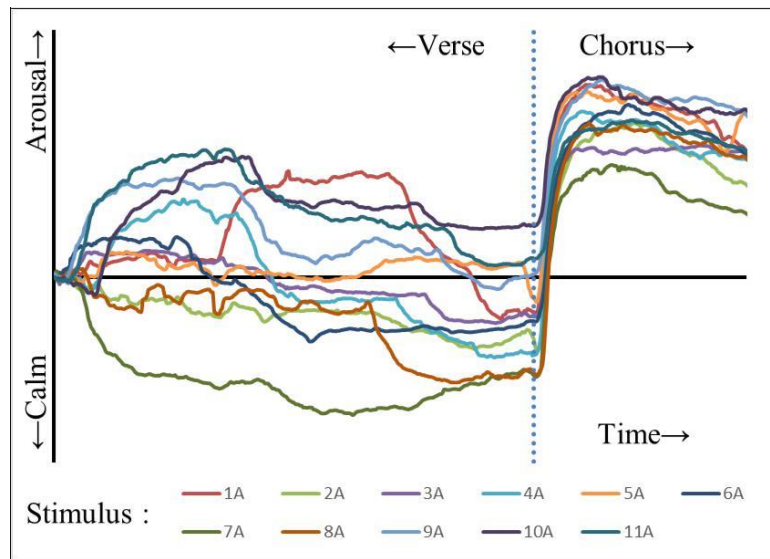


Figure 2: The arousal degree of each stimulus in Experiment 1 is plotted as a function of time

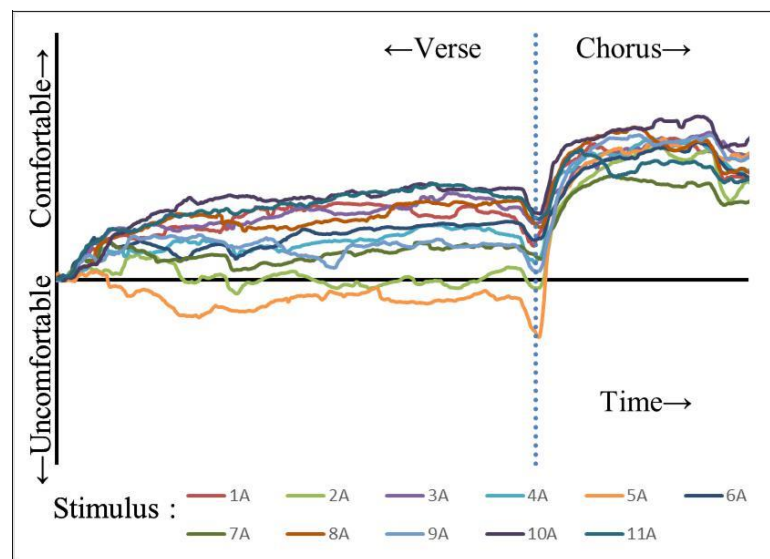


Figure 3: The comfort degree of each stimulus in Experiment 1

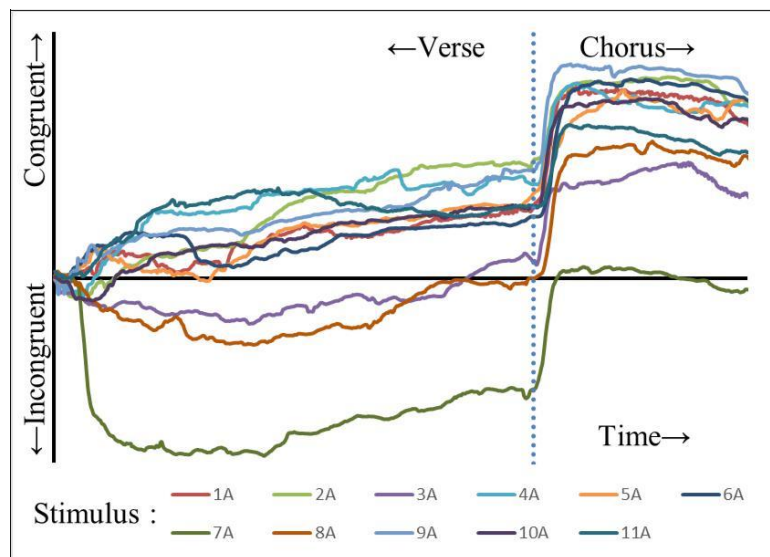


Figure 4: The congruency degree between the music and video for each stimulus in Experiment 1

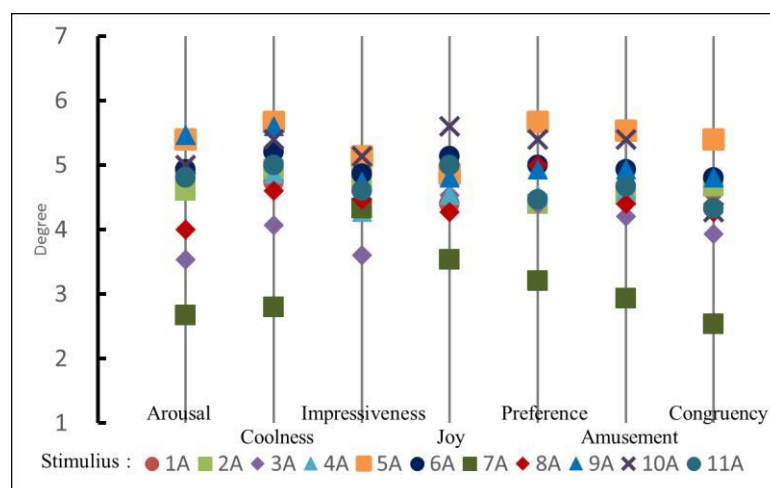


Figure 5: Overall ratings for each stimulus in Experiment 1

3. EXPERIMENT 2

3.1. Experimental Methods

The results in Experiment 1 showed that a musical piece might effectively replace the original piece for the video of "Attack on Titan", if similar structures was used throughout all the pieces. In this structure, the silence before the chorus may separate the connection between the verse and the chorus. Then, in Experiment 2, the verse part of the musical piece "ət'æk ɒn táɪtən" was consistently used for the preceding scene before the most exciting scene and the music was

switched to one of various pieces for the most exciting scene. The musical pieces used in Experiment 2 are listed in Table 2. All pieces commonly contained the structure, including the usage of female voices. The participants and the other experimental methods were identical to Experiment 1.

Table 2: Musical pieces used in Experiment 2

Stimulus ID	Musical pieces
#1B	ymniam-Mkorch
#2B	MKAlieZ
#3B	BRE@TH//LESS
#4B	Bios
#5B	KABANERIOFTHEIRONFORTRESS
#6B	Before my body is dry
#7B	Because of you (used in the drama, “ma-re”)
#8B	StarRingChild -English ver-
#9B	Uncontrollable

3.2. Results and Discussion

Figure 6 shows the arousal degrees. The arousal degree has raised significantly at the most exciting scene in all stimuli. However, the increase of the arousal is lower in the cases where the piece for “ma-re” (#7B) is used. Similarly, the increase of the comfort degree is lower in the piece for “ma-re” than the other pieces (Fig. 7).

Figure 8 shows the congruency between the music and video. In several cases, the congruency maintains in a high level after the piece was switched. However, in the case of #7B, where the piece for “ma-re” was used, the congruency declines after the piece was switched with “ət'æk ON táɪn”. This implies that the silence may not completely separate the verse and the chorus. The differences between the two pieces in various musical factors, e.g., tempo, key, timbre, etc., may decline the congruency between the music and video. In the case where the piece for “ma-re” was switched with “ət'æk ON táɪn” (#12B), the differences between the two pieces also negatively affected the congruency. Figure 9 shows that the overall ratings are very low in the case where the musical piece for “ma-re” was switched with “ət'æk ON táɪn”.

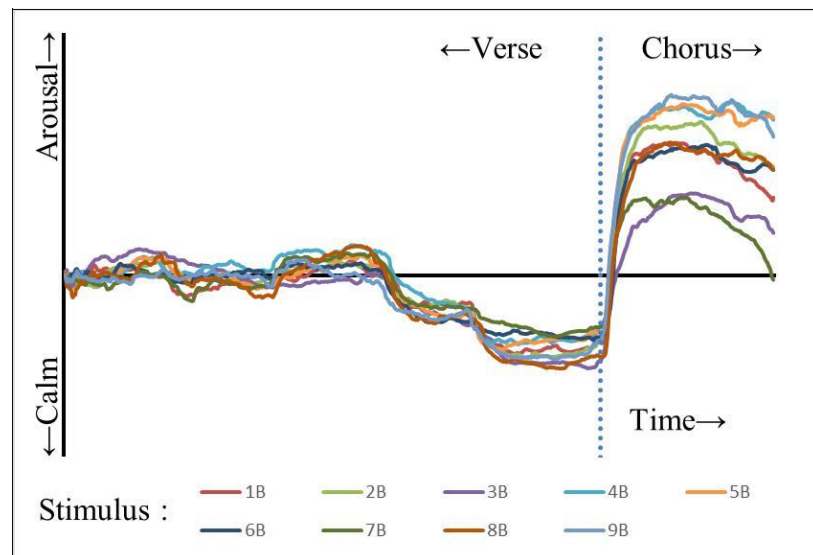


Figure 6: The arousal degree of each stimulus in Experiment 2

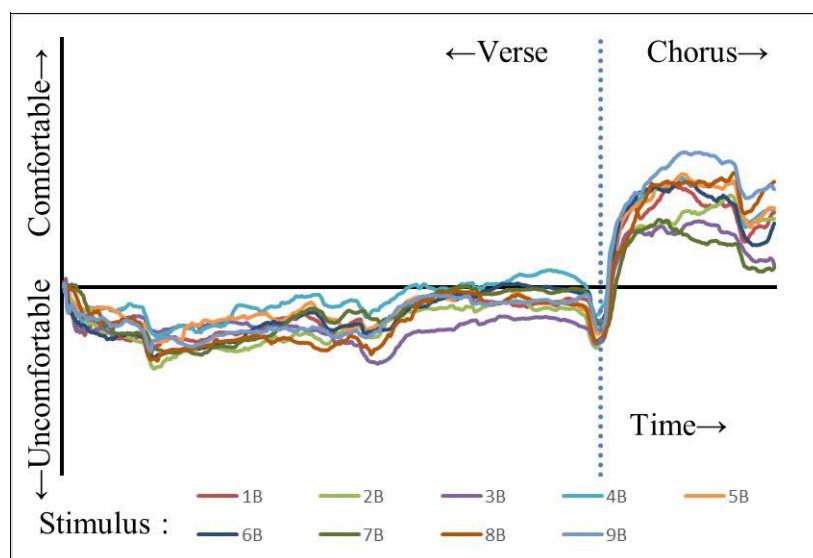


Figure 7: The comfort degree of each stimulus in Experiment 2

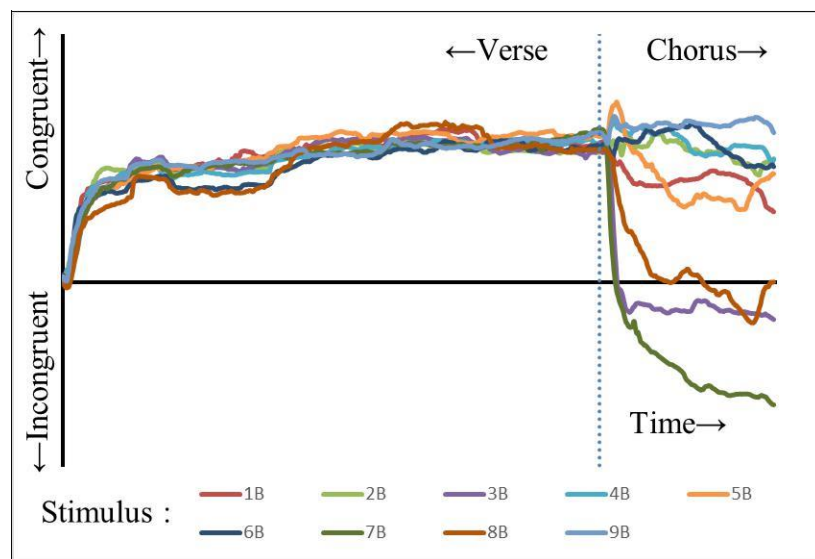


Figure 8: The congruency degree for each stimulus in Experiment 2

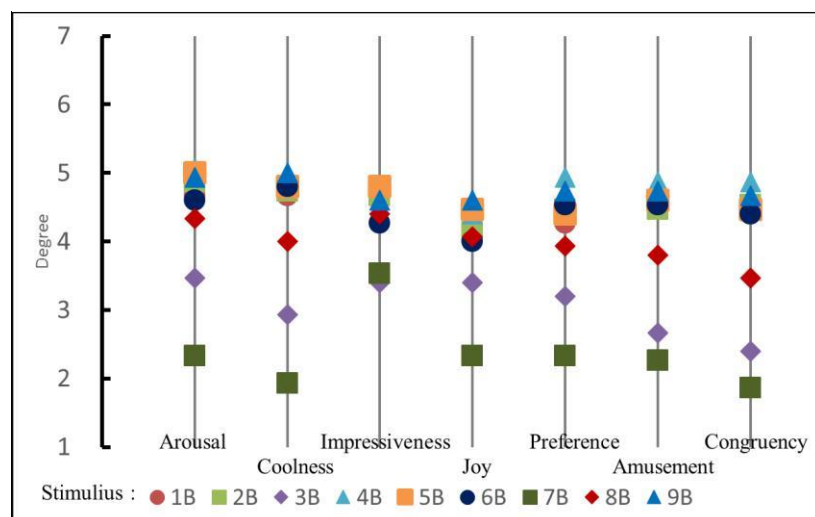


Figure 9: Overall ratings for each stimulus in Experiment 2

4. CONCLUSIONS

The musical pieces composed by Hiroyuki Sawano for anime and dramas shared a common structure in videos. In the present study, the correlation between the structure and the emotions was researched using an excerpt of the video of “Attack on Titan” and musical pieces composed by Hiroyuki Sawano. The results of the experiment strongly emphasised the arousal of the video and it led to a high congruency between the music and video and high degrees of overall ratings. It was also shown that not only the structure but also the emotional congruency between the music and the video was important for the overall ratings. Moreover, the results suggested that the silence at the end of the verse might not be completely separate the verse and the chorus.

5. REFERENCES

- Araki, T. (Director). *Attack on Titan: Wings of Freedom* [Motion picture]. JapanTokyo. WIT STUDIO.
- Russell, R. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39, 1161-1178.
- Sawano, H. (2012). β ios [Recorded by M. Aizawa]. On *Guilty Crown Original Soundtrack* [CD]. Tokyo: Aniplex Inc.
- Sawano, H. (2013). DOA [Recorded by M. Aizawa]. On *"Attack on Titan" Original Soundtrack* [CD]. Tokyo: PONY CANYON INC.
- Sawano, H. (2014a). BRE@TH//LESS [Recorded by M. Aizawa]. On *ALDNOAH.ZERO ORIGINAL SOUNDTRACK* [CD]. Tokyo: Aniplex Inc.
- Sawano, H. (2014b). MKAlieZ [Recorded by Mitsunori Aizawa]. On *ALDNOAH.ZERO ORIGINAL SOUNDTRACK* [CD]. Tokyo: Aniplex Inc.
- Sawano, H. (2014c). StarRingChild -English ver- [Recorded by M. Aizawa]. On *UnChild* [CD]. Tokyo: DefSTAR RECORDS.
- Sawano, H. (2015a). Because of you [Recorded by M. Aizawa]. On *Ma-re Original Soundtrack* (in Japanese) [CD]. Tokyo: SONY RECORDS.
- Sawano, H. (2015b). Uncontrollable [Recorded by M. Aizawa]. On *XenobladeX Original Soundtrack* [CD]. Tokyo: Sony Music Labels.
- Sawano, H. (2015c). Wild war Dance [Recorded by M. Aizawa]. On *BEST OF VOCAL WORKS [nZk]* [CD]. Tokyo: Sony Music Labels.
- Sawano, H. (2016a). Before my body is dry [Recorded by M. Aizawa]. On *KILL la KILL ORIGINAL SOUND TRACK* [CD]. Tokyo: Aniplex Inc.
- Sawano, H. (2016b). KABANERIOFTHEIRONFORTRESS [Recorded by M. Aizawa]. On *KABANERI OF THE IRON FORTRESS ORIGINAL SOUNDTRACK* [CD]. Tokyo: Aniplex Inc.
- Sawano, H. (2017a). æt'æk ON tãɪtn <3Tv> (Instrumental) [Recorded by M. Aizawa]. On *Shingeki no Kyojin Ten (in Japanese)* [CD]. Tokyo: PONY CANYON INC.
- Sawano, H. (2017b). ymniam-Mkorch [Recorded by M. Aizawa]. On *"Attack on Titan" Season2 Original Soundtrack* [CD]. Tokyo: PONY CANYON INC.
- Schubert, E. (1996). Research with the continuous response digital interface, *Phyl. Music Educ. Rev*, 4, 20-32.

TAIWAN ARTS EXHIBITION POSTER CATEGORY AND LAYOUT SEARCHES

Hsiu-Ju LEE*, Tzu-Chiang CHANG^a

Doctoral student, Graduate School of Creative Industry Design, National Taiwan University of Arts 59, Sec.1, Daguan Rd, Banqiao Dist., New Taipei City 22058, Taiwan (R.O.C.), Taiwan, hl.ten@msa.hinet.net

ABSTRACT

In this study, we conducted samples of the posters of art exhibitions in the National Museum of History, the Taipei Fine Arts Museum and the National Taiwan Museum of Fine Arts. Which from 1984 - 2017, and conducted objective and systematic coding and analysis, and realize for more than 30 years, the form of poster layout, and the evolution of design style. The results of the study found that the art posters of the Taipei Fine Arts Museum, and the highest number of poster art categories in the three museums appeared in the west painting category; the most common art exhibition category in the Taipei Fine Arts Museum was the Multiple category. The highest category of exhibitions of National Museum of History, appears in calligraphy and painting. The National Taiwan Museum of Fine Arts poster layout, in the 12 kinds of choreography in the layout of the highest level of the largest followed by the vertical layout. Art exhibitions poster choreography, the use of at least is the oblique layout. Use the time axis and divided into four stages for statistical analysis. After cross analysis is done, the result is the following finding. First, National Museum of History in the layout of vertical take the majority of the total number of 104, of which (1991-2000) year is the vertical layout within 56 pieces. Second, Taipei Fine Arts Museum poster layout of the largest number of 119, of which (1984-1990) up to 57 cases, L and C-shaped use of the least number of only 16. Third, National Taiwan Museum of Fine Arts (2001-2017) annual level of the largest number of layout is horizontal layout. The art exhibitions of the three museums are arranged in a very high proportion, and the exhibition works are printed in the layout of the main title and the text description. Which in the painting and calligraphy, the Western painting, the comprehensive type of exhibition posters since 1990, can see the exhibition posters using the exhibition works for the base map to full version of the arrangement, showing posters design style.

* Corresponding author.

Keyword: Poster, Content analysis, Art Category, Layout

1. Preface

1-1. Research motive

Over the past two decades, international cultural activities are more active, and more countries have often adopted cultural activities to show their cultural characteristics of the countries. The cultural groups regard the posters as a representation of the overall team image. In 1990, Countries of the world were all take the museum's promotional activities as part of the overall image of the country. Using exhibitions for the cultural elements of the museum, the European countries are taking the number of museums in the country, collectibles, the amount of promotional activities, as the country's cultural standards of the benchmark. Through this, the importance of the museum can be revealed.

Domestic museums, in recent years through the museum with foreign well-known art exhibition activities, and gradually in the world cultural arena on the show, in the decentralized visual image of the positive image of the integration to unify the way published, improve the overall efficiency and image of the museum.

In the museum publication, the posters are most affluent and popular, and the posters lead to the overall exhibition activities. The concept of the museum can be used to promote the overall image of the museum to the general public and the international cultural arena through every exhibition poster.

National Museum of History, Taipei Fine Arts Museum, National Taiwan Museum of Fine Arts, no matter its establishment time or the collection in Taiwan has its symbolic status, so that's is the reason choosing these three museum art exhibition posters for the study of the sample motive.

1-2. Research Purpose

With change of time, the Taiwan art exhibition posters changed from the traditional handwritten to the general standard size of the printed posters, then evolved into the current stage by the computer output of large external wall posters. From the poster changes we can see the art exhibition posters received the attention, hope through the art exhibition posters research. National Museum of History, Taipei Fine Arts Museum, National Taiwan Museum of Fine Arts, to complete the following three purpose.

1. Explore changes in art exhibition categories
2. Analysis of changes in the layout of posters
3. Research Art Exhibition Poster Design Style

1-3. Research scope and limitations

This study was done by collecting exhibition art posters from the National Museum of History, Taipei Fine Arts Museum, National Taiwan Museum of Arts, during the 1981-2017, as the scope of the study. And the contents of the three museum art exhibition posters, including exhibitions, exhibitions, exhibitions, etc. to do the classification, the reasons for the selection of these three museums, the establishment of these three museums more historical significance and scale. And because of limited time, manpower, material and other factors, the current only three museums of the poster art category, poster arrangement and style as a research category.

2. Literature Review

2-1. Revolution of Art of Taiwan Posters

Taiwan's clear definition of the "poster" began in the sixties of the Republic of China, one after another experts and scholars referred to the "poster" cognition and interpretation (Lin Ping Cheng, 1996). At the end of the Japanese colonial period, in 1935 held in Taipei, "the beginning of forty years of Taiwan Expo", then left a few poster works (Lin Ping Cheng, 1996).

In addition, Taiwan early painter, Mr. Lin Yu Shan, Mr. Yan Shui Long have also for this period of posters left invaluable poster works. After the restoration to the fifties, "movie poster" is the most representative. In the 1960s, Taiwan's poster design began to progress as a result of economic development and the impact of "Pop style". Followed by colleges and universities "design" related departments have set up (Yang Qing Tian, 2005). This period of the film posters to montage way to describe, coupled with handwritten text content, the effect is very interesting, this period is another feature of the poster will be printed in a specific location political propaganda slogan. In the 1970s, the contents and composition of the Taiwanese posters were greatly influenced by Japan. In the 1980s, the "New Year's Design Exhibition" organized by the Foreign Trade Association was held in the Hong Kong Council of the Hong Kong Special Administrative Region. Enhance, have a great help (Yang Qing Tan, 2005). After lifting martial law from 1987, Taiwan's poster design style performance, although influenced by the Western style of art is very huge. But it can be the essence of Taiwan's cultural spirit and blending to create a Taiwanese cultural characteristic of the design style of expression. In 1991, the "Taiwan Impression Poster Design Association" was established to launch a series of "Taiwan Impression" as the theme of poster design activities, can be said that the development of the Taiwan poster design a great leap forward.

2-2. Poster layout

The definition of the composition of the poster, Lin Pen Chun (1986) that: constitute the basic elements of posters for the text, shape, and color. The text includes the catch phase, sub-catch, slogan, copy, business name, sponsor, address and telephone number. Yuan Man Li (1986) will be poster design elements summarized as: fonts, graphics and text, photography,

illustrations, patterns, colors. Yang Shang Xiong (2002) proposed poster elements: text, images, color.

As for "The layout of the poster" is different, the study is summarized as follows: Table 1:

Table 1. Summary layout of poster layout

Scholar	layout	Name of book	Time	publisher
Yuan Man-Li	Simplicity, emphasis on the degree of emphasis, visual smoothness and impact	"poster design introduction" P.35~52	1986	Taipei Fine Arts Museum
Lin Pei-Chun	Symmetry, balance, contrast, rhythm, repetition, the above five kinds of layout	"poster design overview" P.10	1986	Taipei Fine Arts Museum
Chang Yin Ling	Illustrations, the actual situation of life, light and dark compared to the color control, overlapping collage, aerial view of perspective, contraction perspective,	"Principles of Poster Design", P.103~149	1986	Taipei Fine Arts Museum
Yang Sheng-Xiong	Vertical, horizontal, diagonal, diagonal, divided, cross-shaped, Circular, curved, L-shaped, triangular, compound	"Arrangement design" P.92~109	2002	Arts Hall

(Arrangement of the research)

3、Research method and Step

3-1. Research method

This study uses the "content analysis" to classify posters; Content analysis: A written or spoken record, a breakdown, or a behavior that can be used to analyze a particular category or event, usually using archival material for content analysis (S. Bordens, Bruce B. Abbot, 1988) Content analysis is a method of research that is an indirect path, and can also be called an information analysis or a documentary analysis, which is a method of quantifying color (Jane Sheng Feng, Chen Xiu Han, 1995). Holsti (1969) pointed out that the content analysis method contains three characteristics: 1. Content analysis must be objective 2. Content analysis must be systematic 3. Content analysis must be universal (S. Bordens Bruce B. Abbot, 1988)

3-2. Research Step

This study mainly explores the changes and differences in the time and art categories of the posters of the National Museum of History, the Taipei Fine Arts Museum and the National Taiwan Museum of Art. In addition, the art exhibition content classification as a tool, according to the three museum posters content category, the annual comparative analysis of its layout of the layout changes. Divided into three stages as follows:

1. The first stage: picture collection and remake, literature collection:

- (1). Picture: *a.* Art exhibition posters in National Museum of History from 1984 - 2008
b. Art exhibition posters in Taipei Fine Arts Museum from 1984 - 2007.
c. Art exhibition posters in National Taiwan Museum of Fine Arts from 1988 -2017

- (2). Literature: *a.* The historical evolution of the poster's epoch and historical background ;
b. Literature of National Museum of History, Taipei Fine Arts Museum, National Taiwan Museum of Fine Arts ;
c. Literature and research relate to museum research ;
d. Literature about previous national art exhibition, provincial exhibition, Taipei Art exhibition brochures and text materials ;
e. Content analysis research materials and related literature ;
f. Literature about composition, layout and graphic design.

2. The second step: Three museums posters for filing, coding and classification

There are 1537 posters for the National Museum of History, Taipei Fine Arts Museum, and the National Taiwan Museum of Fine Arts, and other museums. There are 1537 exhibition posters, which will be based on the "Content Analysis" Collection of poster images were encoded and archived:

- (1). Museum Code: To the establishment of the museum in the order, as a basis to be encoded No. '1' is the Museum of History (1955 to build); No. '2' is the Taipei Fine Arts Museum (1977 to build); No. '3' is the Taiwan Museum of Fine Arts (1988 opened).

- (2).Three museums of the exhibition poster content Category: To the national level of the exhibition, the provincial exhibition, the late Taipei Art exhibition competition stage development is more mature (2004), "Museum poster research", which the history of the museum posters as the object of study, divided into painting, artifacts, photography, architecture, sculpture, life art and other five categories. This study divides the collected samples into eight categories and then subdivides them into 16 projects.

3. Step 3: Classified three museum poster's layout

To the content analysis method classify poster choreography, and further by the school, age, exhibition of art content category for cross analysis and comparison. This section of the poster layout in the layout classification, the various types of posters arranged in the form of literature, reference Sheng Xiong Yang 2002, "layout design" leaflet layout. Because the number of "equal split layout" is very small, so it is changed to "proportion split layout" to facilitate the classification of posters in the three museums. The data are organized in following table 2

Table2. poster layout

layout	content	sample	layout	content	sample
vertical	Vertical layout makes theme eye-grabbing, and easily to read.		Horizontal	Horizontal layout of the layout is put the text or image to the length of the horizontal line of horizontal clues with a calm, stable feeling.	 chart 2
oblique	Oblique layout lies between vertical and horizontal layout, but more lively and with dynamic.	 chart 3	Diagonal	Graphic layout in the layout of the diagonal, so that it produces a sense of stability, because the screen is natural and stable, with a sense of vivid.	 chart 4
proportion divided	Proportion divided layout use line divide space, classified by regular and irregular. The type of division contain vertical and Horizontal, And thus divided the line as a basis for the arrangement	 chart 5	Cross-shaped	Cross-shaped layout has not only stability of horizontal layout, but also seriousness of vertical layout, suitable for use in some of the more serious, solemn theme.	 chart 6
circular	Circular layout is use elements array into circle layout. Put theme and interest part into center, which makes the reader's attention to be placed in the center, to achieve the theme of function.	 chart 7	C-shaped	Round with a gap is called "C-shaped". Its gap is not fixed on the right, any one of the direction can be placed a gap. The viewer's sight runs with the circular, so the gap becomes the focus of attention.	 chart 8
curve	Straight line with a hard, clear feeling, the curve is elegant, soft feeling, easy to guide the viewer's line of sight to the screen.	 chart 9	L-shaped	The L-shaped arrangement is to place a vertical line on the left or right side of the layout and crosses an "L" shape with the lower horizontal line. Both in the subject content or layout are bold and innovative design.	 chart 10
triangle	Triangle layout is the arrangement of elements into a geometric composition of the triangle, often gives a stable, peaceful feeling.	 chart 11	Compound	Compound is the layout of two or more of the two layouts of arrangement of the application, because of the various layouts of arrangement, so the overall feeling will be more diverse and lively.	 chart 12
p.s. chart 1-4: Taipei Fine Arts museum exhibition poster ; chart 5-8: National Taiwan museum of Fine Arts exhibition poster; chart 9-12: National museum of History exhibition poster					

(arrangement of the research)

4、Analysis of research result

4-1. analysis by art exhibition content category, museum, and quantity statistic

This research is classified by three design specialists. With the poster's statistics result, we can find that the most category among these museums is west painting .and the Taipei Fine Arts Museum poster category is also the West Painting take highest composition. While the National Taiwan Museum of Fine Arts has the multiple exhibitions, and the second one is West Painting. And the National Museum of History is painting & calligraphy category and design & craft category, both is up to 23%. This research has collected 1,537 pieces of domestic exhibition posters. Detail of situation is shown in table 3.

Table 3. The sum of three museums posters classified by art exhibition category

content category		Painting & Calligraphy	West Painting	Woodblock Print	Sculpture	Photography	Design & Crafts	Multiple Exhibition	other
museum	1	85	44	9	29	15	86	31	71
	2	74	161	35	31	37	36	69	37
	3	110	190	51	14	49	25	218	30
total		269	395	95	74	101	147	318	138
%		18%	25%	6%	5%	7%	9%	21%	9%

(Arrangement of the research)

4-2. Analysis of Three museums poster layout by time interval

Three museums poster layout is the highest in horizontal layout, which accounted to 25% within 12 layouts. The second one is divided layout, which accounted for 18%, while the vertical layout takes 16%. The oblique layout is the least used layout which accounted for 3%, and the following are diagonal layout and curve layout, which both accounted for 4%. With the cross analysis and comparison, researcher has following finding.

First, Vertical layout is the most used in Museum 1's poster layout, which has 104 pieces in total, among these posters, up to 56 pieces which produced during 1992-2001 was occupied the most. The cross-shape is the least, which has only 3 pieces.

Second, Horizontal layout is the most used in Museum 2's poster layout, which have 119 pieces in total, among these posters, up to 57 pieces which produced within 1984-1991 was occupied the most. The C-shape and L-shape are the least, with both having only 16 pieces. Third, Horizontal layout is the most used in Museum 3's poster layout, which has 195 pieces in total, among these posters, up to 69 pieces produced within 2012-2017 was occupied the most. The diagonal layout is the least, which has only 20 pieces.

4-3. Statistic of three museums posters category layout

With the cross analysis in different category layout of three museums art exhibition posters, researcher realized different arrangement design layout percentages among these art exhibition posters, and list the result in following table 4.

Table 4. Three museums art category poster layout

arrangement art category	More often used	Used the least
Painting & Calligraphy	Vertical, Divided, Horizontal	Diagonal, Circular
West painting	Horizontal, Divided, Compound	Oblique, Curve
Woodblock Print	Horizontal	Curve, Oblique
Sculpture	Vertical	C shape, L-Shaped, Oblique
Photography	Horizontal, Divided	Oblique, Diagonal
Design & Crafts	Horizontal, Vertical	L Shape, Cross-Shaped, Curve, Oblique
Multiple Exhibition	Horizontal, Divided, Vertical	Triangle, Diagonal
other	Horizontal, Vertical, Divided	Triangle, L-shaped, Compound,

Within three museums art exhibition poster design, the design background usually use work pictures as illustration combined with title and description, however, in the researcher's collected posters, it is found out there are more than 200 posters directly take work full layout for poster design background, which arrange in following table 5. From the table 5 it can be found that museum 1's full layout posters appear the most in painting & calligraphy category, and museum 2's full layout posters are west painting category, while museum 3's posters appear in west painting and multiple exhibition category. Although different museum have different distributed in full layout background posters, the west painting has still the largest amount of three museums full layout posters.

Table 5. three museums category posters full layout background layout statistics table

Category Museum	Painting & Calligraphy	West painting	Woodblock Print	Sculpture	Photography	Design & Crafts	Multiple Exhibition	other	total
1	24	9	1	5	5	19	6	15	84
2	9	19	4	3	7	8	11	2	63
3	9	25	3	0	8	2	25	4	76
total	42	53	8	8	20	29	42	21	223

(Arrangement of the research)

Continuing the above discussion of full layout posters, the researcher separated these posters to four time interval. Table 6 shows the difference in different time intervals. The 1990s has appeared the maximum numbers in full layout posters, and in these four time interval, Frequency of full layout posters has a great change.

Table 6. Three museums time interval posters full layout background layout statistics table

Category Time interval	Painting & Calligraphy	West painting	Woodblock Print	Sculpture	Photography	Design & Crafts	Multiple Exhibition	other	total
1984-1990	4	9	1	1	1	4	5	1	26
1991-2000	22	16	4	4	10	15	21	8	100
2001-2010	16	14	2	3	7	10	8	10	70
2011-2017	0	14	1	0	2	0	8	2	27
total	42	53	8	8	20	29	42	21	223

(Arrangement of the research)

5、Summary

This Research has collected 1,537 poster samples from three museums domestic exhibitions. From content category and layout analysis, it was found to have the following findings.

- (1) The results of the poster samples from the three museums found that the number of art exhibitions in Taipei Fine Arts Museum was dominated by west painting. National Museum of Fine Arts of the largest number of art exhibition categories for the comprehensive category. National Museum of History of the exhibition types, the highest point in the painting and the arts category, almost 23%.
- (2) The total number of poster arrangement of the three museums, the most widely used in horizontal layout, followed by the divided layout, again in the vertical layout. However, after crossing analyze found that National Museum of History of the poster layout is different from other museum, which is the vertical majority.
- (3) The exhibitions of the three museums promote posters of various types of arrangement, with vertical, horizontal and divided majority. Sculpture category appears in a different poster arrangement, this category in the layout of vertical choreography designed for the majority.
- (4) It is also worth mentioning that, after 2000, the National Taiwan Museum of Fine Arts Digital Technology category, in all kinds of art exhibits in the obvious growth. In particular, after 2010, science and technology art has become the mainstream of the National Taiwan Museum of Fine Arts.
- (5) There are a high proportion of the exhibition posters of the three museums, based on the works shown as the basics, together with the main title and text description, for the design style. Since 1990, painting and calligraphy, Western painting and comprehensive class can be

seen more often to display works as a base map, with full layout of the layout of matching with the main title and copy of the description style. Which the National Museum of History of painting and calligraphy class use the highest proportion.

6. Acknowledgement

Thanks to National Museum of History for providing exhibition propaganda posters for reproduce photographically, and Taipei Fine Arts Museum as they provided past art exhibition poster digital archives, ensuring this article can be successfully completed.

REFERENCES

- Lu, Y., & Zhang, Z. (n.d.). Research design and methods, Taipei: Liu He Press. (Kenneth S. Bordens, Bruce B. Abbot)
- Taiwan Provincial Museum of Fine Arts poster album I. (1993). National Taiwan Museum of Arts.
- Taiwan Provincial Museum of Fine Arts poster album album II. (1998). National Taiwan Museum of Arts.
- Taipei Design Association. (1982), Cultural Poster Planning Report, Taipei: Cultural Construction Committee.
- Print Poster Design Exhibition sequence, Taipei: Valve Publisher
- Lin, P. J. (1996). The poster of Taiwan's back and forth, and the definition and function of Poster, (Aesthetic education, No. 76).
- Lin, P. C. (1986). Poster Design Introduction, Poster Design Skills
- He, Y. Z. (1978). Graphic design, Taipei: Lion Book Company
- Yuan, M. L. (1986). Shallow poster design. Taipei Fine Arts Museum
- Yang, Q. T. (1997). Constitute 1, Taipei: Three people bookstore
- Yang, S. X. (2002). Layout design Taipei: Arts Hall
- Chang, Y. L. (1986). Poster design principles, Taipei Fine Arts Museum

Jane, S. F., & Chen, X. H. (1995). Design research method content analysis method, Taipei: Cheng Hua

Li, P. H. (2001). Study on the Types of Visual Design Works of Taiwan's Official Art Exhibition.

Zhang, X. W. (2004). Research on the Poster of the Museum - Taking the National Taiwan Museum of History as an Example, Taipei City Normal University.

Yang, Q. T. (2005). Postmodernity Observation of Contemporary Poster Design in Taiwan, Postmodern Proceedings.

Cai, M. X. (2006). The Application of Narrative Design Theory in Poster Design - A Case Study of Taipei Poster Design, Department of Applied Fine Arts, Fu Jen University.

DRAWINGS OF MOTHERING PRACTICES: A NEW NARRATIVE OF BEING MOTHERING

Tzu-Ching, HSU ^{*a}

^a National Chiao Tung University, Institute of Applied Arts, Taiwan, tuno1019@gmail.com

ABSTRACT

The purpose of this study was to investigate how female artists can turn mothering practices into opportunities to get back the self-confidence they have lost. Women in Taiwan bear most of the responsibility to raise children after being a mother. Many of them were well-educated and have professional careers, but the burden of mothering made them struggle between family and career, thus making self-actualization a challenge for them. Based on interviews, observations and image analysis, the researcher focused on the case study of a Taiwanese female artist, Dan-Chi Huang (1982-). Her serial oil paintings titled "Creation of Mother and Children's Image" depicted her two children from babies to preschoolers. Having struggled between managing the family and her career without any support to care for the children from her aloof husband and his family, she felt lost for years. Instead of escaping from these difficulties, she decided to draw her daily mothering experiences. Huang tried to keep the personal feeling of each event in her works, therefore, the works were not only the records of her life but the reflections of her emotions or the projections of her wishes. Without the limitation of narratives, she could tell new stories and brought new viewpoints for her mothering experiences through her works. The research found that Huang's art-making has provided a chance for her to re-encounter herself. She integrated mothering and art practices into a process of re-recognition of self, which allows her to regain confidence and find new meanings for her self-identity.

Keywords: *mothering practice, art-making, story-telling, self-confidence, self-identity*

* Corresponding author.

1. INTRODUCTION

In the recent 20 years, women were encouraged to go for their higher education and pursue success in their careers in Taiwan. Based on the statistics from the Ministry of Education, in 2016 the Master and above program enrolment rate for females across the country rose from 26 percent in 1996 to 43 percent (Ministry of Education, 2017). In addition, statistics on the gender rate in tertiary education of 25 years old and above in 2015, female was 42.1 percent and 4.2 percent higher than male (Directorate General of Budget, Accounting and Statistics, 2017). However, when the women got married, they were expected to devote themselves to their husbands' families and their nuclear families, especially those who had children.

Being a mother was a challenge for a woman. First of all, a woman would have to go through the uncomfortable period of pregnant, and then the painful process of birthing the child. Besides that, the seemingly natural connection between women and childbearing has made women's mothering being taken for granted. Therefore, despite the body still has not recover, women still try hard to learn the knowledge of infant care. Just like Chodorow (1978) pointed out, "In our society, as in most societies, women not only bear children. They also take primary responsibility for infant care, spend more time with infants and children than do men, and sustain primary emotional ties with infants". Moreover, women were taught that the development of children was depended on whether or not they provided high-quality caring for their children. If children had any problems while growing up, people were always quick to blame their mother, accusing her of discursive caring. Under the pressure of both the expectations of society and women's potential guiltiness, women were forced to give up their careers and be a full-time mother or chose to struggle between their professional jobs and mothering responsibilities, which made self-actualization a challenge for them. It seemed that mothering practices is an inevitable experience for most women in Taiwan and they needed to find ways to face the crisis for self-confidence. This study focused on how art-making helps women to understand their circumstances, especially female artists in Taiwan, and how they can turn mothering practices to be the opportunities to regain the self-confidence they lost.

2. CASE STUDY

In order to gather knowledge about the mothering practices of female artists, this study conducted in-depth interviews with Taiwanese female artist and focused on the case study, Dan-Chi Huang (1982-). She earned her MFA from the National Taiwan University of Arts in 2016. Huang's serial oil paintings titled "Creation of Mother and Children's Image" depicted her daily mothering experience. She was honoured to be invited by CYCU Art Centre, Cultural Affairs Bureau of Hsinchu City, and National Taiwan University Hospital Hsin-Chu Branch to stage her solo exhibition titled "Reflection on Motherhood: Exhibition by Dan-Chi Huang" which raises awareness about women's mothering experience and brings attention towards these areas.

Apart from being an artist, Huang is an art teacher in high school and a mother of two preschool children. She had grown happily under her mother's protection. Huang did not need to worry about the housework. Without any support from husband, Huang's mother cared for Huang and her brother on her own through her heavy workload in junior high school. She always encouraged Huang to study hard and to find interests of her own. She also reminded her that girls should be well-educated and have a professional career, even after they are married, just as she did. Huang was inspired and believed she could be competent as a good mother even with her successful career.

However, Huang came close to collapsing after being a mother. Without any support from other family members, not even her husband, she needed to take care of her children, do all the housework and trying to get ahead in her career at the same time. Moreover, her mother-in-law would criticize whatever Huang did and asked her to maintain her nuclear family on her own and not become a disturbance to her son (Huang's husband) to launch his career. She felt frustrated and lost. Instead of escaping from these difficulties though, she decided to use drawing to find herself back. By brushing oil painting on canvas, she felt as if she could fly in her imagination and regained courage to face the suffocating situation.

3. IMAGE ANALYSIS

Since 2013, Huang has been creating 25 works for the "Creation of Mother and Children's Image" serial. She depicted her daily mothering experience with her two children from babies to preschoolers. Huang said, "Only when I looked at my children, I could feel brave to be a mother".

3.1. Children's figure

Huang loves to observe the facial expressions and body gestures of her children. For her, it was the privilege and pleasure of being a mother. Through her portraits, viewers not only saw a child but felt the sight of a mother in front of the child. Despite the exhausting infant caring, for Huang, she still wanted to grasp any chances to gaze at her baby.

As in Figure 1, according to Huang's elaborate light setting, viewer could progressively see the gradation of the child's hair, fingers, clothing wrinkles, and toes. It was a recreation of a warm motherly sight. However, it also reflected a novice mother's worries. Huang carefully made the curled-up body stretch to the border of the canvas which looked like the endless darkness trapped the baby, as well as Huang.



Figure 1: "Meaning of Mother: my sweet Baby", Canvas, Oil Paint, 90x65cm, 2013

As Buber (1972, as cited in Arnett, 1986) quoted, "Man can become whole not in virtue of a relation to himself but only in virtue of a relation to another self". Through the existence of a child who needed caring, Huang assured herself that she was being a mother. She became aware and perceptive to the voice of a part of herself. She learned that she should be proud of herself for being tough and supporting her family though she was at the edge of collapsing. Once she felt grateful for being a mother, her works turned from a grey tone to one of vivid colours. As in Figure 2, the stiff figure (as in Figure 1) turned to be one of vital fresh with light around the scene. Her mothering experience made her encounter a new self and made her concern with the wholeness of herself.



Figure 2: "Meaning of Childhood: messy home, time to go out", Canvas, Oil Paint, 90x65cm, 2015

3.2. Emotion reflection

Huang tried to capture the personal feeling of each event in her works, therefore, the works were not only the records of her life but the reflections of her emotions. In Figure 3, Huang depicted a shopping experience for typhoon preparations. She enlarged her facial expression with tears and snot. She opened her mouth to call for help but nobody noticed. The only thing she could do was to carry her crying children and run away from being devoured by the dark blue. It was a huge mentality changing point for Huang. She used to lead an indolent life, therefore, the most frustrating part of being a mother was the nonstop working. At the present, she grasped the sign that she was the one to keep her children and herself safe and there was no room for her to hesitate. Inspired by this event, she trained herself to be more aware and this made her more confident to face the challenge of mothering.



Figure 3: "Meaning of Mother: the day before the typhoon is coming", Canvas, Oil Paint, 90x65cm, 2014

Huang loved to hug her children. In fact, research shows that embrace made people feel happy and helps to create better relationship. It was also an easier way to stimulate a child's growth in physical, mental and emotional health. ("Want A Healthier And Happier Child? Start With A Hug!," 2017) For Huang, the intimacy embrace was a direct expression to convey a mother's love to her children. As in Figure 4, the red seat around the figures and more in the background implicated a mother's endless warm embrace. For Huang, it was not only a cinema seat, but a wonderful place to hold her two babies tight and create wonderful memories for the three of them.

In Huang's serial works, she often uses extremely figure proportion not only to record her emotion but to manipulate memories to give rise those common experiences of mothering. As Ricoeur (2004) said, "The manipulations of memory.....result from the intervention of a disturbing and multiform factor that insinuate itself between the demand for identity and the

public expression of memory". By manipulating memories, Huang valued her banal mothering experiences as a process to find self-identity and brought meaning to her life.



Figure 4: "Meaning of Childhood: the movie theater", Canvas, Oil Paint, 90x65cm, 2014

4. CONCLUSION

4.1. Encounter new self

"All actual life is encounter" (Buber, 1970). Through art-making, Huang realized that to be a mother was a chance to encounter a whole new self. To be a mother, one needed to be patient to observe infants' needs and endure repeated actions without language response. By depicting her children, Huang made a distance between herself and the mothering experience which depresses her. When the work is finished, it turned to be the evidence to assure Huang's relation between herself and her own mothering practice. As Friedman (1998) said, "The first of these two movements Buber calls 'the primal setting at a distance', the second 'entering into relation'. The first movement is the presupposition for the second, for we can enter into relation only with being that has been set at a distance from us and thereby has become an independent opposite". Through the creation of relation, Huang accepted the frustration of being a mother and coped well with her mothering self.

4.2. Live at present

Art works reminded Huang to live in the present. Despite of the depression from her marriage and struggle between her family and career, which was a thing of the past, the new relationship would still be created in the present. As Buber (1970) said, "The present-not that which is like a point and merely designates whatever our thoughts may posit as the end of "elapsed" time, the fiction of the fixed lapse, but the actual and fulfilled present-exists only insofar as presentness, encounter, and relation exist. Only as the You becomes present does presence come into being".

Each art work represented a presentness of Huang's mothering practice. Those responsibilities of being a mother, for Huang, turned to be a proud evidence of woman's existence and push her to re-recognition herself.

4.3. Telling new story

According to the dramatic expressions in Huang's work, she tried to create new versions for her memories of mothering experiences. Story telling makes people recreate facts and keep them occupied from what was happened in real world. Without the limitation of narratives, Huang could tell new stories and brought new viewpoints for her mothering experiences through her art works. Moreover, those stories inspired many viewers in her exhibition. Many women who suffered from mothering practices gave their thanks to Huang for her paintings and made them feel as if they are not alone and encourages them to find meaning in their lives. For Huang, art-making made her realize mothering practice does not destroy her life but is an opportunity to find new meanings for her self-identity.

ACKNOWLEDGMENTS

I would like to thank the artist, Dan-Chi Huang, for her participation in the interview and providing the authorization of her works to help me get results of better quality.

REFERENCES

- Arnett, R. C. (1986). *Communication and community: implications of Martin Buber's dialogue*. Carbondale: Southern Illinois University Press.
- Being the Parent.com. (2017). *Want a healthier and happier child? Start with a hug!* Retrieved from <https://www.beingtheparent.com/benefits-of-hugging-children/>
- Buber, M. (1970). *I and thou*. New York: Touchstone.
- Buber, M. (1998). *The knowledge of man: Selected essays*. New York: Humanity Books.
- Buber, M. (1972). *Between man and man*. New York: Macmillan.
- Chodorow, N. (1978). *The reproduction of mothering*. Berkeley: University of California Press.
- Directorate General of Budget, Accounting and Statistics, Executive Yuan, R.O.C. (2017). *2017 Gender Report*. Retrieved from <http://eng.stat.gov.tw/public/data/dgbas03/bs2/gender/eb/2017/2017C.pdf>
- Friedman, M. (1988). Introductory Essay. In *the knowledge of man: Selected essays*. New York: Humanity Books.

Ministry of Education, Republic of China (Taiwan). (2017). *e106-1 Enrollment & gender Proportion in university*. Retrieved from
<http://english.moe.gov.tw/ct.asp?xItem=14508&CtNode=11431&mp=1>

Ricoeur, P. (2004). *Memory, History, Forgetting*. Chicago: University of Chicago Press.

A CASE STUDY OF DIFFERENCE BETWEEN SAND ANIMATION AND MICRO FILM

Jun WU^{*ab}, Chiang Chang, TZU^b, Gao, YANG^b, Rungtai, LIN^b

^a Department of Animation, School of Journalism & Communication, Anhui Normal University, P.R. C., junwu2006@hotmail.com

^b Graduate School of Creative Industry Design, National Taiwan University of Arts, Taiwan., chang.tc0214@msa.hinet.net, lukegao1991@gmail.com, rlin@mail.ntua.edu.tw

ABSTRACT

As digital media is developing increasingly, image communication has become rapid and convenient gradually. However, there are so many different image forms for artists to create a sense of beauty through their works, so how to make the audience feel the same way in the audio visual experience is actually a complex issue and worthy of discussion. In general, art creators and appreciators are separate from each other and have little intersection, this is especially true in the independent creation process. Although pure self-reproduction creation can maximize the personal aesthetic of an artist, such work may lack of experience in absorbing the aesthetic cognition of audience somehow. Then as a result, the final work gets into a dilemma of “too high-minded to be popular” and the communication effect is thereby reduced greatly. Therefore, this research attempts to discuss the impact of appreciators’ aesthetic experience and preference cognition, and explore the cognition on image composition elements among art creators and appreciators through rational quantitative research. As one of the film animation series study, this research selects the most popular micro films and sand animation as the objects with the purpose of exploring the cognition on different art image carrier and have insight into the core factors in attracting appreciators through aesthetic experience perception of different appreciators. In this way, the impact of different factors on the entirety can be evaluated. The research results can be used to provide reference for video art creators and appreciators.

Keywords: sand animation, micro film, Emotional Effect.

* Corresponding author.

1. INTRODUCTION

In recent years, cultural consumption has become a new trend in consumer market. Commodities are not a reasonable or material requirement for consumers but the spiritual satisfaction (Cavs 2000). Culture is preserved and transmitted through symbols. When animators devote themselves to the promotion of social transformation, they promote new ideas and behaviors (Barnes 2007). The significance of cultural creativity lays in the extraction of cultural elements, which gives new aesthetic meaning through metaphor, metonymy and hypostatization (Lin 2011).

Sand animation and micro film are the media of film and television, which is made up of images, sounds, movements and other elements to form a vivid field of audio-visual perception. Currently, it has become one of the most receptive forms. Both of them are guided by perceptual design and conduct conception in a free and creative way. Dramatic plot narration, vivid and diverse character reproduction and wonderful changing scenes bring people a lot of happiness and have touched them. The presentation of work image's esthetics are not separated from the creator's perceptual cognition and rational performance. It is not separated from the creator's special individuality, subjective perceptual consciousness and interpretation for social environment. It also reflects the cognition of different audiences on similarities and differences.

This paper focuses on comparing the advantages and disadvantages of sand animation and film, television and micro film in the public communication, explores the perceptual recognition and discusses how the art of film and television helps spread the concepts. It mainly includes the following aspects:

- (a) Analyze the strengths and weaknesses of Sand Animation and Micro Film and its differences;
- (b) Explain the creation concept of *Statue of Blood* (representing Sand Animation) and explore its characteristics (attributes);
- (c) Explain the creation concept of Describe the creative concept of *Manifesto for Outsider Art* (representing Micro Film) and explore its characteristics (attributes);
- (d) Compare two different types of individual cases, their different attributes (characteristics) and analyze the similarities and differences of these attributes and individual cases.

2. RESEARCH FRAMEWORK

2.1 Definitions of Micro Film and Sand Animation

“Microfilm” is a derivative of the commercial system that has come forth recently. A microfilm is a narrative short film about 60 minutes in length with three micro features, which are micro length (30s-60mins), micro production cycle (1-7 days or several weeks), and micro investment scale (no more than 10,000 RMB/film) (Zhu 2012; Hu,&Chen.2012; Li 2014). “Sand Animation” refers to animations made by using sand (or small particles, such as flour, salt, etc.) and single frame filming and continuous shooting, which excludes sand painting and sand painting performance images. It is characterized by its unique material, the way of single frame filming, the rich and profound theme connotation, and innovative visual style, so it can show the ontology, handmade, deformation, uniqueness of the aesthetic characteristics (Shih 2010;Wu 2017).

2.2 Market Values of Film Animation

In recent years, micro film gradually spread all over the major video websites, which involves product advertising, MV, corporate videos, city videos etc., common in major public spaces’ LED screen (e.g. airport stations), mobile vehicle systems (e.g. bus, subway, taxi), video system in community building, network platforms (e.g. YOUTUBE), and new media platform (e.g. WeChat). It has spread everywhere at an alarming speed, and are very popular (Wu 2017).

Many places take cultural creativity as an important development industry. In 2008, Taiwan launched “Challenge 2008: National Development Key Program”, which listed the cultural creativity industry as the key program of the national development (Qiu 2011). With the emerging of cultural creativity industries, creative sensory goods designed with cultural connotation can arouse consumer awareness and impressions (Yen,&Lin.2012). Lin (2010) believes that the integration of culture and aesthetics economy can promote the new industries of aesthetic design, but also transform “art” into “business” (Yen,&Lin.2013). In fact, “beauty” is a necessity in today’s life, and art aesthetic style is no longer a luxury, “aesthetic economy” specifically serves the consumer’s aesthetic experience. Cultural creative commodity is not a physiological or material need for consumers, but a spiritual satisfaction (Caves 2000; Liao et al.2009). Cultural consumption has become a new trend in the consumer market.

3. RESEARCH METHODS

3.1 Research framework

The completeness of animation films is inseparable from audience’s cognition. The cognitive structure of films (as shown in Table 1) organized by Lin,Qian,Wu,&Fang (2017) is shown in Table 1. Film makers organize visual effect, camera language, sound creation and others, while audience watch, understand and are touched by the cognitive process through films, thus films attract audience’s attention and lead them to have correct cognition and make them deeply touched. It can be seen that animation films impose a direct impact on audience’s cognition on technology, meaning and effect. This research mainly focuses on characteristics and experience of animation films and truly expressing audience’s voice by the cognition of audience with different sexes, ages, professions, education backgrounds and majors.

Tabel1.The communication matrix for evaluating microfilm and sand animation

	Artist(Coding)			
	<u>Performance</u>	<u>Processes</u>	<u>Products</u>	
	Inspiration	Ideation	Implementation	
Level C	C7-1:Topic and Acknowledgement	C8-1:Thought provoking	C9-1:Emotional resonance	Reflection Affection
	C7-2:Going Beyond Reality	C8-2:Deep planting	C9-2:Authentic experience	
	C7-3:Affluence in life	C8-3:Immersion	C9-3:Mental simpatico	
Level B	B4-1:Curiosity raising	B5-1:Moving stories	B6-1:Richly Culturally-loaded	Realization Accuracy
	B4-2:Desire exploring	B5-2:Mood changing	B6-2:Realistic characteristics	
	B4-3:Emotion stirring	B5-3:Atmosphere bulging	B6-3:Role identity	
Level A	A1-1: Appropriately captured	A2-1: Weil Paced	A3-1: Well defined personalities	Recognition Attraction
	A1-2: Creativeand clever	A2-2: Touchingplot	A3-2: Skillfuland appealing	
	A1-3: Video effects	A2-3: Sensitivesettings	A3-3: Warmtouching	
	<u>Aesthetic experience</u>	<u>Meaningful experience</u>	<u>Emotional experience</u>	
Audience(Decoding)				

3.2 Questionnaire design

The research process of this research includes the following steps:

- Design the questionnaire survey on the target audience of animation films according to communication theories and the art of animation films, and remind everyone: This questionnaire is designed by Department of Animation, Anhui Normal University and Creative Industry

Design Institute of National Taiwan University of Arts aiming to learn about audience's cognition for animation films, find out differences between audience's cognition and feelings for films and improve the follow-up researches in the future. Information you provide is valuable only for the purpose of this research and will not be disclosed. Please fill it out with ease.

b. The questionnaire includes basic information and evaluation on the animation film *Outsider Artists* and the sand film *Alike*. Basic information includes sex, age, profession, education background and major, and the evaluation on two films includes 13 questions respectively. Images of the two films are presented first for distinction, and explanations on how to fill out the questionnaire are provided. The cognition is shown through the hundred-mark system (1-disagree; 100-agree). The mark of questions 1-9 and 11-13 is 100, while question 10 is a multiple choice question.

c. Invite 30 audiences from different majors to the laboratory each time (4 times and 109 audiences in total), explain purposes of the questionnaire and explain how to fill it out.

d. Play *Outsider Artists* and *Alike* for the audience.

e. The questionnaire is filled out through the Internet website:

<https://www.wjx.top/jq/15909747.aspx>

Audience can also scan the QR code to fill out the questionnaire.

3.3 Participants

Participants in the research are those who watch *Outsider Artists* and *Alike*, including teachers and students of the university and social elites. All the participants have been informed that the questionnaire should be completed after watching the movies. After full comprehension, everyone agrees to participate in the questionnaire. There are 109 participants and 101 valid questionnaires in total. In terms of sex, 43 males (42.6%), 58 females (57.4%), in terms of age, 76 participants (75.2%) aging from 20 to 29, 14 (14.9%) aging below 19, 8 (7.9%) aging from 30 to 39, 2 (2.0%) aging from 40-49, 1 aging above 50; in terms of education, 68 participants (67.3%) Bachelor degree, 29 (28.7%) Master graduate and above, 4 (4.0%) Diploma and below. All the participants are cooperative, so the research went well.

4. THE RESULTS AND DISCUSSIONS

4.1 Analysis of validity and reliability

According to the analysis of validity, the KMO coefficient is .86 with a high value; the Sig value is .000 with a strong effect; the characteristic value is 5.79 which would explain presuppose applications; the amount of variation is 64.32%; the factor load capacity of each question varies from .706 to .822; the intercommunity of each question varies from .603 to .692.

The analysis of reliability is to discuss the internal consistency of the questionnaire on each dimension and the depletion of each Cronbach α coefficient after a single question is deleted as the reference standard of topic choosing and whether the reliability of the questionnaire is good or not. Seen from the analysis, the Cronbach α coefficient is .931; the total correlation of each dimension of characteristics and correction of the content varies from .713 to .778; “the α coefficient after deletion” varies from .920 to .924. It can be concluded that the internal consistency of topic chosen is higher, and the settings of the topic are reasonable.

4.2 Analysis of gender differences in responses to characteristics of films

As the sex of participants is an independent variable, 3 overall evaluations on animation films are examined according to the variable, each dimension and independent sample t to examine whether there is a significant difference of sex on characteristics of films. The results are shown in Table 2. In “cultural characteristic depth”, “high-quality creative strength”, “enthusiasm for films”, the cognition of women and men is not significantly related. The “cultural characteristic depth” of sand film is averagely 97.09% for men and 91.47% for women. The result of t test shows that 97.09% for men is higher than 91.47% for women ($t=1.63$, $p<.05$), which is of significant correlation; on high-quality creative strength, 91.26% for women is higher than 85.28% for men ($t=2.38$, $p<.01$), which is of significant correlation.

Table 2. T-tests for Gender Differences in Responses to Characteristics of Films

<i>Subjects</i>	<i>Q</i>	<i>Gender</i>	<i>N</i>	<i>M</i>	<i>sd</i>	<i>t value</i>	<i>sig</i>
Microfilm	Depth of cultural traits	Male	43	79.65	16.79	1.45	Male<Female
		Female	58	84.02	13.41		
	Intensity of high-quality creation	Male	43	78.07	17.46	1.11	Male<Female
		Female	58	81.41	15.46		
	Enthusiasm for this film	Male	43	80.02	16.80	1.74	Male<Female
		Female	58	85.36	14.04		
Sand Animation	Depth of cultural traits	Male	43	97.09	14.95	1.63*	Male>Female
		Female	58	91.47	9.98		
	Intensity of high-quality creation	Male	43	85.28	14.80	2.38**	Male<Female
		Female	58	91.26	8.35		
	Enthusiasm for this film	Male	43	90.02	11.80	.69	Male<Female
		Female	58	91.50	9.85		

* $p < .05$. ** $p < .01$

4.3 Analysis of differences within independent variables of vocation and educational background

The results of variable differences surveys on significant differences on age, education background and characteristic are shown in Table 3. Different ages do not show significance in cognition for micro films and therefore no difference. Different majors show significance of “high-quality creative strength” and “enthusiasm for films” for sand animations. Age shows no difference.

Table 3. Analysis of Variance (ANOVA) for Differences in Response to Characteristics of Films within Two Items of Independent Variables

<i>Subjects</i>	<i>Q</i>	<i>Source of variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F value</i>
Education	Sand Animation	Between Groups	704.58	1	704.58	5.25*
		Within Groups	13348.10	99	134.83	
		Total	14052.67	100		
	Enthusiasm for this film	Between Groups	679.46	1	679.46	6.26*
		Within Groups	10739.87	99	108.48	
		Total	11419.33	100		

* $p < .05$. ** $p < .01$

4.4 The results of the subjects evaluated by the census

The dependent sample t survey is conducted by results of cognition for micro films and sand animations, and the dependent sample t survey is conducted by overall evaluation dimension of animation films and internal key factor of animation films in Table 4. The two surveys are compared in one table. In the column of overall evaluation, it shows the comparison of participants' cognition for two different animation films. For example, in question A1, the average value of micro film is 80.11% and that of sand animation is 88.89%. The results show that 88.89% of sand animation is higher than 80.11% of micro film ($t=5.03$, $p < .001$). In the column of key factors of performance, it shows the comparison and evaluation results of two different films. As for question A1-1, 59% chooses it in the micro film group and 58% in the sand animation, which means that it is not significant. 9 dimensions in the first column show significant correlation. A1, A2, A3, B4, B5 and C7 ($p < .001$) show strong significance; in the

second column, except A1-1, B4-2 and C7-2, all shows significance, and A1-3 and B4-3 shows strong significance ($p < .001$).

Table4. Summary of rating data and comparison with two works

<i>Subjects</i>	<i>N</i>	<i>Total image</i>				<i>Key factors of performance</i>			
		<i>Q</i>	<i>Mean</i>	<i>sd</i>	<i>t value</i>	<i>Q</i>	<i>Mean</i>	<i>sd</i>	<i>t value</i>
Microfilm	101	A1	80.11	17.56	5.03***	A1-1	.59	.49	.16
Sand Animation	101		88.89	11.62			.58	.50	
Microfilm	101	A2	80.50	17.79	4.14***	A1-2	.24	.43	2.78**
Sand Animation	101		87.57	13.26			.39	.49	
Microfilm	101	A3	79.64	18.44	4.05***	A1-3	.41	.49	4.95***
Sand Animation	101		86.26	16.97			.66	.48	
Microfilm	101	B4	80.34	17.57	4.35***	B4-1	.54	.50	2.53*
Sand Animation	101		86.72	16.23			.69	.46	
Microfilm	101	B5	82.42	16.04	3.61***	B4-2	.50	.50	.46
Sand Animation	101		87.52	11.76			.52	.50	
Microfilm	101	B6	82.08	16.17	3.18**	B4-3	.39	.49	3.69***
Sand Animation	101		86.78	13.00			.60	.49	
Microfilm	101	C7	80.19	15.86	4.58***	C7-1	.46	.50	2.93**
Sand Animation	101		87.07	12.98			.61	.49	
Microfilm	101	C8	78.59	19.32	2.74**	C7-2	.58	.50	.84
Sand Animation	101		83.84	20.58			.63	.48	
Microfilm	101	C9	80.92	18.96	2.66**	C7-3	.49	.50	2.40*
Sand Animation	101		85.89	15.82			.63	.48	

* $p < .05$. ** $p < .01$, *** $p < .001$

5.CONCLUSION

This research is modelled after framework of animation films and discusses people's cognition for micro films and sand films by t test and analysis on variables and differences on

target audience's cognition resulting from forms and internal component factors of animation films. The results show that:

1. There is no difference on cognition for micro films when it comes to different sexes; there is significant difference on "cultural characteristic depth" and "high-quality creative strength" of sand films.
2. There is no difference on overall cognition for micro films and sand films when it comes to age.
3. There is no difference on overall cognition for micro films when it comes to education, but there is difference for sand films (when it comes to different majors, there is significant difference on "high-quality creative strength" and "enthusiasm for films").
4. It shows significance of target audience's overall evaluation on micro films and sand films and cognition for key factors of performance. 9 dimensions of overall evaluation show significance. Except "Appropriately Captured", "Desire Exploring" and "Affluence in Life", the others show significance.

It can be known from the comparison that verisimilitude, modelling and movability of micro films are easy to be understood as they are most often created after videos, while verisimilitude of sand films is weaker and modelling and uniqueness tend to be more characteristic as they are all created by artists. As a result, there are differences on target audience's cognition. Seen from overall evaluation and comparison, target audience prefers sand animations.

Suggestion: This research is one of series research on creation and cognition of animation films. Although there are differences on cognition for micro films and sand animations, the impact specific dimensions (overall evaluations and key factors) have on animation films is unknown. These research results will provide valuable references for artists of animation films.

REFERENCES

- Caves, R. E. (2000). *Creative industries: Contracts between art and commerce*. \ Cambridge, Massachusetts: Harvard University Press, 178-200.
- Chiu, C. Y. (2011). *Development of cultural and creative industries and policy overview, reader of cultural and creative industry*. Taipei:Yuanliu press , 31-56.
- Jay. S. C. (2010). *Present Continuous Tense of "art-digital"*. Taipei:City Government department of Cultrul Affairs,15.
- Chu, Y. D. (2012). "Micro lm Ofcially Online." *Homi Techonology Website*.
http://www.homi.com.tw/micro_lm/ (accessed May 30, 2013).

Hu, G. S., & Chen, C. M. (2012). "A preliminary study of the application of micro-film in military marketing communication." Paper presented at the 6th Military News Conference. Taipei: National Defense University, September 14.

Lee, C. (2014). The semiotic analysis of the city marketing microfilm -Take "Heart City Story" as an example. *Journal of Urbanolgy*, 5(2), 105-135.

Liaw, S. Y., & Huang, Y. T., & Tan, Z. W. (2009). Preliminary Study of Aesthetic Elements of Marketing Management. *Marketing Review*, 391-422.

Lin, R. (2010). Cultural Creativity Added Design Value. *Art Appreciation* (7), 9-10.

Lin, R., Qian, F., Wu, J., Fang, W. T., & Jin, Y. (2017). A pilot study of communication matrix for evaluating artworks. In *International Conference on Cross-Cultural Design* (pp. 356-368). Springer, Cham.

Schmitt, B., & Alex, S. (1997). *Marketing Aesthetics: The Strategic Management of Brands, Identity, and Image*. Simon & Schuster, Inc.

Wu, J. (2017). The analysis of the development and characteristics of the sand animation experimental. *World of Chinese Painting and Calligraphy*, (3), 82-84.

Wu, J. (2017). The predicament and opportunity of urban advertisement in the context of new media. *The Press*, (1), 102-104.

Yen, H., & Lin, P. (2013). Discussion on the design and marketing mode of cultural creative products take JIA Inc as an example. *Design and environment*, (14), 39-56.

Yen, H., & Lin, R. (2012). From sensible goods of cultural and creative industries to the design bonus of business models. *Journal of Art*, (2), 127-152.

Zhang, G. L. (2016). *Principles of communication*, Fudan press, 1995, p 104.

IMPRESSION OF SIGNBOARD IN CONSIDERING LANDSCAPE

Hiroshi TAKAHASHI^{*a}, Yohei SHOJI^a and Takashi IRIKURA^b

^a Kanagawa Institute of Technology, Japan

^b Shibaura Institute of Technology, Japan

ABSTRACT

Recently, regulations governing outdoor advertisements have been enacted in Kyoto, and elsewhere, based on landscape and cityscape planning considerations. Commonly, such regulations are based on desires to preserve historical townscapes and permit development of more attractive cities. In this study, we aim to clarify conditions by which signboards can be made to harmonize with their surrounding landscape from the viewpoint of color, while maintaining a sufficient level of “impression” in locations where we normally live. The experiment was conducted using a personal computer monitor on which colored signboards were displayed against various backgrounds. The results are suggested that coloring patterns in which white is used as the background or lettering color are highly evaluated for “harmony”, and coloring patterns of black or chromatic color background × white lettering are likely to remain in the viewer’s “impression”.

Keywords: *impression, harmony, conspicuity, signboard, landscape*

* Corresponding author. Email : htakahashi@ele.kanagawa-it.ac.jp

1. INTRODUCTION

The Landscape Act was enacted in 2004, and local governments became possible an individual outdoor advertisement policy. Recently, regulations governing outdoor advertisements have been enacted in Kyoto [1], Tokyo [2], Yokohama's Minato Mirai area [3], Kanazawa City, Ishikawa Prefecture [4], and elsewhere, based on landscape and cityscape planning considerations. Nonaka [5] clarified the actual situation of landscape planning by local governments. Doumoto et al. [6] clarified the actual situation of color standard in official landscape plan. Commonly, such regulations are based on desires to preserve historical townscapes and permit development of more attractive cities. In this study, we will clarify conditions by which signboards can be made to harmonize with their surrounding landscape from the viewpoint of color, while maintaining a sufficient level "impression" in locations where we normally live.

2. EXPERIMENT

Our findings are based on an experiment that was conducted using a personal computer (PC) monitor in a darkroom on which colored signboards were displayed against various backgrounds, and from which test subjects made subjective evaluations of the "impression" and other factors related to the signboards.

In this experiment, in order to prevent the object coloration from being influenced by light contamination, all external lights in the darkroom were turned off and the color temperature of the monitor was set to 6500 K (white). In addition, the angle at which test subjects viewed the object image was set to 20° horizontal and 15° vertical, which is the normal viewing angle of a pedestrian, and the distance between the test subject and monitor was set to 120 cm in order to ensure that the object was fully visible. The test subjects were eight males in their twenties with normal color vision.

Experimental images were synthesized using the free and open source GNU Image Manipulation Program (GIMP). Tables 1 and 2 show the color codes and coloring patterns, respectively that were used in this experiment. The following color combinations were presented: white background color × colored lettering (excluding white), colored background (excluding white) × white lettering, and chromatic background color (excluding brown) × chromatic lettering color (excluding brown).

Figure 1 shows the signboard patterns used in this experiment. Figure 2 shows the example of experimental images. The background images were set to three conditions of "residential area", "road area", and "downtown area". Test subjects were asked to make subjective evaluations using the seven-stage (-3 to 3) semantic differential (SD) method in which eight word pairs

(calm/restless, conspicuous/inconspicuous, colorful/quiet, harmonious/unharmonious, comfortable/uncomfortable, clean/messy, impressive/unimpressive, easy to see/hard to see) were employed.

The following procedure was used in the experiment:

The subject is given 3 minutes to adapt to the brightness of the monitor in the darkroom.

- (1) The subject observes randomly presented evaluation images.
- (2) The subject provides subjective evaluation judgments via oral response.
- (3) Steps (1) to (2) are repeated for 24 patterns.
- (4) Steps (1) to (3) are repeated in the order “residential area”, “road area”, and “downtown area”.

Table 1: Color codes

color	color codes
W(White)	ffffff
Bl(Black)	2f3130
R(Red)	e03c4a
G(Green)	23a54d
B(Blue)	017eec
Y(Yellow)	ffd900
Br(Brown)	963e30

Table 2: Coloring patterns

[Background color × Lettering color]	[W × Bl]	[Bl × W]	[R × G]	[G × R]	[B × R]	[Y × R]
	[W × R]	[R × W]	[R × B]	[G × B]	[B × G]	[Y × G]
	[W × G]	[G × W]	[R × Y]	[G × Y]	[B × Y]	[Y × B]
	[W × B]	[B × W]				
	[W × Y]	[Y × W]				
	[W × Br]	[Br × W]				



Figure 1: Signboard patterns



Figure 2: Example of experimental images

3. RESULTS

Among the results obtained via subjective evaluation were two excerpts, “harmony”, which is considered to be most relevant to the aim of this study, and “impression”, which is thought to be important for signboard functionality. In order to ensure that the coloring harmonized with the landscape while maintaining “conspicuity”, regardless of background image, we decided to select coloring patterns that resulted in the highest total evaluations scores for “harmony” and “impression”.

Figure 3 shows the relationship between “harmony” and “impression” in the residential area, and Fig. 4 shows the coloring patterns for which the evaluation scores for “harmony” in the same area were 0 or more. These figures show that the evaluation scores of the coloring patterns $G \times W$, $G \times R$, and $Bl \times W$ were high in the residential area. Furthermore, we found that the chromatic color combinations were difficult to harmonize, even though they were evaluated highly in the “impression” score range.

Figure 5 shows the relationship between “harmony” and “impression” in the road area, while Fig. 6 shows the coloring patterns for which the evaluation scores for “harmony” in the same area were 0 or more. As can be seen in these figures, the road area evaluation scores for the coloring patterns $W \times B$, $B \times W$, $W \times Br$, $Br \times W$, $G \times Y$, and $B \times Y$ were high. It can also be seen that the road area evaluation scores for blue patterns were high, in addition to white and green coloring patterns that were evaluated highly in the residential area.

However, the $Bl \times W$ scores show a significant difference between the “harmony” and “impression” scores. Since the signboard is positioned close to the tree shadows, it is thought that the black background became difficult to see and did not make a strong “impression” on the test subjects. In addition, it is thought that the black background combined with the tree shadow to produce a high “harmony” score.

Figure 7 shows the relationship between “harmony” and “impression” in the downtown area, and Fig. 8 shows the coloring patterns for which the evaluation scores of “harmony” in the same area were 0 or more. Together, these figures show that the coloring pattern evaluation scores of $Br \times W$, $W \times Br$, $W \times G$, $G \times W$, $B \times W$, $Bl \times W$, and $W \times R$ are high in the downtown area. Furthermore, Fig. 7 shows that the evaluation scores of black or chromatic color background \times white lettering, or white background \times chromatic color letter are high in the downtown area.

Figure 9 shows the coloring patterns for which the evaluation scores of “harmony” and “impression” were 0 or more in each area along with the sum of the evaluation scores of “harmony” and “impression”. As can be seen in this figure, the total score of the coloring pattern $G \times W$ is the highest score in the residential area, $B \times W$ is the highest score in the road area, and $Bl \times W$ is the highest score in the downtown area. These results indicate that these coloring patterns are harmonious with the landscape and made a strong “impression” on viewers.

In the residential area, it is thought that the $G \times W$ score is high because numerous plants were shown in the background image. In addition, it is thought that green is a suitable color for a quiet residential area sign because it has a calming effect on viewers. The coloring pattern $B \times W$ is used commonly for traffic signs, and it is a coloring pattern that has very high visibility. Therefore, it is thought that the evaluation score was high in the road area. In the downtown

area, it is thought that the score of $Bl \times W$ is high because the building in the background image was black and the image showed a dark alley.

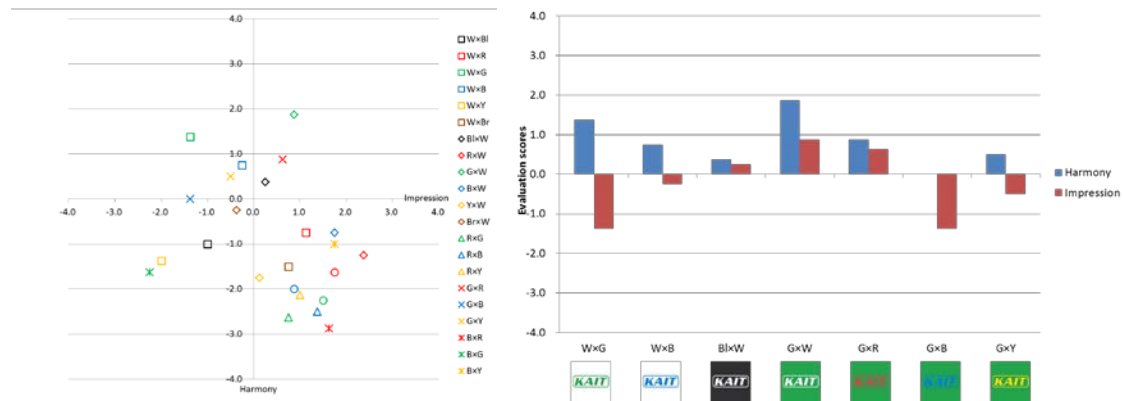


Figure 3: Relationship between “harmony” and “impression” in the residential area (Left)

Figure 4: Coloring patterns for which the evaluation scores of “harmony” in the residential area were 0 or more (Right)

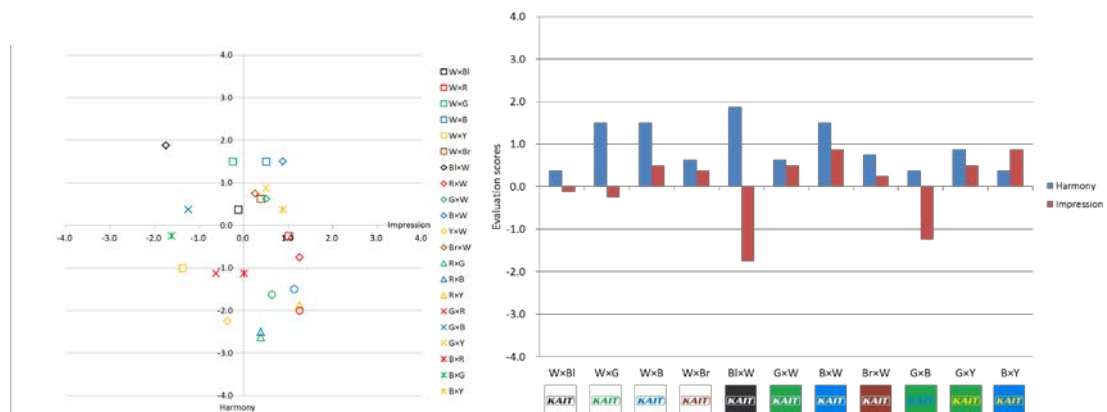


Figure 5: Relationship between “harmony” and “impression” in the road area (Left)

Figure 6: Coloring patterns for which the evaluation scores of “harmony” in the road area were 0 or more (Right)

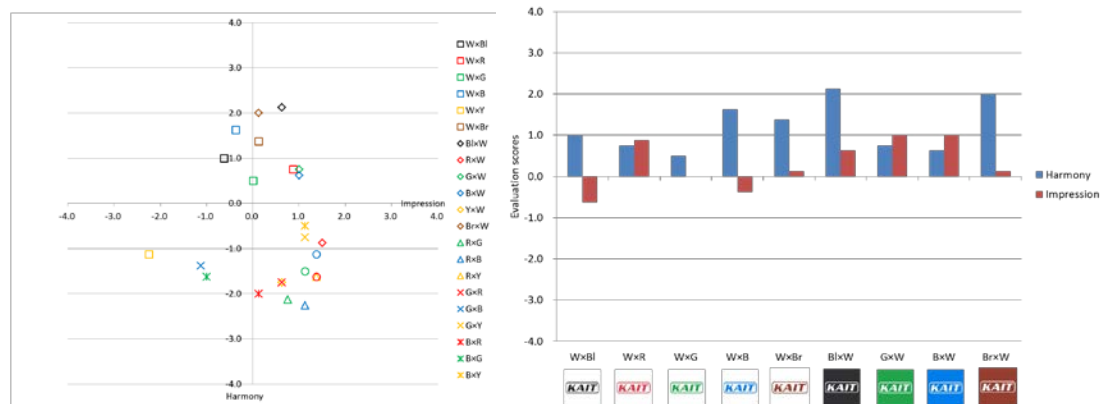


Figure 7: Relationship between “harmony” and “impression” in the downtown area (Left)

Figure 8: Coloring patterns for which the evaluation scores of “harmony” in the downtown area were 0 or more (Right)

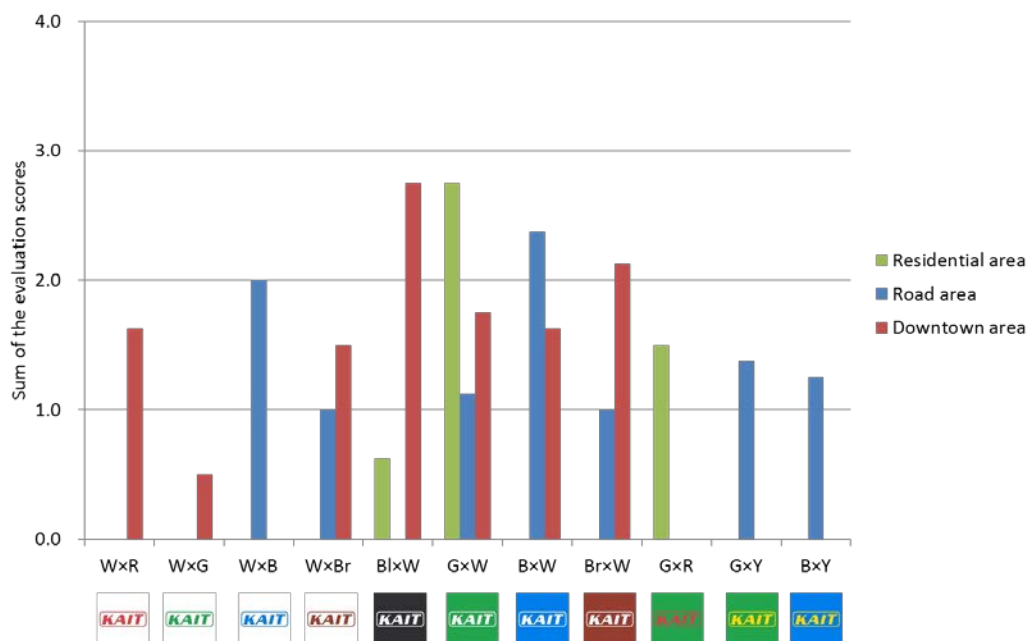


Figure 9: Coloring patterns for which the evaluation scores of “harmony” and “impression” in were 0 or more in each area, and the sum of the evaluation scores of “harmony” and “impression”

Next, the differences in the evaluation between $W \times G$ and $G \times W$ in the residential area were investigated. Interestingly, when the background color and lettering colors were switched, the “impression” scores differed significantly. In an attempt to understand this, the luminance contrasts between the background color and the lettering color in the images displayed on the PC monitor were measured. From these results, we found that $W \times G$ has a luminance contrast of 0.5, whereas $G \times W$ has a luminance contrast of 2.3. This indicates that the lettering became

easier to read because the luminance contrast increases when white (whose luminance is high) is used for the lettering. It is also considered likely that coloring patterns of “black or chromatic background color × white lettering” are likely to remain in the viewer’s “impression”.

Here, the correlations between “impression” and “conspicuity” were investigated. The correlation coefficients were 0.7 in the residential area, 0.9 in the road area, and 0.9 in the downtown area. These results show that there is a strong positive correlation between “impression” and “conspicuity”.

4. CONCLUSION

In this study, a visual experiment was conducted to clarify how the coloring patterns of signboard harmonized with the landscape while maintaining “impression”. The results are summarized as follows:

- (1) Coloring patterns in which white is used as the background or lettering color are highly evaluated for “harmony”.
- (2) Coloring patterns of black or chromatic color background × white lettering are likely to remain in the viewer’s “impression”.
- (3) Coloring patterns G × W in the residential area, B × W in the road area, and BI × W in the downtown area are harmonious with the landscape and are likely to remain in the viewer’s “impression”.

As a future work, we need to consider so that it can be applied to more background situations behind a signboard.

REFERENCES

Kyoto City Official Website. Retrieved from
<http://www.city.kyoto.lg.jp/tokei/page/0000015678.html>

Bureau of Urban Development Tokyo Metropolitan Government Homepage. Retrieved from
<http://www.toshiseibi.metro.tokyo.jp/kenchiku/koukoku/>

Yokohama City Urban Development Bureau Homepage. Retrieved from
<http://www.city.yokohama.lg.jp/toshi/mm21/keikan/>

City of Kanazawa Homepage. Retrieved from
http://www4.city.kanazawa.lg.jp/29020/keikan/keikan/1_1_b.html

Nonaka, K. (2008). A study on the intention of outdoor advertisement administration in municipality by landscape plan. *Journal of the City Planning Institute of Japan*, 43(3), 649-654.

Doumoto, Y., Okazaki, A., Matsui, D. (2015). COLOR STANDARD IN OFFICIAL LANDSCAPE PLAN – Focusing on accent color and discretionary standard -. *AIJ Journal of Technology and Design*, 21(49), 1235-1240.

THE IMPRESSIONS OF POSTERS AND THEIR EFFECTS ON ATTRACTING TOURISTS

Natsuhiro MARUMO ^{*a}, Nobuyuki WATANABE ^{*b}, Masashi YAMADA ^{*c}, Takuya SUGIMOTO ⁺

^{}Graduate School of Engineering, Kanazawa Institute of Technology, Japan,*

⁺Planning and Development Department, Ishikawa prefectural government office,

{^ab1339194@planet, ^bn-watanabe@neptune, ^cm-yamada@neptune}.kanazawa-it.ac.jp, ⁺sugitakku@pref.ishikawa.lg.jp

ABSTRACT

Like many tourist cities around the world, Japanese cities and prefectures have been producing posters for attracting tourists. In the present study, the impressions of the posters were investigated using the semantic differential method. Moreover, the effects of the posters on attracting tourists are clarified using multiple-regression analysis. Forty-one different prefectural posters produced for attracting tourists were used as stimuli. Ninety-five participants rated their impressions of the posters using 22 seven-step bipolar scales. For each poster, the participants also rated the degree of preference, the degree of desire to visit that area and the degree of desire to live in that area in the future, using unipolar scales. The rated scores were used for factor analysis. The results of the factor analysis showed that the impressions of the posters were constructed by a three-dimensional space spanned by “vividness”, “affinity”, and “luxuriousness”. Multiple-regression analyses were conducted using factor scores as the independent variables and the degrees of the unipolar scale as a dependent variable, respectively. The results showed that a friendly and luxurious poster was preferred, and that a friendly, luxurious, and vivid poster made the participants desire to visit that area. The results also showed that the posters were not effective in making the participants desire to live in the area, except for the males in their 60s.

Keywords: poster, factor analysis, semantic differential method, multiple-regression analysis

1. INTRODUCTION

Like many tourist cities around the world, Japanese cities and prefectures have been producing posters for attracting tourists. Most of the posters are consists of letters and photographs of landscapes. Sometimes they also include people or characters. The posters aim to attract tourists to the area. However, it has not been clarified what type of the poster design is effective for attracting tourists. Moreover, it has not been clarified how the impressions of the posters vary among viewers of different genders and different ages.

In the present study, the impressions of the posters were investigated using the semantic differential method. Moreover, the effects of the posters on attracting tourists are clarified using multiple-regression analysis.

2. EXPERIMENTAL METHODS

Forty-one different prefectural posters produced by local governments and their related groups for attracting tourists were used as stimuli.

Ninety-five participants rated the impressions of the posters. The participants included 24 students (20 to 22 years old) from Kanazawa Institute of Technology, 21 staff of the Ishikawa prefectural government, and 50 residents in the Tokyo area. The 50 people consisted of 10 females in their 30s, 10 females in their 50s, 10 females in their 60s, 5 males in their 30s, 5 males in their 40s, 5 males in their 50s, and 5 males in their 60s.

The participants rated their impressions of the posters using 22 seven-step bipolar scales listed in Table 2, e.g., beautiful-ugly, light-heavy, sharp-dull, etc. For each poster, the participants also rated the degree of preference, the degree of desire to visit that area and the degree of desire to live in that area in future, using unipolar scales. The degree of preference was rated by all participants, the degree of desire to visit that area was rated by the Tokyo residents, and the degree of desire to live in that area in future was rated by the staff and the Tokyo residents.

For the university students, the stimuli were presented through a computer display, EIZO FlexScan SX2462W-PX in a random order for each student. The participants sat on a chair in a dark sound-proof room and were requested to view the stimuli. For the participants of the staff of the Ishikawa prefectural government, the stimuli were presented on a large screen with a projector. The order of the stimuli were randomly decided but the order was the same for all participants. The 50 Tokyo residents were divided into three groups so that the numbers of different genders and ages were approximately equal. The experiment was conducted for each groups, and the stimuli were presented on a large screen with a projector. The order of the stimuli were randomly decided for each of the different groups.

3. RESULTS AND DISCUSSION

The rated scores of the 22 bipolar scales were averaged over the participants and the obtained mean values were used for the factor analysis with the principal factor method and varimax rotation. Table 1 shows the resulting factor loadings. The results of the analysis showed that the three-factor solution accounted for 78% of the data variance. The three factors are labelled “vividness”, “affinity”, and “luxuriousness” respectively, after the scales which show large absolute values in the loadings for these factors. Then, the rated scores were averaged over the students. In the same way, the average scores were calculated for the staff of the prefectural government, for the females in their 20s, for the females in their 30s, ..., the males in their 60s. These averaged scores were used for the factor analysis, again, with the principal factor method and varimax rotation. The results of the factor analysis showed that the impressions of the posters were constructed by a three-dimensional space spanned by “vividness”, “affinity”, and “luxuriousness”, again.

Multiple-regression analyses were performed using factor scores as the independent variables and each of the degrees in the unipolar scales as a dependent variable, respectively. The results of the analyses showed that the coefficients of determination for “the degree of preference” and “the degree of desire to visit that area” indicated high values over 0.7. Figure 1 indicates the resulting multiple-regression lines as vectors. Figure 1 shows that a friendly and luxurious poster is preferred, and that a friendly, luxurious, and vivid poster affects the viewers’ desire to visit that area. The coefficient of determination for “the degree of desire to live in that area in the future” showed a low value. Then multiple-regression analysis for “the degree of desire to live in that area in future” was performed using the data for each combination of the different genders and different ages, respectively. The results showed that the coefficients of determination indicated low values, except for the case of the males in their 60s where the coefficient showed a value over 0.7. These results implied that the posters were not effective in making the viewers desire to live in the area, except for the males in their 60s. Deciding where

Care, and other administrative services. The males in their 60s may not be interested in such environments. For the purpose of attracting people to live in an area, an explanatory booklet may be more effective than a poster.

The relative position of a poster for a group of the participants in the three dimensional space was calculated using the position of the same poster for all participants as the origin. Then, the relative positions were averaged over the 41 posters for the group. Figure 2 shows the mean position of each group. Figure 2 shows that female participants tend to be placed on the right side and male participants on the left side. The results of ANOVA and multiple-comparison tests showed that the differences in the positions on the vividness factor were significant between female and male participants. There were no significant differences among the groups except for the females and males on the vividness factor. The results implied that female viewers tend to perceive the posters as more vivid than males; however, there were no significant differences among the different groups in the other features.

4. CONCLUSIONS

The three-dimensional plane, spanned by “vividness”, “affinity”, and “luxuriousness”, illustrated the impressions of the posters. The results showed that a friendly and luxurious poster was preferred, and that a friendly, luxurious, and vivid poster made viewers desire to visit that area. The results also showed that the posters were not effective in making viewers desire to live in the area, except for the males in their 60s.

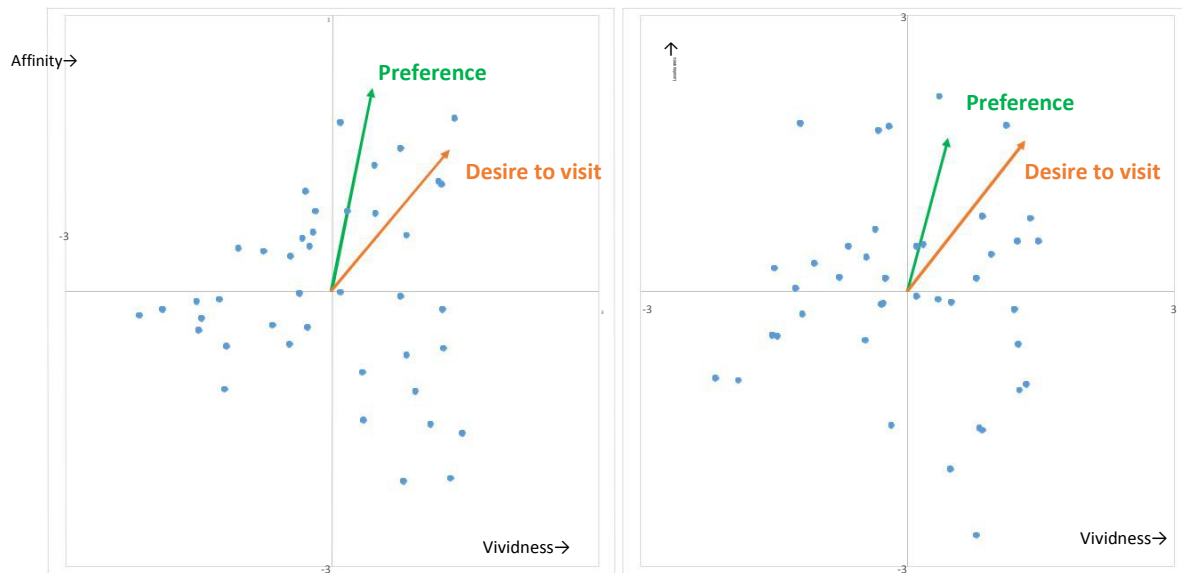
REFERENCES

- Osgood, C. E., Suci, G. J., & Tannenbaum P. H. (1957). *The measurement of meaning*. Urbana, University of Illinois Press.
- Osgood, C. E. (1952). *The nature and measurement of meaning*. Urbana, Psychological Bulletin.
- Osgood, C. E., & Suci, G. J. (1955). Factor analysis of meaning. *Urbana, Journal of Experimental Psychology*.

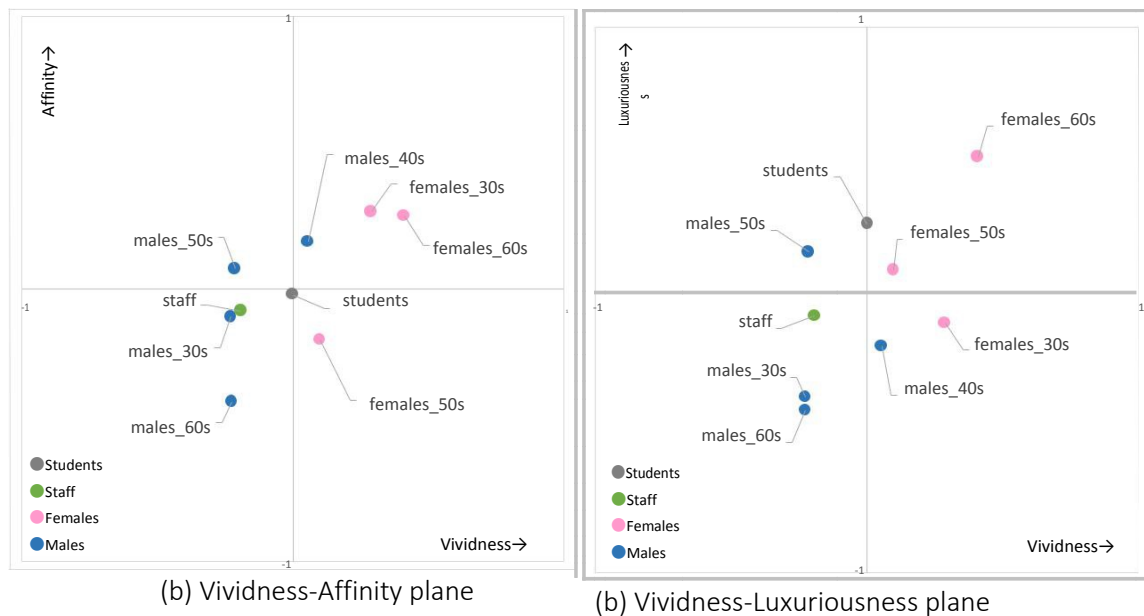
Table 1: Semantic differential scales and their factor loadings

SD scales	Factor		
	Vividness	Familiarity	Luxuriousness
Tight - Loose	0.66	0.61	0.03
Old - New	0.65	-0.15	0.49
Powerless - Powerful	0.70	0.32	0.43
Static - Dynamic	0.94	-0.17	0.06
Delicate - Heroic	0.79	0.01	-0.06
Quiet - Active	0.94	-0.28	-0.05
Weak - Strong	0.71	0.12	0.36
Dark - Bright	0.87	0.20	-0.04
Simple - Vivid	0.87	-0.23	0.35
Agitated - Calm	-0.71	0.64	0.27
Banal - Unique	0.66	-0.29	0.34
Unpleasant - Pleasant	0.11	0.84	0.50
Mixed - Neat	-0.50	0.71	0.27
Ugly - Beautiful	0.00	0.76	0.58
Artificial - Natural	-0.14	0.87	-0.05

Unfamiliar	Familiar	0.26	0.82	0.19
Loutish	- Stylish	0.10	0.32	0.93
Cheap	- Expensive	-0.03	0.19	0.93
rural	- urban	0.23	-0.61	0.50
Cold	- Warm	0.62	0.25	-0.22
Monotonous	- Varied	0.61	-0.57	0.02
Traditional	- Futuristic	0.52	-0.30	0.19
Contribution Rate		0.37	0.62	0.78



(a) Vividness-Affinity plane (b) Vividness-Luxuriousness plane
Figure 1: Impression space of the posters. The vectors show the multiple-regression lines



(b) Vividness-Affinity plane (b) Vividness-Luxuriousness plane
Figure 2: The mean position of the perception of the posters for each participant group

SPECIFYING KANSEI REQUIREMENTS WITH THE APPLICATION OF ENVIRONMENTAL PSYCHOLOGY RESEARCH METHODS CASES OF INTERIOR DESIGN IN ARCHITECTURE

Toru YOSHIDA^{*a}, Masami MAEKAWA^a, Yoshio TSUCHIDA^{*b} and Yukari NAGAI^a

^a Japan Advanced Institute of Science and Technology, Japan, s1620029@jaist.ac.jp

^b Kanazawa Institute of Technology, Japan

ABSTRACT

To design and create architecture that serves the public, one of the foundations of architectural design is identifying and satisfying the demands placed on specific architecture. We constructed an observation model for identifying Kansei requirements applicable in the early stages of architectural design. For the observation model, we used a cognitive psychology based human model predicated on individual diversity. We also studied and referenced previous research on existing environmental psychology research methods, taking into account the features and limitations of each method. We then combined and developmentally applied them to a new observation model. We also focused on the potential of Kansei requirements, setting a requirement for a precise explanation that fit more closely with real conditions, and examined methods for prompting test subjects to think and speak subjectively. With this observation model for Kansei requirements specifications, we attempted observations and analyses. The test results confirmed that through freely chosen images with word prompts, the prompts encouraged speech and showed the potential for identifying Kansei requirements.

Keywords: *Kansei Requirements, Environmental Psychology, Architectural Design*

* Corresponding author: Toru YOSHIDA

1. RESEARCH BACKGROUND

Specifying and meeting the requirements placed on a particular building is a foundation of architecture: not only in order to design and create architecture that serves society; but it is also to design man-made objects. The specification of the requirements in design is one of the starting points for creating the value of man-made objects [1]. In architectural design, the designer thinks not only of the building's function and performance as an object to be the target of the design, but also of how the space and environment will be perceived by human beings [2]. People perceive designed and created objects through their minds, and the state of this design that has passed through the mind has been studied [3]. Human Kansei exist in a complex relationship; however, to make this topic meaningful for the future of design, we focus not on what has been designed and created, but on understanding the issue of what needs to be designed and created [4].

Requirements for design can be generally classified as non-functional and functional demands [5]. Kansei requirements that appear through Kansei of human, focused on in this study, are non-functional requirements. Non-functional requirements are usually requirements that are tacit, such as Kansei of human, and as such are not easily programmable. It is important to identify Kansei requirements. Previous research has shown that by observing human Kansei, through which each person perceives the space and environment, and including it in design and creation, we can improve our understanding of the design process [6].

Environmental psychology research methods are used as a way to systematically understand human cognitive structure [7]. These discuss how to explain human Kansei requirements, including individual differences, in a detailed way that is grounded in reality. Furthermore, in the history of architecture, designs often relied on the architect's personal intuition. However, according to the definition at the meta-level of the design, it is pointed out in the essence to be theoretical problem-solving [8].

2. OBJECTIVES AND METHODS

The objective of this study is to indicate methods for specifying Kansei requirements of architectural design in the early stages of its design. By indicating methods for identifying Kansei requirements, it will become possible to consider the architectural design process as logical problem-solving work, and to optimize the design process.

This study's methods are to first review existing environmental psychology research methods. Next, we propose an observation management model that makes it possible to understand and show human cognitive structure. In accordance with the proposed observation method model, we decided on a procedure of attempting observations and confirming the specification of Kansei requirements.

When we reviewed the human-based models that were the subject of existing environmental psychology research methods, we found that, while there are some differences in the human-based models used in psychology and sociology, there are no differences in their approach toward the “individual” and “personal.” We thus thought that it would be appropriate to assume a human-based model along the lines of cognitive psychology [9]. After reviewing the existing environmental psychology research methods, we established the following three demands:

- 1) It must have the potential to specify Kansei requirements as functional demands.
- 2) In assuming that humans are diverse by nature, it must have the potential to explain in detail, and in a fashion that fits with actual circumstances, how and from what perspective the test subjects came up with their Kansei requirements.
- 3) It must operate scientifically from the point of view of reliability and practicality, to be adopted in the early stages of the design process, as a problem-solving system.

3. ANALYSIS AND REVIEW OF EXISTING ENVIRONMENTAL PSYCHOLOGY RESEARCH METHODS

3.1. Evaluation Grid Method

The “Evaluation Grid Method,” or EGM, is a method for exploring individual cognitive structure, developed by Junichiro Sanui as an “advanced technique of the repertory grid method” (1986) and was later renamed the “Evaluation Grid Method” [9].

In this method, elements are selected and evaluation items are extracted through comparing elements; the extracted evaluation items are then arranged for laddering, with the higher and lower items extracted, shown in a tree diagram, and evaluated. A qualitative assessment is made of the individual’s cognitive structure and, through extracting components related to the evaluation, the links between those components can be understood. The interview technique used is a half-structured interview, and its psychological invasiveness is low.

Laddering (leading questions) is a technique for finding the contracts between upper and lower items, developed by D.N. Hinkel. The operation of this laddering process is characteristic to the evaluation grid method.

3.2. PAC Analysis

“PAC Analysis,” or “Personal Attitude Construct” [10], is a method for exploring individual cognitive structure that was developed by Naito Tetsuo (1988).

It defines the cognitive structure of the subject being studied, and indicates this through an associative, prompting text. The subject extracts free association words from this text to expose important things about the subject's consciousness through the subject's free association. Paired comparisons of all the combinations with a degree of similarity from the extracted free association words are compared and recorded in random order. From the information recorded, a cluster analysis is conducted and the reciprocal links between free association words (phrases) are shown in a dendrogram (tree diagram) to be understood visually; these are grouped, understood, and appreciated as clusters. The individual's cognitive structure is qualitatively evaluated using the cluster and, by extracting factors related to the evaluation, the links between the components are understood. The interview technique used is a semi-structured interview, and its psychological invasiveness is low [13].

The biggest advantage to PAC analysis is that, even if the subject him or herself is not exactly aware of their own cognitive structure, it is possible for the researcher to deduce that cognitive structure. By having the researcher categorize the cluster analysis results together with the subject, it is possible to form an appropriate cluster, and it is easy to create a structured framework. It takes some practice to analyse these clusters, but the results are not influenced much by the skill of the researcher conducting the interview, and uniform analysis is possible [13].

3.3. Photo Projective Method

The photo projective method is as a method of observing human introspection through the visual medium of photographic images, developed by Masaaki Noda (1999) [11].

In this method, the subject is given a camera and some instructions, and is asked to take pictures. The things that the photos record are regarded as reflecting the relationship between the subject's self and the external world, and this method attempts to understand the perceived environment (outside) with the individual's psychological world (inside). The photo projective method is used in academic fields such as environmental studies, geography, and psychology. In studies using photos as a technique for moving an interview forward, it has been shown that content which a research subject was unable to verbalize or conceptualize could be more concretely expressed with the use of photos [12].

The photographer's cognitive structures is projected in their photos and, in this method the researcher evaluates externally, but it has been noted that it can be difficult to retrieve cognitive structures [13].

3.4. Caption Evaluation Method

The caption evaluation method combines the photo projective method and EGM, and was developed by Takaaki Koga et al (1999).

In the caption evaluation method, the research participant is given a camera and asked to walk freely around town taking photos of scenery that interests them, and write free descriptions of the scene's components, features, and impressions on a scene card. These cards are collected together with the photos and an EGM analysis is conducted; it is used in research such as environmental improvement proposals.

The goal of this method is to extract the free opinions of people with as few constraints as possible. It does not require the personal interviews or control seen in EGM and PAC analysis, and it is a method that can analyse a large amount of quantities of data [14]. It is clearly not a method for showing the cognitive structure of a person projected by the photos.

3.5. Consideration of demands for the Application of Existing Environmental Psychology

Research Methods

Regarding the three demands set out, we summarized the considerations of each case with reference to past works and considered them as follows. Regarding demand 1, the operation of laddering used in EGM has the potential to draw out functions with lower evaluation items. Regarding demand 2, the network chart shown in the cluster analysis of EGM can statistically handle individual cognitive structures. Furthermore, the dendrograms shown in PAC analysis show as clusters of words (phrases), and can operate statistically. Regarding demand 3, the objective of sensory demand specification that can easily be made implicit by subjects, the photo projection method was considered and, through free selection of photo images and provision of speech prompts, it can be applied to a wide variety of people. Furthermore, free association was used to select evaluation items. We considered PAC analysis's unstructured interview method, which makes it possible to explore human subjectivity non-invasively and includes the potential for explaining in detail, and in a form that fits with actual circumstances.

4. KANSEI REQUIREMENTS SPECIFICATION THROUGH THE APPLICATION OF ENVIRONMENTAL PSYCHOLOGY RESEARCH METHODS

4.1. Observation Model Proposal

From our study of environmental psychology research methods, we constructed an observation model for Kansei requirements specification as follows.

Activity 1. Selection of Images for Association Prompting

To prompt participant's internal observation, we choose images through free selection. Referencing the photo projective method, the subject freely chooses as many cards as they wish, based on their intuition for which images they prefer, from a set of images prepared by an architectural design professional. We also make it possible for participants to freely choose from images published in magazines or on the Internet. We give the subject the following instructions: "We are going to conduct an interview to understand people's Kansei on Interior

image of architecture. First, please select the images you prefer from among these prepared images. You may choose as many as you like. Please tell us if you do not like any of the images. "When participant has finished selecting images, we give the following instructions: "Next, please search for images you like on the Internet. Perform the search yourself by entering keywords for images in an image search engine or similar. You may also search by any other methods that occur to you." We have participant choose images using the above procedure. We also record the search keywords participant used.

Activity 2. Selection of free association words (phrases)

While looking at the selected images combined with themes (association prompt phrases), we conduct a non-structured interview along the lines of a PAC analysis procedure and, through free association, and we select free association words (phrases).

Because our aim is to specify Kansei requirements by using images to find things that can become latent demands, we give participants a theme (association prompt phrases) by saying "Look at these images and tell us any words or images that come to mind on the topic of _____

that fits your Kansei. Use as many words or images as you like." If the participant falls behind in free association, we encourage the free association with the following instructions: "Is there anything else?" "Please recall it again." We continue this process until participant can no longer easily come up with new free association words (phrases). Next, we focus on the potential of speech, give a simplified explanation of the human senses, show Kansei words selected by experts on several printed cards, and dig deeper to find more free association words (phrases). We continue this process until participant can no longer easily come up with new free association words (phrases).

Activity 3. Similarity Comparison

Through free association made with non-logical thinking, and by calculating the dissimilarity of evaluation items in a cluster analysis, PAC analysis allows for the advance of indicating cognitive structure. We randomize paired comparisons of all items and ask the subject to conduct a similarity comparison. We judge participant's intuitive similarity selection while checking that they did not grow weary and let their similarity comparisons become lazy.

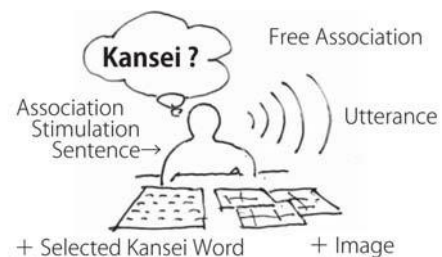


Figure 1: Diagram of Kansei extraction

Resemblance degree judgment by the intuition

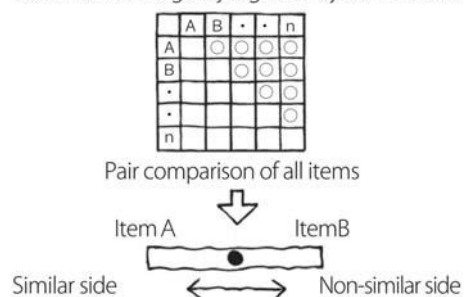


Figure 2: Diagram of similarity

Activity 4. Laddering

Laddering is conducted, using each of the following instructions to discuss the evaluation items selected in Activity 2. For selecting higher-level free association words (phrases) (laddering up): “You said that it is ____ and it fits Kansei, why do you suit your sensibility when it is ____ for you? How do you feel if it is ____? Please explain your reasons and senses?” For selecting lower-level free association words (phrases) (laddering down): “You said it would be good if _____. To you, specifically what and how is _____? Please explain your reasoning.”

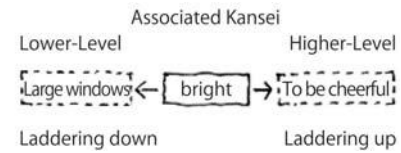


Figure 3: Diagram of Laddering

4.2. Analysis and Comprehension

With the data collected in Activity 3, we conducted a cluster analysis, expressed it in a dendrogram, indicating the subject's cognitive structure, and read the connections and grouping of Kansei requirements. With the data collected in Activity 4, we expressed it in a network diagram, indicating the subject's cognitive structure, and I determined the whole of the lower free association words (phrases) and language of higher free association words (phrases) tied to free association words (phrases) picked up by free association words (phrases). We can scientifically understand the subject's Kansei requirements by combining the dendrogram that showed relationships and groups of free association words (phrases) and the network diagram that is indicated by laddering

5. OBSERVATION MODEL TESTS

5.1. Test Summary

We conducted tests of the observation model using four subjects. These tests had the objective of confirming the following: that the proposed observation model could be smoothly conducted, that potential Kansei requirements could be specified easily in the early stages of design, and that if the requirements were non-functional, most Kansei requirements could be understood as functional requirements through identification. We did an online image search of architectural interiors, we then chose and printed 50 photo images from the web. We gave information about Kansei and showed Kansei words on printed cards ahead of time.



Figure 4: Example of prepared photo image

5.2. Use of Support Tools in the Observations

During testing of the proposed model, we used the PAC analysis support tool “PAC-assist” [15]. For cluster analysis, we used “R.” For the laddering activity, we used “EGM-assist” [16].

5.3. Results and Analysis

Figure 5 shows the dendrogram of test participant-3 created by Similarity Comparison of subjects in free association words (phrases). The cluster derived by the subject's subjectivity between free association words (phrases), and words (phrases) are given to the group by participant 's own words (phrases), are indicated by a dendrogram as shown in Figure 5. Looking at the cluster of participant-3, it is Feeling of external environment, and it is understandable that Kansei to the coming in of Natural soft light comes from the fact that it is Not overly visually stimulating is low. It is possible to quantitatively capture relationships and groups of free association words (phrases) derived by the subject's subjectivity.

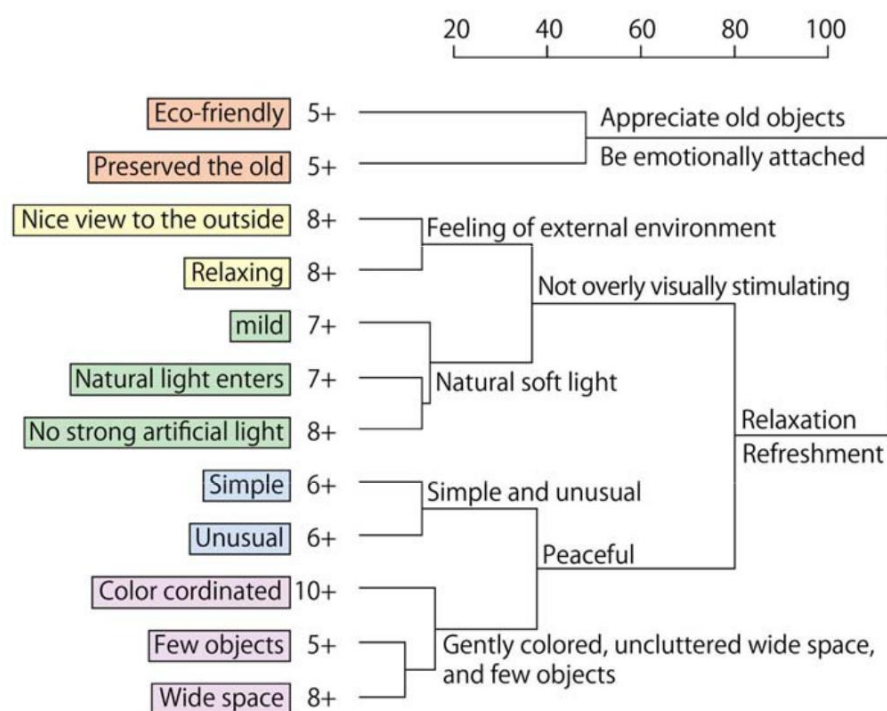


Figure 5: The dendrogram indicated by cluster analysis (participant-3 47 year old female)

Figure 6 is a network diagram created by laddering. From the free association words (phrases), it is possible to understand the condition and state the Kansei requirements is specifically lower free association words (phrases) indicated by laddering. In addition, it is possible to understand which upper level conceptual free association words (phrases) are linked to specific conditions and states.

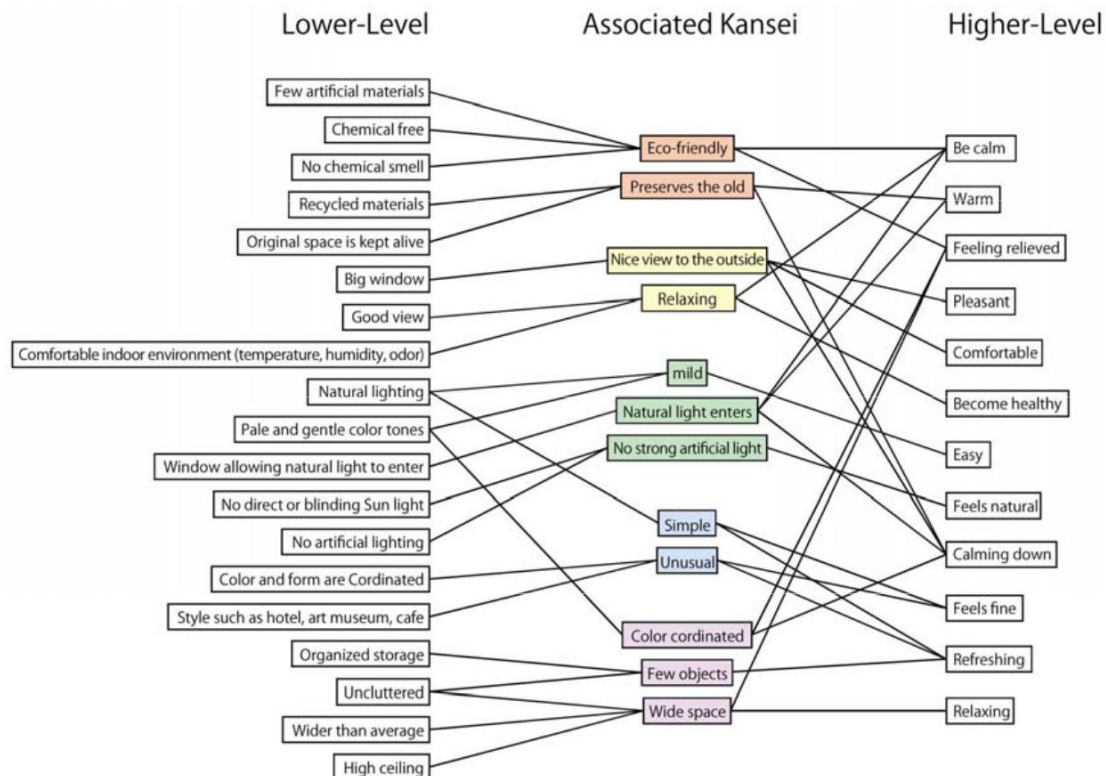


Figure6 : Network diagram indicated by laddering (participant-3 47 year old female)

In this way, we could show the dendrogram by similarity comparison and cluster analysis. While the network diagram could be shown by laddering. I would like to focus on the work of integration in the design process of the designer. The designer will capture multiple Kansei requirements and will do the integration work to satisfy the client's desires and requirements. Regarding this integration work, while it is impossible to satisfy the lower specific Kansei requirements shown in the network diagram, we can quantitatively understand the subjective Kansei requirements as clusters by using a dendrogram, and possibly make the design creation process more efficient.

6. CONSIDERATIONS ON SPECIFYING SENSORY DEMANDS THROUGH THE APPLICATION OF ENVIRONMENTAL PSYCHOLOGY RESEARCH METHODS

Using images to prompt associative words, we confirmed that these were connected to subjective speech by testing the observation model. Through the test subjects, and through methods proposed ahead of time involving the cognitive psychology human model used in this study, potential was indicated for explaining how, and from what perspective, people come up with sensory demands, in detail, and in a way that fits real conditions. We also confirmed through the observation model tests that this method is able to grasp statistical meanings with reliability and practicality, which in turn aids as problem-solving system in the early stages of the design process.

7. CONCLUSION

We used existing environmental psychology research methods to propose a new observation model for specifying Kansei requirements through the application of such research methods, and tested this model. The result of the test was that this method has the potential for specifying Kansei requirements in this study. Regarding the data obtained from testing the observation model, we have only gone so far as to discuss the potential for using this in the process of drawing up designs. However, regarding Kansei requirements that can easily become potential requirements, the question of how the subject perceives the indicated data is a topic to be pursued in future research. In the study of design, research focusing on human senses can make its approach from myriad angles for the future of design, and the present study shows one possibility.

REFERENCES

- Toshiki Yamaoka. (2003). *Human Design Technology*, Mori Kita Publishing, 8.
- The Architectural Institute of Japan (Co-authored by Masao Inui et al.). (1998). *Human Environment Studies*, Asakura Shoten.
- Norman, D. A., Okamoto, A., Yasumura, M., Iga, S., & Ueno, A. (2004). *Emotional Design*, Shin-yo-sya.
- Yukari, N. (2012). Design thinking and design. *Special Issue of Japanese for The Science of Design 2012*, 20-1(77), 78-81.
- Oonishi, J., & Go, K. (2002). Requirements engineering. *Kyoritsu Shuppan*, 15-16.
- Maekawa, M. (2012). *Study on getting Kansei requirements to design user experience*. 14th Annual Conference of Japan Society of Kansei Engineering.
- Architectural Institute of Japan (Co-authored by Junichiro Sanui et al.). (2000). *Yoriyoi Kankyō -Sōzō no Tame no Kankyō-Shinri-Chōsa- Shuhō Nyūmon*, Gihoudou books, 60.
- Yukari, N., & Taura, T. (2010). Concept generation and design. *Cognitive Studies*, 17(1), 66-82.
- Sanui, J., & Inui, M. (1986). *Phenomenological approach to the evaluation of places*, J.Archit.Plann.Environ.Eng. AIJ, 15-21.
- Naito, T. (1997). *How to use pac analysis*. Nakanishiya.
- Noda, M. (1988). *Hyohaku sareru Kodomo-tachi*. Joho Center Publishing, 198-200.

Yulofumi et al. (2008). *Measurement of place attachment using the Photo Projective Method*. Kansei Gakuin Sociology Department Studies. Shakaigakubu-kiyo No.106, 15-16.

Tsuchida, Y. (2002). *Comparison of the analysis of the cognitive structure -Evaluation grid method and PAC analysis -*. J.Archit.Plann.Environ.Eng.,AIJ, 845-846

Takaaki Koga et al. (1999). *Participatory Research of Townscape, using Caption Evaluation Method*. J.Archit.Plann.Environ.Eng. AIJ, 79-84.

<http://wwwr.kanazawa-it.ac.jp/~tsuchida/lecture/pac-assist.htm> (31th Aug.2017)

<http://wwwr.kanazawa-it.ac.jp/~tsuchida/lecture/egm-assist.htm> (31th Aug.2017)

AN EXPERIENTIAL SEMANTIC ANALYSIS OF “EXHIBITION” AND ITS PEDAGOGICAL IMPLICATION ON ENGLISH FOR ARTS PURPOSE A LINGUISTIC PERSPECTIVE

Larry Hong-Lin, LI^a, Tiffany Shuang-Ching, LEE^b and Po-Hsien, LIN^c

^a National Taiwan University of Arts, R.O.C. (Taiwan), larryli@ntua.edu.tw

^b National Taiwan University of Arts, R.O.C. (Taiwan), tiffanie@ntua.edu.tw

^c National Taiwan University of Arts, R.O.C. (Taiwan), t0131@ntua.edu.tw

ABSTRACT

Defining an exhibition as a museum object, Ntzani (2015) indicates that they are metaphorically conceptualised as a container and a conduit. The container account contends that displayed objects have intrinsic value as they are filled with messages from the past. The conduit account sees museum objects as conduits of messages, the signs of a language that museums employ to build their narratives. However, Ntzani's (2015) account of museum objects runs into entailment problems. Therefore, the study examines clauses containing EXHIBITION in the discourse of arts and detect how it is interpreted through its co-occurrence with English verbs as well as associated process types and participant roles. The finding provides a new window on the notion of EXHIBITION and demonstrates the significance of using linguistic features appropriate for the subject field. In a word, the study opens the possibility of an interdisciplinary research between arts and linguistics.

Keywords: *exhibition, experiential semantic representation, arts discourse, English for Arts Purpose*

1. INTRODUCTION

1.1. Background

This study seeks to explore arts-related notions from a linguistic perspective. To this end, the word EXHIBITION is chosen as the case of study, for exhibitions play a very important role in the arts-related profession. Therefore, the experiential construal of this word is approached through the investigation of its linguistic context in genuine data. Since this work characterises the linguistic features prompted in sentences containing EXHIBITION, the finding can also increase the understanding of the language use in English for Arts Purpose.

1.2. An exhibition as a container and a conduit (Ntzani, 2015)?

Closely related to the discussion is the work of Ntzani (2015), who investigates the effects that conduit and container metaphors (Reddy, 1979) have on visitor's experience in museums. Defining exhibitions as museum objects, transformed from cultural artefacts and displayed inside museum premises, she examines and analyses the metaphorical expressions obtained from official museum discourses. In her view, museum objects, as substantial particles of exhibits, are conceptualised through container and conduit metaphors. The first approach that she adopts, underlined by Reddy's container metaphors, contends that displayed objects have intrinsic value as they are filled with messages from the past, and where information could be extracted. Ntzani pronounces that although containers also transfer their contents, their primary function is to hold them and shape them. Witness the data provided by Ntzani:

(1) Maintenance of the material form of an object readily allows us to believe that it continues to represent the same things and therefore holds the same meanings (MacGregor, 1999).

As in (1), the use of the verb *hold* indicates that exhibited museum objects maintain and preserve certain meanings. In other words, museum objects are seen as sealed containers of cultural values that speak for themselves in the container metaphor approach.

The second approach that she uses is supported by Reddy's conduit metaphor. According to Ntzani, this approach sees museum objects as conduits of messages, the signs of a language that museums employ to build their narratives. Since conduits are involved in the act of transmission in a passive fashion, the passivity often renders the content invisible. As illustration, consider the data offered by Ntzani:

(2) In this case, the museum object—musealium or musealia— does not have any intrinsic reality. . Objects can thus be used as signs, just like words in speech, when they are used in an exhibition ... (Desvallées & Mairesse, 2010).

With respect to (2), exhibited objects are understood as signs, which are conveyed from people to people just like language. In short, museum objects are conceptualised as conduits of information that are communicated from museum curators to museum visitors.

While Ntzani's (2015) analysis is impressive, it appears that her metaphorical account of museum objects runs into some difficulties. A consequence of metaphorical interpretation is that metaphors have entailments (Lakoff and Johnson, 1980) for the target domain that they thereby

organise far beyond any initial structural similarity (Krippendorff, 1993). An entailment of container metaphor renders communicated contents as entities with objective qualities. As objective entities, contents must exist independent of human experiences. Krippendorff (1993) offers a good analogy: it is difficult to imagine that one can pour wine or milk out of a bottle filled with water. That is, the physics invoked by the container metaphor implies that one can remove from a message only, what had been put into it, and that this would have to be the same for everyone. Under such an entailment, as Krippendorff (1993) notes, metaphorical accounts offer no logical place for variations or discrepancies in interpretation.

The conduit metaphor account faces the entailment issue as well. The conduit metaphor entails a transfer of possession: the sender that possesses the object ejects it, and the receiver picks it up and subsequently possess it (Ruiz de Mendoza Ibáñez & Mairal Usón, 2007). However, it must be noted that museum objects transmit other phenomena than thoughts and ideas, which cannot be “possessed” by exhibition viewers. Consider (3) and (4):

(3) Many of the exhibited objects display a curious balance of utility and excessive luxury.

(4) This exhibition displays the diversity of contemporary Asian American identity through the collaboration between the National Portrait Gallery and the Smithsonian Asian Pacific American Programme.

As in (3) and (4), *display* is a verb of communication, which is metaphorically comparable to an act of transferring. In terms of the conduit metaphor, *display* indicates that an exhibition is conceptually profiled as an agent transferring an object to others, whereas the exhibited content is encoded as the object being transferred (Dabrowska, 1997). In these two examples, what are being exhibited are a balance of utility and excessive luxury and the diversity of contemporary Asian American identity. Although these two phenomena are perceivable from the displayed objects just like the message or idea being delivered, they cannot be taken away and kept in possession. In a word, the conduit metaphor account is also subject to the entailment gap as demonstrated in the sentences (3) and (4).

1.3. Key issues

In this work, the aim is to solve the following issues: What verbs does the word EXHIBITION co-occur with in the discourse of arts? What are the process types of the verb collocates and the associated participant roles activated by EXHIBITION? What do these linguistic features reveal regarding the experiential representation of EXHIBITION? Lastly, what do the features imply with respect to the writing for arts purpose? Having presented the critical issues to pursue, a theoretical basis for this work is offered in the subsequent section.

2. THEORETICAL CONTEXT

2.1. The verb dynamic paradigm

In this study, the issues raised above is assessed by focusing on how the English word EXHIBITION is profiled by its co-occurring verbs. In the experiential terms, language contains resources for construing world entities: Verbs represent our experiences of the goings-on of an

entity. As Langacker (1987) stresses, the same entity can be construed in different ways depending on how the speaker construes or views the entity. Also, Castro (2012) shows that the basic meaning of each verb construes the meaning of a term in different dimensions. Hence, it is decided that the concept of EXHIBITION is explored in the noun-verb paradigm.

2.2. Process types and participant roles

In Halliday & Matthiessen's (2014) systemic functional grammar theory, our impression of experience consists of a flow of events. This flow of events is portioned into quantum of change by the grammar of the clause. Each quantum of change is modelled as a figure-one of happening, doing, sensing, saying, being, or having. All figures are made up of a process unfolding through time and of participants being involved in this process. Halliday & Matthiessen (2014) pinpointed that a figure is basically composed of three components:

(5) process unfolding through time; the participants involved in the process; circumstances associated with the process

The three components are typically realised by grammatical elements in grammar:

(6) processes as realised by verbal groups; participants as realized by nominal groups, including directly and indirectly involved ones; circumstances as realised by adverbial groups or prepositional phrases

The six process types and relevant participant roles directly and indirectly involved in them are presented in (7). These properties determine the configuration of clauses, i.e., (in-)/transitivity.

- (7) a. Material: Actor, Goal/ Recipient, Client, Scope, Initiator, Attribute
b. Behavioural: Behavior/ Behaviour
c. Mental: Sensor, Phenomenon
d. Verbal: Sayer, Target/ Receiver, Verbiage
e. Relational: Carrier, Attribute; Identified, Identifier; Token, Value/ Attribute, Beneficiary, Assigner
f. Existential: Existent

With Halliday & Matthiessen's (2014) framework, it is detected how an exhibition interacts with other participants of the processes in the experiential realm. It is crucial to distinguish participants from circumstantial factors of processes. Circumstantial elements are always optional augmentations of the clause. In contrast to circumstances, participants are inherent in the process. Viewing that this study discusses the co-occurrences of EXHIBITION with its verb collocates, the discussion is focused on the processes and corresponding participants directly engaged in the usage sentences.

3. METHODOLOGY

3.1. Data collection

The data was collected from BNCweb that was developed by the University of Zurich (Lehmann et al., 2000). Akin to many other corpus tools, BNCweb offers a range of additional features for the analysis of the retrieved data. The corpus text on BNCweb is classified by domain, including

applied sciences, arts, belief & thought, commerce & finance, leisure, natural & pure science, social science, and world affairs.

3.2. Procedure

Clauses containing the word EXHIBITION were extracted from the data and the verbs appearing with it as situated in the subject position of sentences are investigated. The survey is based on the text obtained from the domain of arts. On the basis of Hardy and Colombini (2011), only collocations with an MI (Mutual Information) score of 3.0 or higher are taken to be of sufficient interest in the survey. However, since MI overestimates the importance of collocations of low frequency (Hamilton et al., 2007), what is considered for analysis are only collocations with five or more occurrences. Using the KWIC Concordance, it is analysed that all the occurrences of the word EXHIBITION in the span of three words to its right (R1 to R3). Once the data are screened, the verbs collocating with the subject noun EXHIBITION are identified. Subsequently, their semantic relations with the other participants that directly engaged in the processes denoted by the verbs are probed.

3.3. Results and discussion

Now, the analysis of the results shall be presented. The verbs co-occurring with the word EXHIBITION include *feature*, *display*, *examine*, *open*, *coincide*, *continue*, and *travel*.

3.3.1. Verb Collocate *feature*

Feature co-occurs with EXHIBITION at the frequency of 18 with the MI score of 5.82. The data containing *feature* are exemplified as in (8):

(8) Intriguingly, the **exhibition** *features* several pictures and objects which date from the beginning of Bacon's career, when he was employed as a decorator and influenced by Picasso.

Given that the verb *feature* refers to including something as an important part, the word EXHIBITION in the context is best interpreted as an entity, which contains specific work(s) of arts as an important component.

With respect to the intra-sentential semantic-role relation, the study resorts to Halliday & Matthiessen's (2014) theory of process types. According to Halliday & Matthiessen, the verb *feature* denotes a relational process representing the notion of "being" and "having", which can further be divided into two modes of relation: attributive and identifying. Subsumed under the mode of identifying relation, the verb *feature* specifies a kind-part relation between the participants of events. In terms of participant roles, the word EXHIBITION in the subject position and the noun groups in the object position play the roles as Token and Value respectively: An exhibit collection is portrayed as a representative type consisting of divergent artworks.

3.3.2. Verb Collocate *display*

In addition to *feature*, the verb *display* is also attested with 5 occurrences at the MI score of 3.38 in the corpus data. The appearance of *display* with EXHIBITION shows that an exhibition is responsible for showing objects to people. The instance containing *display* is provided in (9):

(9) Several **exhibitions** have recently *displayed* the art branded as ‘degenerate’ by the Nazis in their notorious show of 1937.

With the verb *display* denoting the act of showing, the word EXHIBITION obtained in the corpus data is felicitously encoded as an entity, which shows objects to the public.

Again, Halliday & Matthiessen’s (2014) framework is critical for our discussion of the verb *display*. In their view, there is always one participant in the type of material process, Actor. This participant Actor leads to the unfolding of the process in time, which produces an outcome that is different from the initial stage of the unfolding. This outcome may be confined to the Actor per se on the condition that there is only one participant inherent in the process. The material process as such signifies a happening, which is dubbed as intransitive in traditional terminology. The unfolding of the process may extend to another directly involved participant of the process, Goal. When this happens, the participant Goal is impacted in a certain way: more precisely, the outcome is registered on Goal. Such a material process characterises a doing, which is labelled as transitive. Along this line of reasoning, the verb *display* is typed into the material process that requires two directly involved participants, Actor and Goal. As manifested in (9), EXHIBITION occurring in the subject position takes on the Actor Role, and the noun groups located in the object position play the Goal Role. If we take a further step in Halliday & Matthiessen’s (2014) framework, the process denoted by *display* is a transformative material process, which signifies an elaboration of the participant Goal, the displayed content in our case, leading to a change in its exterior condition.

3.3.3. Verb Collocate *open*

The verb *open* used with EXHIBITION encodes the starting of the operation of an exhibition. It occurs at the frequency of 33 with the MI score of 4.36. Witness the data attained from the BNCweb corpus:

(10) Exactly a month after the **exhibition** *opened*, the Secretary of State announced that state aid for churches in use would begin with immediate effect at the rate of £1 million a year.

With the occurrence of *open*, the noun EXHIBITION appears appropriate to be encoded as an entity, which offers space for people to come inside to pursue a purpose.

Now, the process type of the sentences containing EXHIBITION and *open* is analysed. Recall that material processes, as previously discussed for the verb *display*, distinguish themselves into two types by the number of inherently engaged participants: one requiring Actor and Goal, and the other requiring only Actor (Halliday & Matthiessen, 2014). The verb *open* attested in the survey is categorised into the latter type. That is, *open* in this context profiles a happening, producing an impact on the participant role Actor, which is taken up by the word EXHIBITION in the usage sentences. In a deeper analysis of the semantic property of *open*, it is suggested that it decodes an elaborating transformative material process, where the Actor is construed as being operating and running as the process goes on.

3.3.4. Verb Collocate *examine*

The verb *examine* is found to collocate with EXHIBITION with 8 occurrences at the MI score of 3.48 in the domain of arts. Witness the sentence collected from the BNCweb showing *examine*: (11) The **exhibition** *examines* the period from the fourteenth century to the third century BC. The word EXHIBITION is best interpreted as an entity, which has the mental ability to focus attention and look at something carefully and thoroughly, so as to find out more about it.

In the view of Thompson (2014), the verb *examine* denotes a Behavioural process, which is in the middle area between Mental and Material processes. Behavioural processes signify specifically human physiological acts, which distinguish themselves between purely mental processes and their physical manifestations. As illustration, many Mental processes have corresponding processes that construe a conscious physical act involved in perception like *see* versus *watch* and *hear* versus *listen*. The verb *examine* as Thompson pinpoints, represents a process of this type. In this analysis, the noun EXHIBITION in the subject position plays the role as Behaver (Thompson, 2014), which has the property of being Actor on one hand and Sensor on the other hand. Aside from the participant of Behaver, the verb *examine* appears to occur with another participant in the corpus sentences. In line with Downing's (2015) analysis of *watch*, *examine* is treated as involving the participant of Phenomenon realised by the noun group in the object position of the clause: for instance, *the period from the fourteenth century to the third century BC* in (11).

3.3.5. Verb Collocate *continue*

In addition to *examine*, the verb *continue* appears with EXHIBITION in the data at 19 occurrences marking the MI score of 5.82. The verb *continue* was used with EXHIBITION entails the state of existing in a period of time. Consider the instance attained from the BNCweb corpus: (12) The Jackson Pollock/Lee Krasner **exhibition** *continues* at the Kunstmuseum, Bern, until February 4, 1990.

The verb *continue* portrays the extension of an event in time. Thus, the usage sentence (12) construes an exhibition as an entity, which keeps happening and existing.

On the basis of Halliday & Matthiessen (2014), the verb *continue* denotes a creative Material process in this case, as do verbs *grow* and *develop*, which encode changing the state of an event with an input of impetus. If a process that instigates and affects an event is a Material process, the clause co-occurring with *continue* falls into this type because it can be interpreted as constantly initiating an event to maintain its operation. Regarding the participant role of EXHIBITION, and since EXHIBITION appears with *continue*, it takes on the role of Actor, which receives momentum input to keep operating.

3.3.6. Verb Collocate *coincide*

Coincide is another verb that appears with EXHIBITION in the domain of arts. The use of *coincide* in this context profiles the co-occurrence of an exhibition with other events. Consider the sentence collected from the BNCweb corpus:

(13) Her **exhibition** *coincides*, of course, with the Tate Gallery's survey of Ryman's paintings. If it is the case that *coincide* denotes the co-occurrence of events, it is suggested that the word EXHIBITION collocating with *coincide* is experientially comparable to an entity, which comes into existence with another at the same time.

According to Halliday & Matthiessen (2014), the type of process that designates the simultaneous occurrences of two or more entities as realised by verbs *join*, *meet*, or *crowd* is Material process. Along this line of reasoning, it is considered that the verb *coincide* to be a process of Material, signifying an extending transformation impacting the exhibition through a relation of accompaniment. Thus, the word EXHIBITION assumes the role of Actor in the context of arts discourse.

3.3.7. Verb Collocate *travel*

Travel collocates with EXHIBITION in the corpus of arts. It is attested with 19 instances at the MI score of 4.72. The use of this verb depicts the tour of an exhibition. Consider the instance obtained from the BNCweb in the following:

(14) The **exhibition** will afterwards *travel* to the Centre Pompidou in Paris and the Guggenheim Museum in New York as well as another location either in the United States or Canada. As the corpus sentence demonstrates, the presence of *travel* indicates that EXHIBITION is profiled as an entity, which tours different locations.

One category of Material processes that covers those encoding the movements of entities: *go*, *approach*, *traverse*, *follow*, or *precede*. By the same token, *travel* is a process of Material, for it codifies making movement from one place to another. In the words of Halliday & Matthiessen (2014), *travel* symbolises an enhancing transformative Material process, which involves a motion construing the movement of a participant through space. In co-occurrence with a Material process, the noun EXHIBITION performs the Actor role in the arts relevant fields.

4. GENERAL DISCUSSION

In the analysis, it is identified that the verbs collocating with EXHIBITION in the discourse of arts in the BNCweb corpus as well as the corresponding process types and participant roles, as summarized in Table 1:

verb collocate	process type	participant role
Feature	Relational	Token-Value
Display	Material	Actor-Goal
Examine	Behavioural	Behaver-Phenomenon
Open	Material	Actor
Coincide	Material	Actor
Continue	Material	Actor
Travel	Material	Actor

Table 1: Verb collocates of EXHIBITION and relevant process types and participant roles

In terms of Halliday & Matthiessen (2014), processes codify the worlds of experience, which can be distinguished into three types: the physical world, the world of consciousness, and the world of abstract relations. Material processes designate the world of physical entities. The corpus sentences containing *display*, *open*, *coincide*, *continue*, and *travel* denote Material processes. The co-presences of EXHIBITION with these verbs indicate that exhibitions are conceptualised as an actor, which implements physical events.

Relational processes symbolise the world of abstract relations. The clauses containing EXHIBITION and *feature* signify a Relational process. From the experiential perspective, the usage sentences co-occurring with *feature* communicate the message that exhibitions, being a symbol token, bear a relation with the exhibited content.

Behavioural processes are on the borderline of the world of consciousness and the physical world. In the presence of *examine*, the target sentences decode Behavioural processes, where EXHIBITION is conceptually construed as a sensor, being responsible for carrying out a mental activity that is manifested and characterized through physical properties.

The aforesaid discussion demonstrates that exhibitions perform different acts and therefore take on diverse roles in human mind, which provides a new window on what an exhibition is.

In addition, this study has pedagogical implication for arts-purpose writing. Awareness of the strategies, as Schleppegrell (2001) has noted, which are functional for effective presentation of different types of texts, can inform the analysis of student's developing writing. Therefore, given that linguistic features are specific to a given field of domain, the information as to the choices of verbs as well as the (transitive/intransitive) configuration of clauses as associated with process types and participant roles evoked by EXHIBITION is very critical to the style of language appropriate for topics related to arts, design, curating, or museology.

5. CONCLUSION

This study contributes to the experiential depiction of the English word EXHIBITION. Through the linguistic properties that it activates, what an exhibition does and what roles an exhibition assumes were sketched. This finding also indicates that English offers linguistic options for making different kinds of meanings in the arts-related context. In the future, a more systematic and comprehensive survey of the language use in the domain of arts, so as to foster interdisciplinary collaborations between arts and language science should be frequented.

REFERENCES

- Castro, M. B. (2012). Verb dynamics. *Terminology. International Journal of Theoretical and Applied Issues in Specialized Communication*, 18(2), 149-166.
- Dąbrowska, E. (1997). *Cognitive semantics and the Polish dative*. Berlin: Mouton de Gruyter.
- Desvallées, A., & Mairesse, F. (2010). *Key Concepts of Museology*. Paris: Armand Colin.
- Downing, A. (2015). *English grammar: a university course*. London: Routledge.
- Halliday, M. A., & Matthiessen, C. M. (2014). *Halliday's introduction to functional grammar*. Abingdon: Routledge.
- Hamilton, C., Adolphs, S., & Nerlich, B. (2007). The meanings of 'risk': a view from corpus linguistics. *Discourse & Society*, 18(2), 163-181.
- Hardy, D. E., & Colombini, C. B. (2011). A genre, collocational, and constructional analysis of RISK. *International journal of corpus linguistics*, 16(4), 462-485.
- Krippendorff, K. (1993). Major metaphors of communication and some constructivist reflections on their use. *Cybernetics & Human Knowing* 2 (1), 3-25.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Langacker, R. W. (1987). *Foundations of cognitive grammar: Theoretical prerequisites*. Stanford: Stanford University Press.
- Lehmann, H-M., Schneider, P. & Hoffmann, S. (2000). "BNCweb". In J. Kirk (Ed.), *Corpora Galore: Analysis and Techniques in Describing English*. Amsterdam: Rodopi, 259-266.

Macgregor, G. (1999). Making sense of the past in the present: A sensory analysis of carved stone balls. *World Archaeology*, 31(2), 258-271.

Ntzani, D. (2015). Under the Spell of Metaphors: Investigating the effects of conduit and container metaphors on museum experience. *Curator: The Museum Journal*, 58(1), 59-76.

Reddy, M. (1979). The Conduit Metaphor: A case of frame conflict in our language about language. In A. Ortony (Ed.), *Metaphor and Thought* (pp. 284-310). Cambridge: Cambridge University Press.

Ruiz de Mendoza Ibáñez, F. J. & Mairal Usón, R. (2007). High-level metaphor and metonymy in meaning construction. In R. Günter, K. Klaus-Michael, B. Thomas, & S. Peter (Eds.), *Aspects of Meaning Construction* (pp. 33-49). Amsterdam: John Benjamins.

Schleppegrell, M. J. (2001). Linguistic features of the language of schooling. *Linguistics and education*, 12(4), 431-459.

LACKING OF SOCIAL INTERACTION AT OPEN SPACES IN THE CITY OF BAGHDAD, IRAQ

Sarah Abdulkareem SALIH^a, Sumarni ISMAIL^b, Noor Fazamimah ABD HAMID^c

^a Iraq, *sarah_alsaadi1990@yahoo.com*

^b Malaysia, *sumarni.upm@gmail.com*

ABSTRACT

This paper outlines the issue on open spaces, which led to decrease social interaction among residents in Baghdad city nowadays, and compares the social interaction issue in Baghdad between past and present (before, and after 2003). The main objective of the paper is to identify the factors that affecting social interaction in the open space, through proving that lack of open spaces led to the lack in social interaction in Baghdad city. This paper employed qualitative method in term of content analysis which mainly focused on collecting, summarizing and analyzing various documentation such as writing journals, articles, researches, books, Websites, manifestos, transcripts and figures from more than 35 source both in Arabic and English languages regarding the importance of open spaces for community interaction. Findings of the paper confirm that sound social interaction need an appropriate open space that meets the needs of community in Baghdad. Appropriate factors of the open space also could determine the nature of social activity and the amount of space occupation.

Keywords: *social interaction, open spaces, Baghdad, Iraq, content analysis method.*

1. Introduction

Baghdad is the capital of Iraq and largest city in Iraq. Located along Tigris River which runs through Baghdad center and divided it to two parts *Karkh* the western shore of the Tigris and *Rusafa* the eastern shore of the Tigris (al-Rajhy, 2006). Since the establishment of Baghdad on the hands of the Abbasid caliph *al-Mansur* (766 CE), it had become a cultural, historical and social center for Arab and Islamic civilization. Baghdad was characterized by gardens, orchards and cultural and social diversity (al-Rajhy, 2006). Presently, the City of Baghdad has been exposed to multiple changes as result of political conflicts, religious diversity, ethnic diversity, administrative changes and technological developments. All of these factors lead to disintegration and change in social interaction, neglecting many recreational facilities and open spaces in Baghdad (Fathel, 2015).

This paper elaborates the issues of lack of social interaction as a result of lacking of open spaces based on the previous literature from different books, articles, researches and etc. to provide a significance information of open spaces to active outdoor recreation and social interaction in Baghdad by comparing social interaction in Baghdad between past and present. The paper transfers an overview of previous studies that published in Arabic and English languages, while documents and papers in this area are very little so it has been relied heavily on some literary descriptions and photos, which are tenuous in the extreme.

2. Iraqi Society and Social Interaction

When mentioning the historical social life in Baghdad, it must deeply highlight the role of Abbasid rule in Baghdad, between 762-1258. Where the social life in Baghdad based on two different social layers: 1) caliphs' and ministers' life lived a comfort and luxury life, and 2) local people which lived a simple life with high social interaction, where some poor people shared the same house, also various social layers of Baghdad were meeting in markets, mosques, riverbanks, parks, orchards and streets. Community of Baghdad was diverse in ethnic and religious, but it was open and amicable therefore, e.g. many of Muslim men married a Christian woman. Also people in Baghdad shared the important social events e.g. Friday prayer, *Eid*, Ramadan, promenade after *Eid*, weddings and festivals and etc. (al-Rajhy, 2006).

Ottoman era and British invasion in Iraq create a vast gap between the authority and local people as a result of Iraqi society that characterized in Bedouin values (neurological, revenge, hospitality, chivalry and etc.) which led to various crisis in Iraq (Wardi, 1971). The period of founding the first Iraqi state in 1920 had a great influence on Iraqi society, where political awareness appeared, attention to follow the news and newspapers, emergence the movement of constitutional claim, referendum its appeared for the first time in Iraq, emergence of national movement (Patriots) and political awareness in Iraqi society has grown

under the framework of religious consciousness and has been linked with it close (Wardi, 1974) and. While Iraqi individual grew up on the disputes and conflicts as a result of wars and conflicts experienced by, Ottoman British wars, communal conflict, religious conflict and a tribal dispute, nevertheless, the revolution has changed a lot in the culture of Iraqi society, it became more coexistence community after the revolution (Wardi, 1980).

Ethnic relations in Iraq have been strained since the last war 2003, ethnic relations have been particularly uncooperative and violent. The crisis aggravation between different ethnic in Iraq led to the decay the interaction between them. The war of 2003 in Iraq has led to the loss of lives and social capital, and has destroyed the Iraqi infrastructure. This substantially lowers the quality of life, leads to the inability to provide essential services and renders state-building activities even more difficult (Rydgren and Sofi, 2011). The human tragedy in Iraq represented in four parts first; daily human losses, second; loss of social capital in Iraq, third; destruction of the Iraqi infrastructure, which has a direct bearing on the daily needs of the Iraqi people, fourth; conflict and strife between the various groups in Iraq, sectarian tensions and Iraq's territorial unity. So it is very necessary to understand and recognize the reality of Iraq's political and humanitarian in order to understand the social, economic and the urban life in Iraq and Baghdad (Ihsanoglu, 2007).

3. Open Spaces and Recreational Forms in Baghdad City

Since the founding of Baghdad, it has been given a special interest for recreational facilities, open spaces, green spaces and parks. Baghdad name has been accompanied with the names of paradise, garden and orchard. Tributary of Tigris and Euphrates rivers were flow in all Baghdad, to promote its beauty and splendor, the vast orchards also extended along the banks of the tributaries, then spread in all city (al-Rajhy, 2006). Every foreigner who came to Baghdad impressed by its beauty, charm and morals of its people (al-hassani, 1958). In Abbasid era there were a lot of recreational means in Baghdad that were shared by both public and special people, Muslims, Christian and Jewish. There was two types of recreation; 1) physical activities that take place in the open space (gardens and green fields) e.g. aviculture, hunting in wild, horsemanship in open field, golf, ships race and etc., 2) intellectual activities e.g. chess and drafts. Baghdad citizens gave a special interest for the design of gardens and parks, that due to their historical experience in Babylon hanging gardens, where usually people went to parks and orchards on Monday (al-Rajhy, 2006; al-hassani, 1958). There were also many types of open space e.g. parks, orchards, rivers blanks, zoo and mosques courtyard. So recreation means were familiar in Baghdad, and promenade was essential activity in Baghdad, because it has been characterized natural beauty, green orchids and a lot of river tributaries (al-Rajhy, 2006).

First zoo in the world history has been established in 797 in Baghdad, during the

Harun al-Rashid rule (one of the Abbasid caliphs), which contained various types of birds, rabbits, fishes, monkeys, lions, etc. Some open spaces were also used to play golf or horsemanship (Mohammed, 2012). As well as Abbasid Caliph *αλ-Μυταωακκιλ* built zoological park to the south of Baghdad city to house more than two thousand kinds of different animals, both wild and domesticated ones. In terms of its plan, it functions as an utterly opulent display of richness as well as a piece of engineering genius. The whole area covered by the park is about 53 square kilometers. A man-made river called *Ναψζακ* was brought to flow from the northern part of the Tigris through the park and finally through the pool to end again in the river. The whole park was densely planted with trees and bushes imported from every corner of the empire and the wild animals, also some dolphins were to be seen there (al-Samarrai, 2002).

In 20th century each component of Baghdad elements were has a special effect on social interaction there including; 1) historical streets and paths were narrow and zigzag, shading by *Σηνασηιλ*, that made houses close and open to each other's (Hayes, 1983). 2) Special schools (*Κυταβ*) emerged in 20th century in Baghdad, where people had sent them children to *κυταβ* to learn principles of reading and writing, Quran, mathematic and physical sports. 3) Public baths; the lack of bathrooms in most of Baghdad houses had to use public baths, that located in each neighborhood in the markets, and there was a private women's baths, so people were find public bath as a mean to meet, interact and enjoy, where many baths were contain a cafe and open space. 4) Historical cafes in Baghdad in 20th century were regard as a social clubs that complement the daily life cycle of the markets and the old neighborhoods, although it was not reflect a special architectural form but it had ample space to accommodate numbers of people to rest, drink some tea or coffee cups and chatting in term of recreation and social interaction (Marouf, 1972). So cafes regards as one of the most important public buildings in Baghdad. Baghdad is one of the oldest Arabic cities in the establishment of cafes, where people meet, rest, paying, chatting and drink Iraqi tea. 5) Traditional markets were one of the most important components of old Baghdad neighborhood, while markets were not only includes basic goods for daily life, but also it was containing neighborhood cafe and bath, and it was regard as a place where people meet every day (Marouf, 1972; Geoffrey, 2005).

A lot of parks, gardens and squares has been constructed in 20th century in Baghdad, Also the establishment of Parks Directorate, which is an institution interested in public spaces and park establishment, in order to improve the atmosphere and for people recreation and relaxation e.g. Najebia Public Park, King Ghazi (Umma) Park and etc. Also there were a lot of entertainment means in Baghdad for social integration e.g. clowns and executors of magical games, promenade near Tigris, Eid habits (installing a simple games for children in neighborhoods open spaces in the Eid), cinema (outdoor cinema), television and museum (al-Tamimi, 2013). 20th revolution in Iraq lead to significant changes in the structural of Iraq and its population and the number of Baghdad residents. After 20th revolution public parks, open

spaces and squares have been developed and increased. also growing the interest in theaters and cinemas and opening the first TV station in Karkh district in 1956 and Baghdadi Museum in 1970 (al-Tamimi, 2013).

War of 2003 in Iraq has also led to many losses, destruction of Iraqi Infrastructure and important buildings. Many local open spaces have become dumping sites for garbage or in winter months collection areas for sewerage and stagnant water (JAU, IOM and UN, 2011). Recreation places such as city parks and the stadium, and activities such as walking along or boating on the Tigris have been either closed or off limits since 2003. Lack of safe public spaces means that families have little respite from the pressures of daily life (Rydgren and Sofi, 2011). This substantially lowered the quality of life and destroyed social interaction (Ihsanoglu, 2007).



Fig. 1: Umma Park after and before the War of 2003

Source: algardenia.com

Existing parks in Baghdad do not perform their role effectively, this in turn reflected on residents' interaction which limited to indoor spaces only. Where the responsible authorities (Municipality of Baghdad and Baghdad Provincial Council) do not make enough efforts for open spaces' and parks' maintenance, construction and administration (Rikabi and Ali, 2013). Existing parks in Baghdad also insufficient in number and space, and the facilities especially children's facilities within this parks are not effective (worn and not protected), this in turn reflected on the interaction of the community (Rikabi and Ali, 2013). Governmental efforts toward this issue are slight as a result of political and economic issue experienced by the country since the war of 2003, also charities and the general financial allocations only belong to humanitarian crisis and living conditions (Rikabi and Ali, 2013).

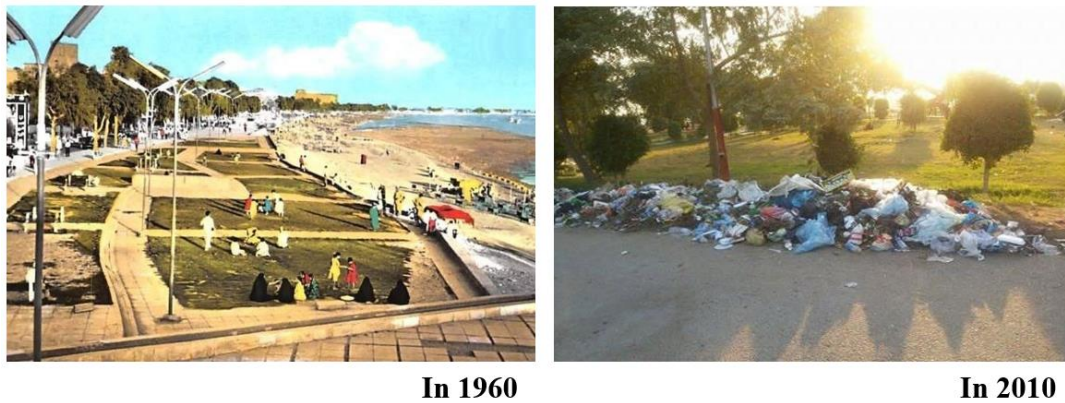


Fig. 2: *Abu Nuwas* Park, Baghdad, before and after the War of 2003

4. Open Spaces and Social Interaction in General

Most of the previous studies confirmed that physical space is an essential to achieve social interaction. Where public spaces allow people to meet on ostensibly neutral ground in planned and unplanned ways, to interact with others within the context of the whole community, so public spaces can contribute to the cohesion of communities (Holland et al., 2007). Social relationships vary according to the age, gender and place, where, place and place elements are the key factor to determine the nature of social activity for all ages (Holland et al., 2007). Park is an important space in the relationship of man and nature to promote and provide space for physical activity, health behavior, while to achieve successful park must provide some factors such as; degree of comfort and image (design) while open spaces design have great role to lead individuals to outside spaces, socializing and being together, also space design tools can be used to provide social interaction to cure from complex social diseases (Nezlek et al., 2002). Community (players) in recreational zone (recreational parks) can create a wide range of physical games and being shared and participated as a type of social interaction. This in turn invite people especially children to replace the television, computers and video games with physical games that participate with other people in open space to stimulate social interaction (Bekker et al., 2010). Distance, linkage and good of access where outdoor recreation preferably over shorter distances to closer areas, rather than long distances and trips to more pristine and undisturbed environments (Buta et al., 2014).

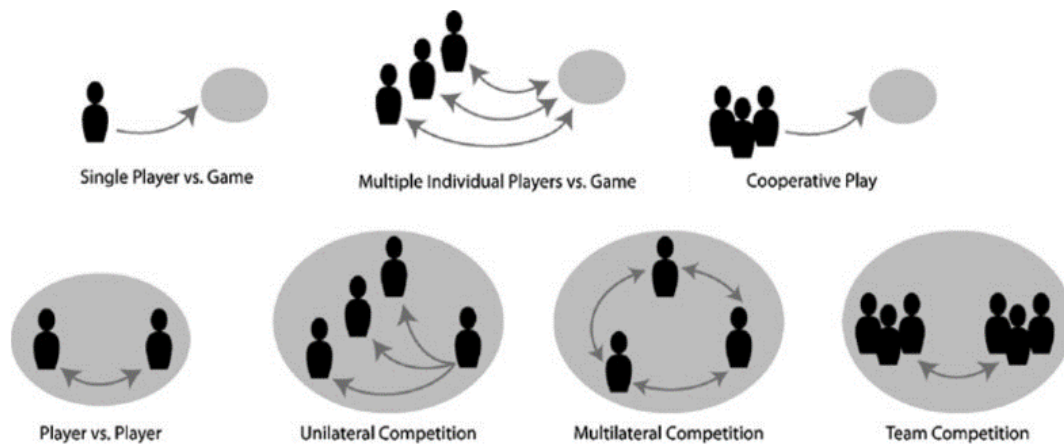


Fig. 4: Patterns of Players Interaction

Source: (Buta et al., 2014)

User and activities where (looking, listening and talking) are the activities which determine the quality of open space, good open space with good facilities plays an important role in the reinforce social contacts and meet their psychological needs of residents. Open space facilities include: walking trails, horse trails, gardens, children's play areas, sitting areas, and green space (Poodeh and Vali, 2014). Maintenance and management of the natural and the built environment, design and image, good access, and socialization are an important factor in the successful park as well (Sakip et al., 2014). The user's characteristics affect how people interact with each other in outdoor spaces. Characteristics such as; age, marital status, educational attainment and annual income are relevant socio-demographic characteristics presumably associated with social interaction (Haggerty, 1982).



Fig. 5: Factors affecting Open Spaces

Source: (Kent, 2009)

Most people in Baghdad prefer to visit *Zawraa* Park, as a result of being the only park in Baghdad which still has some attention and care as well as it is providing a variety of facilities e.g. green open space, entertainment, water bodies, zoo, food courts and etc. Parks in Baghdad have a great social-recreational effect, while parks have an important role to achieve social, psychological, cultural, aesthetic, political and economic benefits for community. One of factors that led to the decline the role of parks in Iraqi society are administrative negligence and poor organization, along with poor planning and design (CAUB, 2005). While being outside in natural surroundings may improve health and how outdoor physical activities benefit participants. Particular attention is given to children's health problems that can be mitigated through outdoor play, sports, and nature study. There is a link between physical activity that takes place outdoors and positive health outcomes and also an association between an indoor, sedentary lifestyle and negative health consequences. There is also evidence that both being outdoors and viewing natural scenes can reduce stress (Godbey, 2009). Outdoor recreational activity is helping to mitigate health consequences associated with sedentary behavior. Enhanced understanding of socio-demographic differences in physical activity (PA) location preferences could therefore contribute to health promotion (Larson et al., 2014).

5. Paper Methodology

The main objective of the paper is to identify the factors that affecting social

interaction in Baghdad through proving that lack of green open spaces led to the lack in social interaction in Baghdad nowadays. So it has been highlighted the relationship between social interaction and open spaces since the establishment of Baghdad till today, as well as highlighted the factors that affecting social interaction in open space in general. This paper employs (Mayring, 2002) recommendations to design the method of the paper while data obtained from more than 35 source varied among articles, researches and books both in Arabic and English languages regarding the importance of open spaces and green area for the community of Baghdad and social interaction. Summarizing content analysis is a tool of research methodology used to determine the presence and meaning of concepts, terms, or words in one or more form or structure of the information. This systematic and replicable technique allows for compressing many words of text into fewer content categories on explicit rules of coding in order to allow researchers to make inferences about the author (Mayring, 2002).

6. Discussion and Findings

Findings from the content analysis regarding to the previous studies about social interaction in green open spaces in Baghdad, emphasize that sound social interaction need an appropriate physical space that meets the needs of community so the key element to achieve sound social interaction is a safe open space that provides various amenities and recreation activities to promote social interaction (Nezlek et al., 2002; Holland et al., 2007). While public spaces allow people to meet on ostensibly neutral ground in planned and unplanned ways, to interact with others within the context of the whole community, so public spaces can contribute to the cohesion of communities. So the conclusion is that, lack of safe green outdoor spaces in Baghdad city recently, may has a direct impact on social problems that occur every day in Baghdad city. This result is similar to (CAUB, 2005; Rikabi and Ali, 2013) results, which confirmed that existing parks in Baghdad do not perform their role effectively, that led to decline the role of parks in Iraq in social interaction. While, the former Baghdad had characterized by a very cohesive social setting coincides with wide spread of green open spaces e.g. parks, orchards, rivers banks, zoo, markets, cafes and mosques courtyard, with different outdoor recreational forms, while it's lose most of the sound social constituents nowadays (al-hassani, 1958; al-Rajhy, 2006).

Findings of this study also confirms that the factors of open spaces to achieve social interaction are:

1. Design, scenery and image (Nezlek et al., 2002; Sakip et al., 2014).
2. Activities, play objects and facilities (CAUB, 2005; Rikabi and Ali, 2013; Bekker et al., 2010; Poodeh and Vali, 2014).
3. Distance, linkage and access (Buta et al., 2014; Sakip et al., 2014).

4. Users' characteristics and interest (Haggerty, 1982)
5. Administration and maintenance (CAUB, 2005; Rikabi and Ali, 2013; Sakip et al., 2014)
6. Safety and security (JAU, IOM and UN, 2011; Rydgren and Sofi, 2011).

So, governmental efforts toward this issue is very slight as a result of political and economic crisis experienced by the country since the war of 2003, also recommendations of charities and the general financial allocations only belong to humanitarian crisis and living conditions (Rikabi and Ali, 2013). Therefore, Municipality of Baghdad and Baghdad Provincial Council should make more efforts for open spaces and parks maintenance, construction and administration. Providing a sufficient number and space of parks with an appropriate criterion in Baghdad will increase the social interaction, (where the existing parks nowadays do not perform their role functionally and effectively). As well as provide a variety of facilities and elements within the parks could improve the function of this spaces and this in turn increases community interaction. Therefore the results of this paper emphasize that that achieving appropriate green open spaces in Baghdad city is an essential to enhance physical, health, mental, social, environmental, and aesthetic aspects for residents and city, thereby encourages social interactions in the city between citizens.

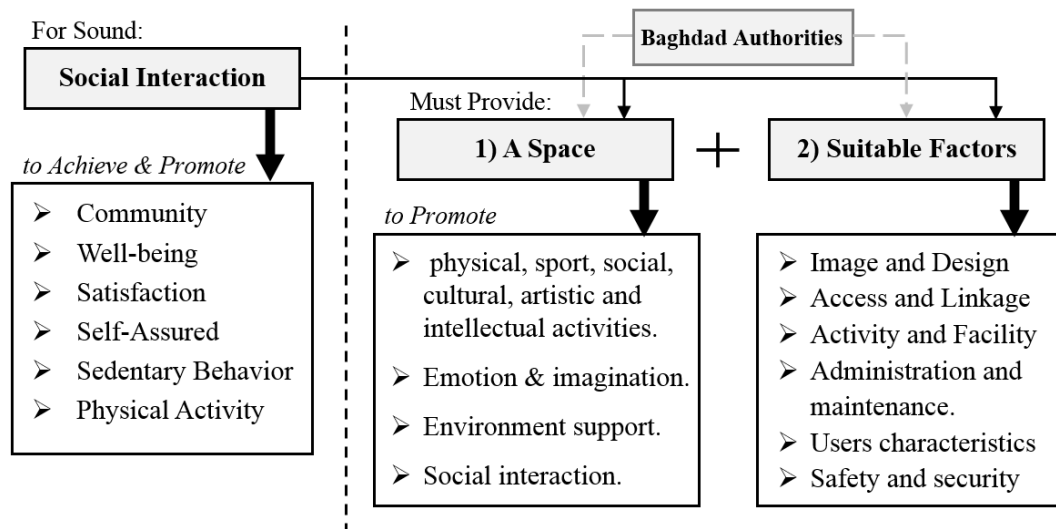


Fig. 7: Means to Enhance Social Interaction in Open Spaces of Baghdad

7. Conclusion

Paper results indicate that one of the means to achieve social interaction in Baghdad nowadays is to provide an appropriate space. Criteria and components of green open space are also an important mean to achieve sound social interaction including, design, activities,

elements, access, users' characteristics, security, administration and maintenance. It has been mentioned the benefits and importance of social interaction in green open spaces as well, including; improve health and wellbeing, sedentary behavior and reduce stress. Therefore the results of this study prove that achieving green open space is an essential to enhance physical, health, mental, social, environmental, and aesthetic aspects for residents and residential area, thereby encourages social interactions in the city between citizens through implementing an appropriate criteria and components in that space. The results of this paper are useful reference for urban and landscape planners, architects, social psychologist, and researchers in this fields, so the significance of this paper lies in linking social-psychology to architectural research.

REFERENCES

- Al-hassani. (1958). *Ancient and Modern Iraq*. 3rd ed. Sidon: Lebanon.
- Al-Rajhy, C. (2006). *Social life in Baghdad from the beginning of the sixteenth century until the fall of Baghdad in 1258 AD*. Makkah: Umm Al-Qura University.
- Al-Samarrai, Q. (2002). The Abbasid Gardens in Baghdad and Samarra 7-12th Century. *Foundation of science technology and civilization*, 6, pp. 2-8.
- Al-Tamimi, A. (2013). *I was secretary of Baghdad*. Beirut: Private publishing house.
- Blair, S. (2011). *Islamic Architecture – Abbasid Period*. *Islamic art and architecture*. [Online] Islamic Art and Architecture. Available at: <http://islamic-arts.org/2011/architecture-of-the-abbasids-iraq-iran-and-egypt/>.
- Bekker, T., Sturm, J., & Eggen, B. (2010). Designing playful interactions for social interaction and physical play. *Journal of Personal and Ubiquitous Computing*, 14, pp. 385-396.
- Buta, N., Holland S., & Kaplanidou. (2014). Local communities and protected areas: The mediating role of place attachment for pro-environmental civic engagement. *Tourism Recreation Research*, 5(6), pp. (1-10).
- CAUB. (2005). *The history of parks and gardens, Baghdad, Iraq*. Baghdad: Baghdad University.
- Fathel, A. (2015). *Development the area of Baghdad city in the Abbasid era*. [Online] Alsabaah journal. Available at <http://www.alsabaah.iq/ArticleShow.aspx?ID=87453>.

- Geoffrey, R. (2005). *The fate of manuscripts in Iraq and elsewhere*. Al- Furqan Islamic Heritage. London: Foundation Wimbledon.
- Godbey, G. (2009). *Outdoor recreation, health, and wellness: Understanding and enhancing the relationship*. Washington: Resources for the Future.
- Haggerty, L. (1982). Differential social contact in urban neighborhoods: environmental vs. socio-demographic explanations. *The sociological quarterly*, 23(3), pp. 359-372.
- Hayes, J. B. (1983). *The genius of Arab civilization: Source of Renaissance*. 2nd ed. Cambridge: MIT Press.
- Holland, C., Clark, A., Katz and Peace, S. (2007). *Social interactions in urban public places*. Bristol: Joseph Rowntree Foundation.
- Ihsanoglu, E. (2007). Assessing the human tragedy in Iraq. *International review of the Red Cross*, 89(868), pp. 915-927.
- JAU, IOM and UN. (2011). *Urban Baghdad: Impact of conflict on daily life*. Amman: International Organization for Migration, pp. 2-9. Available at: <http://reliefweb.int/report/iraq/urban-baghdad-impact-conflict-daily-life>.
- Kent, F. (2009). *What makes a successful place?*. [Online] Project for Public Spaces. Available at: <https://www.pps.org/reference/grplacefeat/> [Accessed 06 Oct. 2016].
- Larson, L. Whiting, J., Green, G. and J. Bowker. (2014). Physical activity locations in Georgia: Frequency of use by socio-demographic group. *Journal of Outdoor Recreation and Tourism*, 5(6), pp. 68-72.
- Marouf, N. (1972). Chapters from the civilization of Baghdad. *Al-Mawrad magazine*, (15), pp. 35-49.
- Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures and software solution*. Klagenfurt: misc.
- Mayring, P. (2002). Qualitative content analysis - Research instrument or mode of interpretation? In M. Kieglmann (Ed.), *The role of the researcher in qualitative psychology* (pp. 139-148). Tübingen: Ingeborg Huber.
- Mohammed, K. (2012). Urban space transformation in old city of Baghdad –Integration and management. *Megaron journal*, 1(13), pp. 79-90.
- Nezlek, J., Richardson, D., Green, L., & Jones, E., (2002). Psychological well-being and day-to-day social interaction among older adults. *Journal of Personal Relationships*, 2, pp. 1350-4126.
- NRPA. (2011). Creating mini-parks for increased physical activity. *National Recreation and Park Association*, 677, pp.626-800.

Poodeh, S., & Vali, A. (2014). Investigating the characteristics of open spaces to enhance social interactions in neighborhood environments. *Journal of Natural and Social Sciences*, 3(4), pp. 148-158.

Rikabi, N., & Ali, E. (2013). Study of green spaces and its impact on the environment of residential district: Case study: Kathemih, Baghdad. *Journal of the planned development*, 28(13), pp. 25-46.

Rydgren, J., & Sofi, D. (2011). Interethnic relations in Northern Iraq: Brokerage, social capital and the potential for reconciliation. *International sociology*, 26, pp. 25-49.

Sakip, S., Akhir, N., & Omar, S. (2014). Determinant factors of successful public parks in Malaysia. *Procedia-Social and Behavioral Sciences*, 170, pp. 422-432.

Shorbagy A. (2010). The architecture of the traditional Arab house. *International Journal of Civil & Environmental Engineering*, 10(4), pp. 15-20.

Subhi, A. (2010). *The Abbasids' house of wisdom in Baghdad*. [Online] Foundation of science technology and civilization. Available at <http://www.muslimheritage.com/article/abbasids-house-wisdom-baghdad>.

Tan, T. (2008). Entertainment is emotion: The functional architecture of the entertainment experience. *Media Psychology journal*, 11(1), pp. 28–51.

Uslu, A., & Gökçe. (2010). Social interaction in urban transformation areas and the characteristics of urban outdoor spaces. *African Journal of Agricultural Research*, 5(20), pp. 2801-2810.

Wardi, A. (1971). *Social aspects of Iraqi modern history*. 2nd ed. Alexandria, Bibliotheca Alexandrina.

Wardi, A. (1972). *Social aspects of Iraqi modern history*. 3rd ed. Baghdad: National Library of Baghdad.

Wardi, A. (1974). *Social aspects of Iraqi modern history*. 4th ed. Baghdad: National Library of Baghdad.

Wardi, A. (1980). *Social aspects of Iraqi modern history*. 6th ed. Baghdad: National Library of Baghdad.

Zaimeche, S., Ball, L., & Jahangir, R. (2005). *Baghdad*. Manchester: FSTC Limited.

AN INFORMATION PRESENTATION SYSTEM FOR WOBBLING ELDERLY PEOPLE AND THOSE AROUND THEM IN WALKING SPACES

KOSHI OGAWA^{*a}, TAKASHI SAKAMOTO^b and TOSHIKAZU KATO^c

^a Graduate School of Chuo University, Japan, a13.4ska@g.chuo-u.ac.jp

^b National Institute of Advanced Industrial Science and Technology, Japan, takashi-sakamoto@aist.go.jp

^c Chuo University, Japan, kato@indsys.chuo-u.ac.jp

ABSTRACT

Before the Tokyo Olympic Games and the Paralympic Games, support for people who have weak locomotors became an urgent issue. It is seen that people who have weak locomotors that encompasses the disabled, pregnant women as well as elderlies find themselves facing difficulty in walking using the pedestrian walking space. Since the walking space is used by both categories of people; the healthy locomotors and the weak locomotors; it is seen that the second category of people experience stress using the same space. Therefore, in order to reduce the stress that is related to walking; smartphones offer as an effective device to present information to both healthy and weak pedestrians. There is a high possibility that most pedestrians own smartphones. It is also considered to be an easier option to present information to both healthy and weak walkers. Based on the above discussion, it is believed that an information presentation system using a smartphone would be the most appropriate solution for reducing the stress of both categories of people in walking spaces. In this paper, a system to achieve this aim is proposed.

Keywords: *universal design, pedestrian guide, locomotor, elderly people.*

* KOSHI OGAWA.

1. INTRODUCTION

Before the Tokyo Olympic Games and the Paralympic Games, support for weak locomotors has become an urgent issue. It is seen that people who have weak locomotors that encompasses the disabled, pregnant women as well as elderlies find themselves facing difficulty in walking using the pedestrian walking space. There are several scenarios in which such people have indicated that they struggle with their daily lives due to the lack of consideration by healthy individuals. This problem is believed to be due to the fact that the environment of the walking spaces makes weak people feel extremely stressed every time they use the space. Healthy people are also expected to pay close attention daily to avoid potential risks that could occur whenever they walk in the same space with weak people. In other words, it is believed that both healthy people and walkers with weak or different physical abilities experience stress when moving in the same walking spaces. As the Tokyo Olympic Games and the Paralympic Games draw closer, it seems that this issue is being treated as a more serious problem.

Regarding the support for people with weak locomotors, although there are several researches conducted, it seems that these problems are not dealt with in its essence. For example, with regards to the research theme of the Tokyo Olympic Games, there are several related studies on technology development for a barrier-free or universal design for pedestrians other than healthy people and foreigners visiting Japan and for pedestrian guidance or human flow guidance to combat congestion [literatures 1 and 2]. In these studies, the flow of people that is provided with an evacuation guidance, or conduct leads [literatures 〇 ~ □] were stimulated. The common aim of these technical studies is to capture people as one equal molecule. In reality, however, people have individual differences. Hence, it is not always effective to apply the same approach to everyone. It is necessary to consider the differences of personality and the individual features of each person, such as their attributes as well as their physiological state.

Smartphones are seen as an effective device to present information to both healthy and weak pedestrians, while taking into consideration their individual characteristics, attributes and physiological state in order to reduce the stress related to walking. There is a high possibility that most pedestrians own smartphones. It is also considered to be an easier option to present information to both healthy and weak walkers. It is hoped that the study is able to develop an application that is able to provide necessary information with the aim of mitigating stress and creating a state in which both healthy and weak walkers are able to travel in the same walking space by installing and using the application on their smartphones. In the case of smartphones, it is necessary to register individual features like presence or absence of failure, fast or slow walking, ease or difficulty in walking as well as attributes like user's age and sex. It is possible to assess the physiological state of users by measuring their heart rate and blood pressure by linking the application with a wearable health tracking device.

Based on the above discussion, it is believed that an information presentation system using a smartphone would be the most appropriate solution for reducing the stress of both healthy and

weak walkers in walking spaces. In this paper, a system to achieve this aim is proposed. The concept is outlined in order to gauge and present the information to reduce the stress of vulnerable walkers as well as that of the healthy pedestrians around them. The information is presented using smartphones. Then, an outline of the system is described in detail. Section 2 describes several related researches to the subject matter. Section 3 reports the results of the questionnaire conducted on elderly people. Based on these results, types of information that should be presented to the elderly and healthy people in the vicinity are described and discussions relating to implications of the solution is detailed in Section 4. Additionally, the configuration and functions of the proposed system are described in Section 5.

2. RELATED RESEARCH

In this chapter, related studies that have conducted evacuation guidance or conduct leads are referred in relevance.

As an existing study by Asano et al. [4] who proposed and verified a model focusing on the look ahead behaviour of human movement which is considered as necessary solution for capacity expression, and was reproduced as it is better than the existing model. A study by Yamashita et al. [5] that proposed a one - dimensional pedestrian model to calculate the interference between pedestrians and calculation of obstacle avoidance as well as the calculation of the evacuation process at high speed without degrading the reproducibility of movement. In addition to that, a high-speed evacuation simulator NetMAS was developed using a one-dimensional pedestrian model and compared the results of actual evacuation drills to verify the effectiveness of the one-dimensional pedestrian model. An evacuation in a large-scale complex commercial facilities were held to test and simulate NetMAS in order to verify the factors that affect the evacuation's efficiency. The simulation is performed by assuming various evacuation conditions, and the effectiveness of NetMAS is confirmed by applying a statistical method to the data. As a result, by considering the factor of shortening the evacuation completion time from Kitakyushu Arts Theatre as a target of simulation where the multiple regression analysis is applied to numerous trial results obtained by making use of high speed calculation, it is possible to quantitatively grasp the influence of evacuation conditions.

In the previous analysis, people is seen as an equal molecule. However, this study does not regard people as an equal molecule but only acts to present information to both healthy and weak people. There are three ways of presenting information using smartphones. It is as follows.

- How to display a message on the screen
- Audio guidance
- Using vibration function

Among the three above, the method that human beings could react fastest is the use of the vibration function. Therefore, in this paper, the vibration function is used as an information presentation method.

In an existing research conducted by [6], it is found that the vibration function is used in presenting information. In this research, a method to reduce the burden on users by notifying the user the minimum navigation information from the mobile terminal side at an appropriate timing is proposed. In addition to that, navigation information is transmitted using vibration and at the same time, its usefulness is verified.

The previous research does not classify users' navigation systems. It is found that from the specifications of the system, it is possible to give an instruction to turn left or right, but it is impossible to navigate the user to a designation.

A previous study conducted by Asano et al. [7] depicted that a system that realises pedestrian navigation by giving intuitive direction clues by a tractive force sensation that the direction changes according to the position or posture of the hand which entails that the system traces the hand of the user. The system is developed by Asano et al. The walking navigation tool developed by Asano et al. was able to create a force that the asymmetric oscillating mechanism internally rotates, pulling in a 360 degrees of the horizontal plane.

Therefore, in this paper, a method of using the idea of the towing device of [7] is proposed hand in hand with the presentation system in order to assist and reduce the stress felt by the weak walkers as well as all others in the walking space.

3. RESULTS AND DISCUSSION OF THE QUESTIONNAIRE

A questionnaire that uses elderly people as subjects or respondents is conducted. The respondents were 30 people whose are aged between 75 to 85 years old.

As a result of the questionnaire, the following answers were obtained:

- If I am surrounded by a group whose walking pace is faster than mine, I move to the edge and try to walk at my own pace.
- In spaces where a lot of pedestrians are walking in different directions and at different speeds, while looking for a space with fewer people, I walk behind the person who walks at the same pace as myself.
- I plan to walk straight on my own but in reality I will walk to the left and right.

This questionnaire also provided answers regarding the situations in which elderlies often felt stressed:

- When people are walking fast and coming from the opposite direction, or when people pass by on a bicycle

- When I am overtaken by a bicycle

There were numerous elderly people who responded with the following as reasons for feeling such stress:

- The field of vision has narrowed

- Hearing ability has decreased

- Lack of physical strength and quick reflexes

In order to summarize these answers, it turns out that a lot of elderly people are physically challenged to realise the movement of pedestrians or bicycles approaching from the opposite direction. Moreover, it was found that there are a lot of elderly people who find it difficult to recognise the danger that they themselves pose to others.

Based on the results of this questionnaire, potential dangers that could pose problems to elderlies is addressed in advance and the information or an alert for other pedestrians around or in the vicinity to acknowledge elderlies should be proposed. This is to reduce potential dangers faced by elderlies. It is presumed that there is a possibility of avoiding stress. Based on this consideration, it is believed that an information presentation system that encourages elderlies to identify the potential dangers and stressors which draws the attention of the pedestrians in the vicinity is an essential part of solving this problem. Hence, it is decided that the information presentation system should be proposed.

4. OUTLINE OF THE PROPOSED SYSTEM

In this section, an outline is provided for the information presentation system that is proposed to assist elderlies and the healthy people around them.

It is assumed that all elderlies and healthy people in the vicinity carry a smartphone while walking as well as having a certain application that is installed in the smartphone and wear a wearable Bluetooth device that is connected to the smartphone. Although currently, wearable devices have not become popular worldwide, it is projected that the above assumption is valid as wearable devices will become ubiquitous in the near future.

An application installed on the smartphone detects a state in which an elderly person is unintentionally wobbling and estimates the potential danger of that person. When this happens, the smartphone application alerts the elderly person and the surrounding pedestrians about his/her unintentional wobbling state through vibrations from the wearable device. For the elderly person, the vibrations mean, "Please take care to walk straight" and for other pedestrians in the

vicinity, they mean "There are elderly people who are easy to knock down, do not go through the vicinity at high speed. Please be careful." This content is set up in advance in the application. The vibration function is used only to notify users about elderlies wobbling to the left and right.

5. EXAMPLE OF OPERATION OF THE PROPOSED SYSTEM (SCHEDULED TO INCLUDE PUNCH PAINTING, HAND WRITTEN)

A proper example of presenting information to elderlies who are wobbling sideways, as well as to pedestrians in the vicinity is described using a scenario.

It is known that a walking space is a sidewalk by a road where the roadway and the sidewalk are firmly separated. It is in the evening, when different kinds of people such as workers leaving their companies after working hours and headed for the station, while others are heading to kindergartens or nursery schools to pick up their young children, and they are all walking at their own pace. Meanwhile, an elderly person with wobbly feet and weak balance begins to feel crowded while trying to walk at his own pace. However, unintentionally he ends up wandering to the left and right instead of walking straight. Hence, the situation requires other pedestrians to anticipate and react instantly to hinder a potential danger whether of a person walking fast, coming from the opposite direction, or of a passing bicycle speeding by the elderly person at a close distance. The image diagram is as shown in Figure. 1 below.

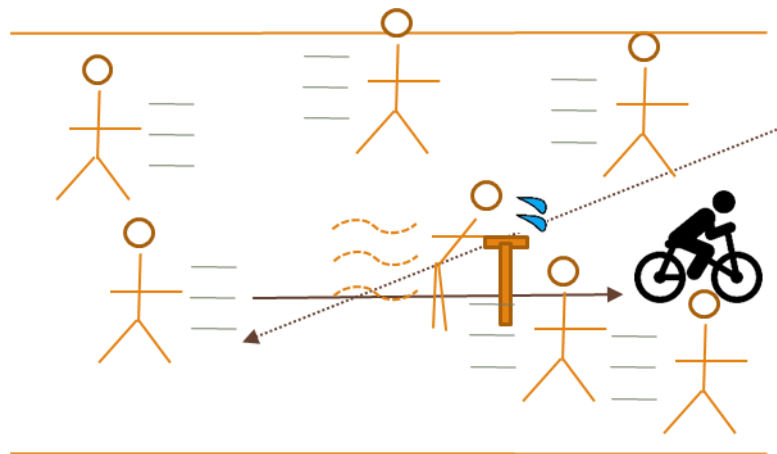


Image diagram of wobbling elderly people in pedestrian space and pedestrians passing around

The approach to the elderly person and the pedestrians around him in the above situation is described as follows:

For elderlies who are unintentionally wandering, a vibration alert from the smartphone that is synchronised with a wearable device displays an alert, "Watch out! Let's be conscious of walking straight ahead because we are staggering!" The image diagram is as shown in Figure. 2 below.

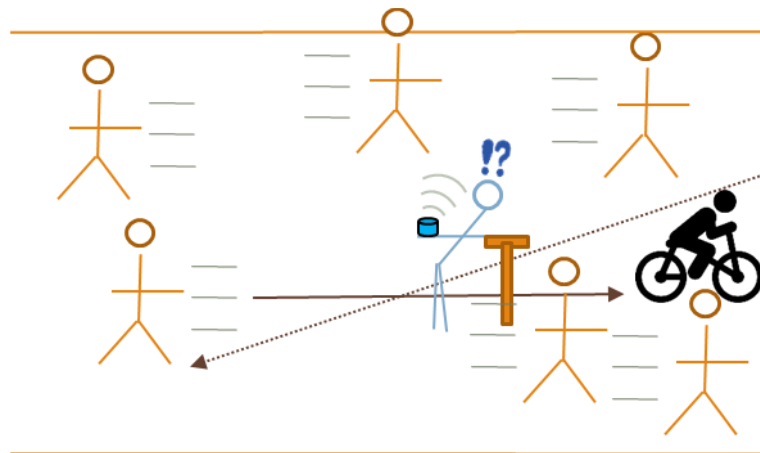
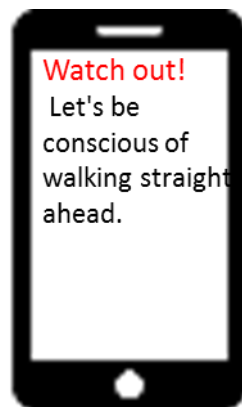


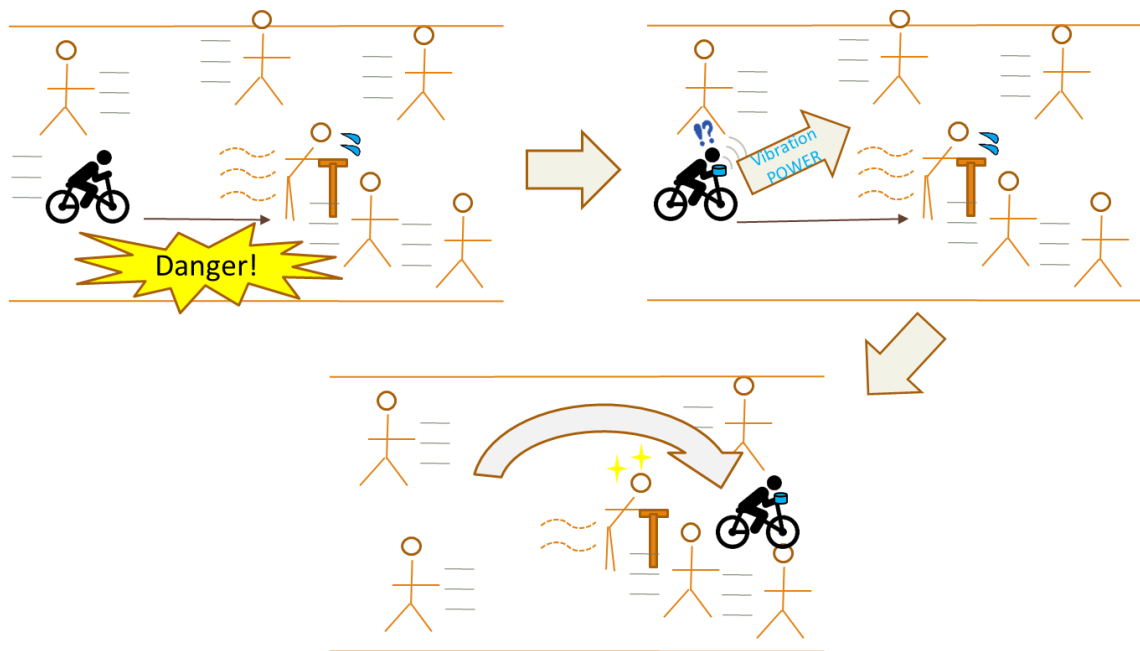
Image diagram showing how the elderly person noticed notification by vibrating wearable device

Figure. 2 explains that the blue object at the elderly person's hand of the light blue is a wearable device. Figure. 3 below is an image of the screen of the smartphone when the elderly person receives a notification notifying the crisis from their wearable device.



Smartphone screen image when notified to the message of wearable device

Therefore, with regards to other people moving forward or backward at a certain speed towards the elderly person who is unintentionally wobbling, or for those within a specific fixed distance zone around such elderly people, vibrations increase to a certain extent for these pedestrians to be guided to walk in a particular direction. The image diagram is as shown in Figure. 4 below.



| An image diagram that it is guiding towing in a safe direction by vibrating (when the bicycle seems to hit the elderly person)

From the above, both sides are conscious about walking in a more straightforward manner. This also alerts the elderly person who wobbles unintentionally to walk straight and pedestrians will move out of the close range of the elderly person, thereby reducing stress and eliminating potential hazards.

6. SUMMARY

In this paper, an information presentation system is proposed to reduce the stress faced by elderlies that have trouble wobbling in walking spaces and with other pedestrians around them.

In this paper, it is assumed that all pedestrians possess smartphones, a different context information service application, and a wearable tracking device. A projection mapping around the wobbling elderly is also used. If one can display information that there is a senior citizen nearby, it could also be possible to send a signal to others as well as the senior citizen himself/herself to raise awareness. Further research on such ideas will be conducted.

Moreover, it is possible to estimate stress by having physiological data that was measured by a wearable health tracking device. Therefore, weak walkers especially elderlies who unintentionally sway from side to side are able to automatically detect their state of stress. It is believed that it is possible to approach the wider population of weak locomotors, not just elderly people and this is recommended as a future research subject.

Such advanced research is expected to eventually contribute to the creation of a walking space design that minimizes the stress among pedestrians including the weak and elderly.

REFERENCES

Yoda, I., & Onishi, M. (2010). A long-term comparison and visualization method of human flows in large complex facilities. *Journal of the Institute of Electronics Information and Communication (D)*, J93-D(4), pp. 486-493.

Shimura, K., Ohtsuka, K., Vizzari, G., Nishinari, K., & Bandini, S. (2014). Mobility analysis of the aged pedestrians by experiment and simulation. *Pattern Recognition Letters*, 44, 15 July, pp. 58-63.

Gorrini, A., Bandini, S., & Vizzari, G. (2014). Empirical investigation on pedestrian crowd dynamics and grouping. *Traffic and Granular Flow '13*, pp 83-91.

Asano, M., Kuwahara, M., & Tanaka, N. (2006). Microscopic pedestrian behavior model in congested conditions. *The 5th ITS Symposium*.

Yamashita, T., Soeda, S., Onishi, M., Yoda, I., & Noda, I. (2012). Development and application of high-speed evacuation simulator with one-dimensional pedestrian model. *Journal of Information Processing(JIP)*, 53(7), 1732-1744.

Yamamoto, A., & Yashiro, T. (2003). Proposal of pedestrian navigation system using vibration. *Information Processing Society Research Report Intelligent Transportation System (ITS)*, 56, 55-62.

Amemiya, T., & H. Gomi, H. (2014). Active touch sensing of being pulled illusion for pedestrian route navigation. *The IEICE transactions on information and systems* 97(2), 260-269.

EXPERIENCING USER OPERATION BEYOND THE FIRST METAPHORICAL IMPRESSION CASE STUDIES ON METAPHORICAL PRODUCTS

Shih Hung CHENG ^a, Yung Chuan MA ^b, and Ming Huang LIN ^c

^a *Department of Industrial Design, National United University, Taiwan,
achille.shc@gmail.com*

^b *Department of Industrial Design, National Yunlin University of Science and Technology,
Taiwan, mayc@yuntech.edu.tw*

^c *Institute of Applied Arts, National Chiao Tung University, Taiwan,
ludwiglin@mail.nctu.edu.tw*

ABSTRACT

In this study we are concerned with user operation in product design and try to explore its metaphorical expressions followed by applying it to design education. First of all, we review three types of user operation to expound their indexical associations with the user's first visual impression. Then, we conducted a design course for master's students. These students were guided to complete creative lamp design concepts. They illustrated how special and interesting ideas can come out of a focus on expressions of user operation. After the initial analysis, we found that it's not easy for students to create reasonable ideas under the common context of user operation. Furthermore, we took Grounded Theory as the research method and then conducted in-depth interviews with sound recordings to investigate professional opinions and suggestions on user experience of operating these design works. We chose six students' lamp designs as the stimuli and recruited three Taiwanese senior design practitioners with at least six years of professional experience. Each design expert was guided to express their ideas regarding applying these design skills to go beyond the first metaphorical expression. The oral comments during the interviews were transcribed into text files and were analysed by the qualitative data analysis software. Finally, we found out five typical factors of metaphorical user operation - detection, safety, ritualization, intuitive, and effect after operation.

Keywords: *user experience, user operation, metaphor, design education*

1. INTRODUCTION

Many designers are often trying to pay considerable attention to user experience design, instead of focusing only on product form and function. When user experience designs become popular, the expressions of product form, function and operation followed by the consequent cognitive and emotional effects should not be ignored (Desmet, & Hekkert, 2007). Originally, the form of product design and its expression resemble those of language (Krippendorff, 2006). Product semantics plays an important role in offering designers new meaningful forms to convey information. In product semantics, product form is the very basic element and offers users an initial sensation or perception. Its expression usually borrows the images from other things (Lakoff & Johnson, 1980), according to reasonable visual clues. These expressions including metaphor, simile, and metonymy all originated from linguistics. They have been applied continuously into industrial design. Nowadays however, it is not enough to only explore the expressions of product form. Operation, another key factor of user experience design, should be discussed more widely. Especially in metaphorical product design, creative or conventional ways to operate product are both somewhat paradoxical under the first impression of new product appearances. In order to clarify these characteristics and the effects of user operation in metaphorical product design, this study tries to represent an analysis of typical factors of metaphorical user operation.

2. WORKSHOP OF METAPHORICAL USER OPERATION

Considering that “form defines expression” is the basic characteristics of interaction design (Hallnäs, 2011), we have tried to illustrate the forms of user operation, and to explore how deep metaphors can be applied to expression of user operation (Cheng, Hsu, & Lin, 2016). By borrowing the figurative concept, we also have proposed three metaphorical forms of user operation, including consecutive, clued, and juxtaposed user operation (Lin & Cheng, 2014). These forms refer to metaphor, simile, and metonymy, respectively. Among them, first of all, the key point of consecutive user operation is the typical operations carried out by following existing conventions. Second, the clued user operation is elicited from a strong visual clue offered by product appearance. Third, the juxtaposed user operation stresses to superimpose the image or component and operate it in a defamiliarized way (Lin & Cheng, 2014). In order to examine how far these metaphorical user operations can go beyond the first metaphorical expression, we conducted a metaphorical lamp design workshop.

We recruited sixteen master's students (6 males and 10 females) to participate in a design course and assigned them to apply the three metaphorical manners mentioned above to develop lamp design. The course included lectures, a warm-up exercise through brainstorming, sketching concepts, and a final presentation. After the process of brainstorming, students

gathered more than 300 concepts. Then, each student was assigned to design two metaphorical lamp. Consequently, there were 32 design concepts finished after the workshop. More design concepts refers to clued user operation, and less concepts are about consecutive user operation. This outcome reveals that it is easier for students to create a totally new shape followed by the consequent operation than to create a meaningful shape under the conventional operation.

3. INTERVIEW

In order to gather knowledge about design expert's comments and opinions on application of metaphorical user operation, we conducted in-depth interviews with sound recordings. The interviews uses student's design works from workshop as stimuli (two works per type of user operation). Three Taiwanese design practitioners (including one freelancer and two design managers) with at least six years (more than twelve years in average) of professional experiences (see Table 1) were recruited to evaluate student's works and to make suggestions on the application of three forms of metaphorical user operation.

Table 1: The identity of interviewees

Interviewees	Expert 1	Expert 2	Expert 3
Gender (Age)	M(35)	M(36)	M(49)
Year of working experience	6	10	22
Position	Freelancer	Design manager	Senior design manager

3.1. Stimuli

Six lamp designs belonging respectively to three types of metaphorical user operation were chosen as the stimuli. The first stimulus of consecutive user operation is Basin-upside-down Lamp (Figure 1). It is based on the association between releasing the plug of a washbasin with a chain and pulling the pull-cord of a suspension lamp. The designer borrowed the image of an upside-down basin to write a special story in which light seems to spill out like water. The second stimulus, Volume Light (Figure 2), represents the great consistency between a volume knob and a lamp dimmer, in the aspect of user operation. Furthermore, the designer completed the story by choosing the icon of sound wave to make the lighting area able to change size.



Figure 1: Stimulus 1, Basin-upside-down Lamp, Ching-Hsun Chen



Figure 2: Stimulus 2, Volume Light, Che-Jung Chang

The third stimulus of clued user operation is Spray Lamp (Figure 3). It consists of a spray-can-shaped body and a transparent lid. It can charge energy by shaking its body and turn on after user takes the lid off and pushes the nozzle. In other words, besides borrowing the appearance of spray can, the designer chose the very operation of spraying paint to accentuate the connection between product appearance and user operation. Another stimulus, Extract! (Figure 4), also deeply mimics the appearance and operation from the same image - syringe. This concept is to extract energy from the electrical outlet. The visual clue can lead us strongly to pull the plunger. Then we will see the illumination in the transparent tube get longer and longer until it is unplugged from the outlet and reveals the image of a candle.



Figure 3: Stimulus 3, Spray Lamp, Sheng-Yu Li

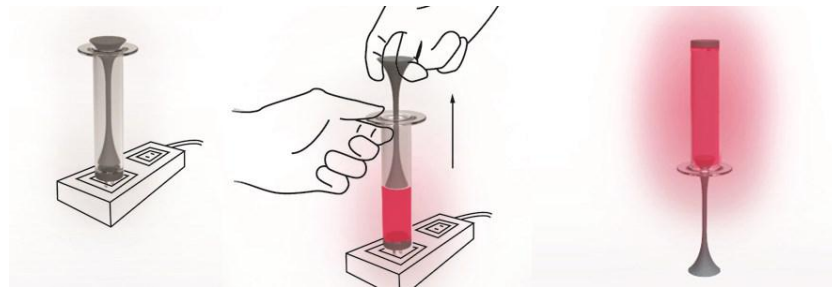


Figure 4: Stimulus 4, Extract! by Yen-Hsiang Huang

The first stimulus of juxtaposed user operation is Doorknob Lamp (Figure 5). It is a wall lamp of which the light bulb is similar to a doorknob. We can switch it on and off only by pulling the cord. Moreover, the designer used a key tied to the cord to superimpose the concept that it should be put into the keyhole. Users may find that they were intentionally guided to detour a simple operation. Another stimulus of juxtaposed operation is Bloom Lamp (Figure 6). It comprises a vase-like main part and a watering-pot-like component. The designer tries to express the special transition from one movement to another for telling a common story, and she deploys a LED screen to display the image of a blooming flower on the underneath side of the “watering pot.” Users may intuitively lift up the “watering pot,” as if to water, followed by feeling confused. Then, users may find out the special expression that the “watering pot” can be connected to the “vase” and show a shiny blooming flower on the underneath side.

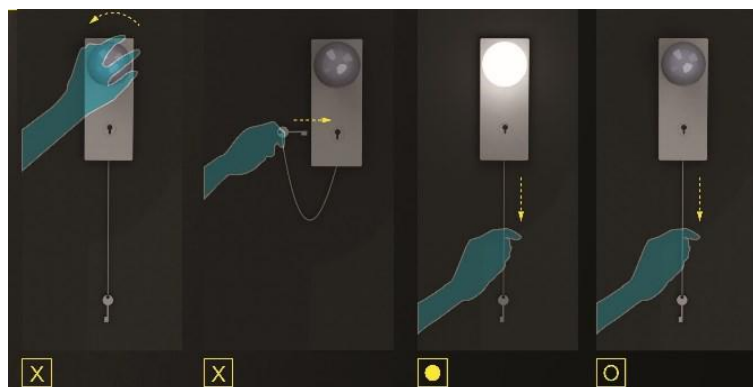


Figure 5: Stimulus 5, Doorknob Lamp, Yen-Ju Lai



Figure 6: Stimulus 6, Bloom Lamp, Chia-Ying Lin

3.2. Procedure

All six stimuli were printed on A4 size papers and revealed totally to each design expert (Figure 7). Interviewer introduced these six concepts to each expert, ordered according to the form of user operation: consecutive, clued, and juxtaposed user operation. Interviewees were asked about their opinions on the six stimuli, any feedback to improve the three forms of metaphorical expressions, and whether these skills can be applied into the design industry. Each expert, on average, spent about 30 minutes on the whole process. The processes were recorded and their oral comments during the interviews were transcribed into text files.

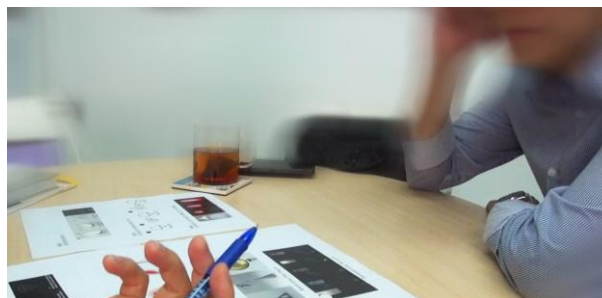


Figure 7: Interview the second design expert.

3.3. Analysis method

All text files were imported into the qualitative research software NVivo. NVivo's flexible option of "Free Nodes" was applied for open coding, followed by arranging them into "Tree Nodes" for axial coding. The opinions and feedbacks of design experts were organized into a hierarchy to reveal the typical factors of applying these metaphorical design skills. Finally, for proceeding with the final selective coding process in grounded theory (Strauss & Corbin, 1990; Glaser & Strauss, 1999), the "Matrix Coding Query" was used to check the degree of overlapping between the "Tree Node" selected as the crucial axis and other "Free Nodes."

4. RESULTS

4.1. General response

After the process of open coding through using "Free Nodes," every code of encoded sentence was grouped with similar codes of sentences and given an appropriate name to represent the concept of the comments. For example, a comment like "The design of this switch adopts a humor code for integrating the behavior of energy saving and the concept of carbon reduction" (Expert 2) was coded as "code for integrating," and one such as "Strictly speaking, the code of this concept is transformed from our existing experience." (Expert 3) was coded as "transformed code." Both comments were then integrated to form a new code category, "Transformation of signifier." After the open codes were revised, 96 coding categories were deduced from 322 references of sentences. Then, similar open codes were integrated and turned into axis codes by using "Tree Nodes." Based on the data calculated and shown in Table2, it is obvious that the numbers of the coding references in the first level of axial coding are different. Among all four axes, the number of references in "design language" is highest, and the number for "design education" is the lowest. Among all second-level axis codes, the numbers of "signifier" (52 reference sentences) and "branding & marketing" (40 reference sentences) are the highest. On the axis code of "interaction & operation," the "effect after operation" (27 reference sentences) is more often mentioned by experts; whereas "pursuing innovation" (20 reference sentences) is the most notable code on "design education" axis

Table 2: The main hierarchy of axial codes and the distribution of 322 references of sentences.

The first level	The second level	Number of reference sentences
Interaction & operation (17 open codes from 66 references)	Detection	7
	Safety of operation	6
	Ritualization	14
	Intuitive operation	12
	Effect after operation	27
Design industry (28 open codes from 83 references)	UX design	8
	Taiwan design industry trends	11
	Consideration of technology	15
	Branding and marketing	40
	Product development	9
Design education (12 open codes from 43 references)	Responsibility of supervisor	7
	Personal attribute of designer	3
	Training of designer	5
	Connection with industry	8
	Pursuing innovation	20
Design language (39 open codes from 130 references)	Attribute of design language	27
	Product identification	4
	Signifier	52
	Design expression	22
	Consideration of experience	25

4.2. Examining the context of metaphorical user operation

In this study, metaphorical user operation is the most crucial factor. For this reason, the axial code “interaction & operation” will certainly be the very selective code. For further examining the context of metaphorical user operation, the option of “Matrix Coding Query” in Nvivo was applied to find out other codes having reference sentences which overlapped with the codes under the axial code of “interaction & operation.” Consequently, concepts related to

“interaction & operation” emerged (Table 3). For example, a comparison between “intuitive operation” (under “interaction & operation”) and “life experience” (under “consideration of experience”) indicates that intuitiveness of user operation is based on the user’s life experiences and may be able to strengthen or weaken its effect when encountering different user groups. Comparing “effect after operation” (the second-level selective code) with “the strength of the signifier” (under “signifier”) reveals that user operation and the consequent effect are influenced by the strength of the signifier designers used. Finally, we found out five crucial concepts related to metaphorical user operation: life experience, the strength of the signifier, existing examples, transformation of signifier, and suitable product categories. Furthermore, the context of the selective code “interaction & operation” is illustrated (Figure 8) and shows that “design language” is much closer to this selective code than the other axial codes do.

Table 3: The open codes in connection with “Interaction & Operation.”

The related open codes	The second level of axial codes	Number of overlapped sentences
Life experience	Consideration of experience	8
The strength of the signifier	Signifier	6
Existing examples	Attribute of design language	5
Transformation of signifier	Signifier	4
Suitable product categories	Branding and marketing	4

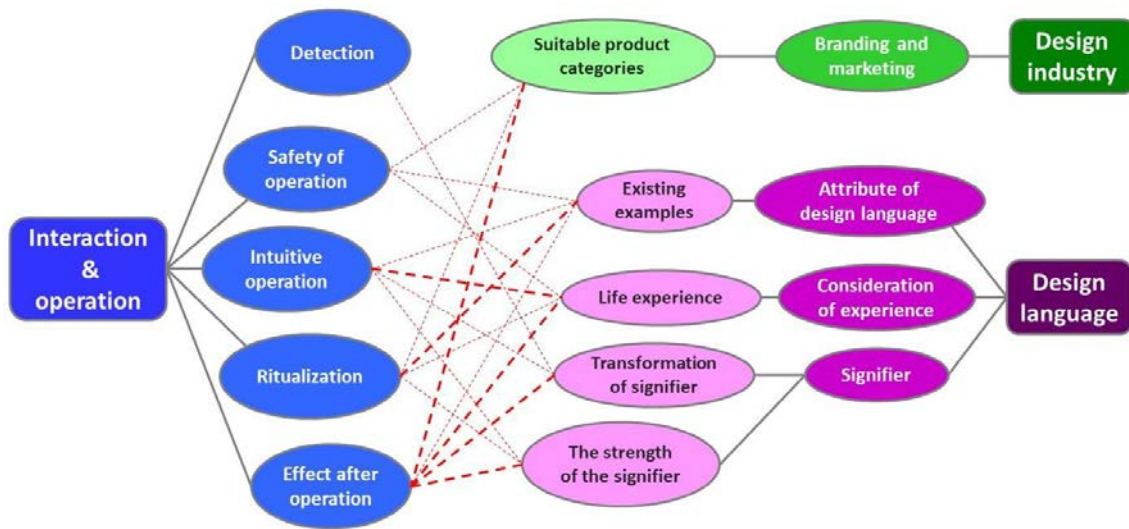


Figure 8: The hierarchical context of metaphorical user operation. Rounded rectangles represent the first-level axial codes, whereas ovals represent the second-level and third-level axial codes. Solid lines delineate the hierarchy of axis codes; dotted lines signify the connections across different axes, and the thicker dotted lines indicate the stronger links.

5. DISCUSSION

This study represents speculative design regarding metaphorical user operation. According to the analyses above, we tried to make some points clearer. First, we found that the appraisal patterns of emotions (e.g., Demir, Desmet, and Hekkert, 2009) still play important roles in experiencing metaphorical user operation (e.g., “effect after operation” under the selective code). Second, design language including applying signifiers to arouse user’s life experience is able to be associated with the intuitive operation, the ritualized behaviour, and the consequent effect. Third, designers need to be concerned about the concepts of branding and marketing when they try to apply metaphorical user operation to product development. Fourth, safety is the required factor for some product categories in which user operation should avoid too much trial and error, but it is not for all products. Therefore, metaphorical user operation can at least be an access made applicable to the majority of cultural creative designs or products that need not require high safety. Building on the initial findings of this study, further and wider investigations will be carried out in the near future to find out more details of metaphorical user operation.

ACKNOWLEDGMENTS

The authors would like to thank financial support by the Ministry of Science and Technology under grant number MOST 106 - H - 239 - 014 -.

REFERENCES

Cheng, S.H., Hsu, T.C., & Lin, M.H. (2016), How far figurative design can go: Defamiliarized expressions by operation, *The 5th International Symposium on Business and Social Sciences*, 2016/08/02-04, Higher Education Forum, Okinawa, pp.38-48.

Demir, E., Desmet, P. M. A., & Hekkert, P. (2009). Appraisal patterns of emotions in human-product interaction. *International Journal of Design*, 3(2), 41-51.

Desmet, P. M. A., & Hekkert, P. (2007). Framework of product experience. *International Journal of Design*, 1(1), 57-66.

Glaser, B. G., & Strauss, A. L. (1999). *The discovery of grounded theory: Strategies for qualitative research*. New York, NY: Aldine.

Hallnäs, L. (2011). On the foundations of interaction design aesthetics: Revisiting the notions of form and expression. *International Journal of Design*, 5(1), 73-84.

Lin, M. H., & Cheng, S. H. (2014). Examining the “later wow” through operating a metaphorical product. *International Journal of Design*, 8(3), 61-78.

Krippendorff, K. (2006). *The semantic turn: A new foundation for design*. Boca Raton: Taylor & Francis.

Lakoff, G., & Johnson, M. (1980). *Metaphor we live by*. Chicago: University of Chicago Press.

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.

A PROPOSED QUANTITATIVE UX ANALYSIS METHOD BASED ON A PSYCHOMETRIC QUESTIONNAIRE SURVEY

Yuka SUGIYAMA^{*a}, Toshikazu KATO^b and Takashi SAKAMOTO^c

^a Graduate School of Chuo University, Japan, a17.y5g4@g.chuo-u.ac.jp

^b Chuo University, Japan, t-kato@kc.chuo-u.ac.jp

^c National Institute of Advanced Industrial Science and Technology, Japan, takashi-sakamoto@aist.go.jp

ABSTRACT

In recent years, the User Experience or (UX) has become an important element in product design, including affective engineering as well as marketing. The UX analysis is typically driven by qualitative methods such as customer journey maps. On the other hand, the number of quantitative data analysis methods involved, such as multivariate analysis, is comparatively less. Therefore, the purpose of this study was to propose a UX data analysis method. It has been reported that the UX can be divided into the time spans of anticipated UX (before usage), momentary UX (during usage), episodic UX (after usage), and cumulative UX (over time). In this study, an analysis method focused on the time span of the anticipated UX imaging experience before usage is suggested. In this time span and since users may recall previous experiences and usage episodes, a psychometric method based on an uncertain experience is proposed. As a method of analysis, a psychometric questionnaire survey using product samples and two sets of evaluation terms with pragmatic and hedonic attributes were conducted according to the pragmatic/hedonic UX model proposed by Hassenzahl (2008). In addition to that, a Customer Satisfaction (CS) analysis is used to enhance users' satisfaction of the UX. The evaluation terms that greatly improved the pragmatic and hedonic attributes using this analysis were extracted. Moreover, rough sets were used to extract concrete morphological elements that comprised of

* Corresponding author.

the knowledge of design from the evaluation terms. As a portfolio map (x-axis: importance, y-axis: satisfaction) can be obtained from a CS analysis where each company's sample positioning can also be analysed. Therefore, the evaluation terms for enhancing each company's UX were clarified. A case study is conducted to confirm the effectiveness of the proposed method. Specifically, a questionnaire survey with 37 female office workers in their 30s were selected as subjects. The questionnaire included 60 sample photographs of bags downloaded from a mail order site and the evaluation terms consists of six pragmatic attributes and six hedonic attributes that were obtained using the laddering technique. The abovementioned analyses were conducted on the data obtained from the survey to confirm the effectiveness of the proposed method.

Keywords: *User Experience, Product Design, Rough Sets*

1. BACKGROUND AND PURPOSE OF THE STUDY

In recent years, the User Experience (UX) has become more important not only in product design, including Kansei engineering, but also in marketing. Hassenzahl and Tractinsky (2006) have proposed the UX as "a consequence of a user's internal state that includes predispositions, expectations, needs, motivation and mood. The characteristics of the designed system like complexity, purpose, usability and functionality and the context or the environment within which the interaction occurs either in an organisation or a social setting, the meaningfulness of the activity, voluntariness of use". [1]

The UX is a broad concept. The method of evaluating the UX involves several qualitative investigations such as the customer journey map and persona scenario methods. However, quantitative methods based on data analysis methods such as multivariate analysis have not yet been established. Therefore, a UX data analysis method in the present study is proposed.

2. DATA ANALYSIS METHOD

In the UX White Paper (2010) [2], it was reported that the UX involves four usage periods which are identified as *Before Usage*, *During Usage*, *After Usage*, and *Over Time*. In the present study, an analysis method for the anticipated UX period is proposed which entails the imagination of the experience before the first use. In this period, since users rely on past memory and experience as a reasoning, a psychometric method of "∼ so," is devised which is presumed from uncertain evidence.

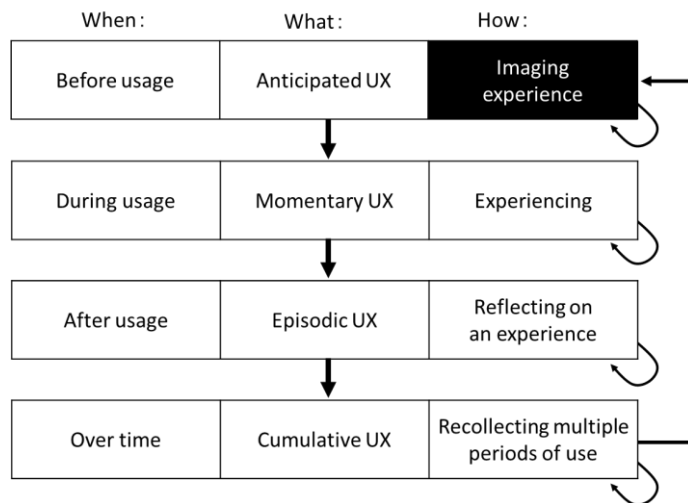


Fig. 1 Time spans of user experience

The study uses pragmatic and hedonic qualities, which were included in Hassenzahl's (2008) definition of the UX, as the evaluation items of the questionnaire. A psychometric method to conduct the questionnaire survey is used in the evaluation items and a product sample. Furthermore, in order to increase user satisfaction, which is an important element of the UX, the analysis included the Customer Satisfaction (CS) analysis. The CS analysis enabled the extraction of evaluation terms that contribute substantially to the realisation of pragmatic and hedonic qualities. Subsequently, using the rough set, the specific form factors that constitute the knowledge of the design from the evaluation terms were extracted. This portfolio map (x-axis: importance, y-axis: satisfaction) obtained from the CS analysis, enabled the study to analyse each company's sample positioning. In other words, it could clearly identify the evaluation terms that improve each company's UX.

3. CASE STUDY VALIDATION

In order to confirm the effectiveness of this proposed method, a case study was conducted on female bag design.

3.1. Questionnaire survey

First, a keyword search for "Commuter female A4" on major e-commerce (EC) sites (Amazon, Belle Maison Net, and ZOZO Town) were conducted. Then, similar samples were deleted and 60 samples of bags identified.

Subsequently, a laddering survey using 6 female college students that consists of 5 undergraduates and 1 graduate student was conducted. Then, cognitive sites were extracted and 13 evaluation terms were derived.

After extracting the cognitive site, 40 pragmatic qualities were classified into 13 items, and 36 hedonic qualities were classified into 9 items.

The evaluation terms used for pragmatic qualities were ; this bag seems to be "easy to take things out," "durable," "light-weighted," "ability to hold without fatigue," "easy to tidy things up," "easy to hold," and "easy to use."

Additionally, hedonic qualities such as this bag seems to be..."making a favourable impression," "inducing a sense of attachment, " "sophisticated," "good quality," "eye-catching," and "inducing a sense of fun." These qualities were all rated using a 5-point scale. The traditional semantic differential scale method uses opposite words, but the Kansei Engineering method often uses negative words. Therefore, in the present study, expressions such as "it seems to be ..." is used in order to enable the participants to infer from their memory and answer easily.

The Fig. 2 demonstrates pragmatic and hedonic attributes.

Pragmatic attributes	Hedonic attributes
<p>This bag seems to be ...</p> <p>light-weighted</p> <p>easy to hold</p> <p>easy to tidy things up</p> <p>durable</p> <p>holdable without fatigue</p> <p>easy to take things out</p>	<p>This bag seems to be ...</p> <p>sophisticated</p> <p>inducing a sense of attachment</p> <p>making a favorable impression</p> <p>good quality</p> <p>eye-catching</p> <p>inducing a sense of fun</p>

Fig. 2 Pragmatic and hedonic attributes

The details of the questionnaire survey are as follows:

- 1) Implementation date: October 2016
- 2) Participants: 37 people (Female, office workers, in their 30s, living in or near Tokyo prefecture)
- 3) Method: Internet survey with items comprising of a 5-point rating scale
- 4) Sample: Sample pictures from EC sites; 60 photos of bags
- 5) Evaluation terms: 13 adjectives

3.2. Customer satisfaction analysis

As the UX gives emphasis towards the viewpoint of satisfaction, the concept of CS portfolio is applied and shown in Fig. 3 in the proposed analysis. This concept is able to highlight the needs for improvement by clarifying the customers' priority items. It can identify the "maintenance items," "Improvement items," and "Priority improvement items." Thus, a CS portfolio can be used to improve satisfaction by focusing on the "priority improvement areas" (Fig. 3).

The proposed analysis method statistically calculates the strength of influence of the comprehensive evaluation, with "level of satisfaction" on the y-axis and "degree of importance" of each evaluation item on the x-axis. The extracted evaluation items with high improvement priority have been shown in Fig. 3.

In this study, the partial correlation coefficient was used to assess the degree of importance of each evaluation item. Additionally, the average value on the 5-point rating was used as an indicator of the level of satisfaction.

Objective variables such as "easy to use" for practical attributes, and "inducing a sense of fun" for emotional attributes are used.

The circle in Fig. 3 shows the result that is placed in the map of the CS portfolio. The triangle is an example of the result of the positioning analysis of the product.

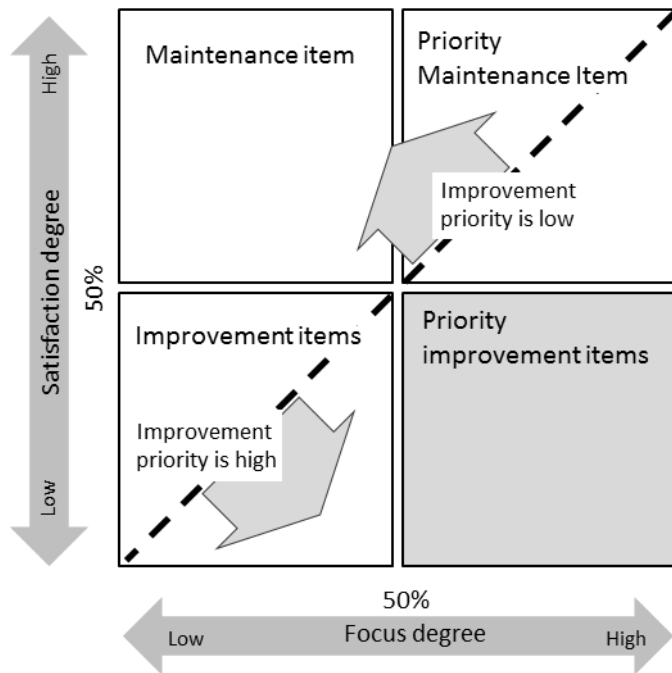


Fig. 3 Outline of the customer satisfaction portfolio analysis

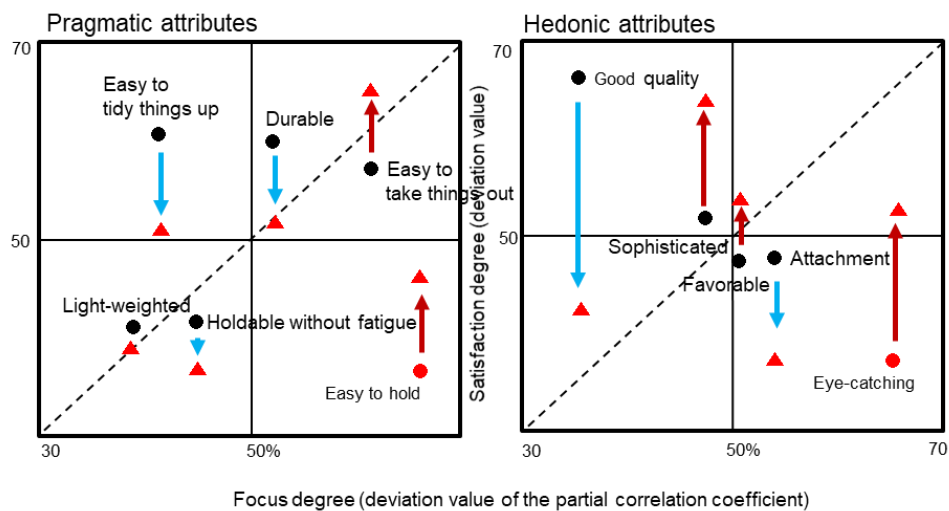


Fig. 4 Customer satisfaction placement and positioning based on the analysis results (Sample 8)

3.3. Analysis result consideration

As shown in Fig. 4, among the practical attributes, "easy to hold" was a "priority improvement item." In terms of emotional attributes, the item "prioritise" had the highest priority, "making a favourable impression" and "it seems to have an attachment " were identified as "priority improvement items." That is, for these items, although the degree of importance was high, the satisfaction level was lower than that for other items.

However, this result does not reveal concrete measures that each company should take to improve the UX. Therefore, a positioning analysis was conducted for each company. For instance, the triangle on Fig. 4 shows the positioning analysis for the company of Sample 8 (hereinafter referred to as Company A). The degree of importance is the same, and the degree of satisfaction is plotted using the average value of Company A. The findings reveal that the evaluation of Company A's "easy to hold" characteristic was among the pragmatic qualities that is higher than the average of the other companies, but it is also a "priority improvement item." This indicates that further improvement in this characteristic needs to be achieved.

On the other hand, among the emotional attributes, the highest priority was observed for "it seems to attract attention," which indicates a relatively high degree of satisfaction. However, the score for "it seems to have an attachment" was considerably lower than that of the other companies. These findings indicate that the company could employ a strategy for improving "it seems to attract attention" by making "it seems to have an attachment" the top priority improvement item.

However, a concrete method to obtain the design knowledge that contributes to these images is to determine the priority improvement items as decision classes (object variables) by calculation of a rough set.

A part of these results have been shown in Table 1. The middle and small classifications in the table were extracted based on the results of the laddering method.

Table 1 Summary of the rough set results

Pragmatic attributes		It looks easy to use		Hedonic attribute		It seems to be eye-catching		
		+	−			+	−	
Length of handle	Long	1.10	2.10	Image	Round	0.86	1.04	
	Short				Intermediate	1.03		
	Intermediate				Angular			
Thickness of handle	Thick	0.98	1.58	Material	It looks soft	0.74	0.78	
	Thin				Intermediate			
	Intermediate				It looks hard			
Number of handles	One	1.26		Surface treatment	Gloss	1.88	1.76	
	Two				Intermediate			
How to hold	Shawl only		2.19	Metal fittings	Matte	0.86	0.85	
	Shoulder				With simple metal fittings			0.78
	Both WAY				With decorative brackets			
Metal fittings	Present	0.75			None	1.71	1.17	
	None				Present			
How to fasten	Fastener	1.58	1.05	Outer pocket	None	1.03	1.43	
	Magnet / Button				Long			
	Purse			Length of handle	Short	1.95		
	None				Intermediate			
	Other				Black			
Inside pocket	Present	0.82	0.79	Color (main)	Gray	0.34	0.39	
	None				Brown system	1.03		
Outer pocket	Present		0.79		Beige	0.34		
	None				White system			
Bag thickness	Present	1.90	1.58		Red type	0.34		
	None				Blue series	0.68		
Form	Rectangle	0.82	1.05		Other			
	Inverted trapezoid		Color (sub)	Black	0.34	0.98		
	Trapezoid			Gray				
	Hexagon			Brown system				
Vertical / Horizontal	Round		2.28		Beige			
	Vertical				0.34	Blue series		
	Horizontal					Other		
Independent style	Square	0.96	0.73	Color		None	0.34	
	Self-supporting type				Clear color			
Material	I can not stand it					Chic color		
	Leather			Pal e colour				
	Nylon							
	Other							
	Using different materials							

It is evident from Table 1, having a long handle was evaluated positively for "easy to hold," and having a thick handle was evaluated negatively.

For the number of handles, two handles were evaluated positively, and the reverse trapezium evaluated more positively as compared to the trapezoid. Further, it seems that colours other than

black, glossy surface, and round shape were evaluated positively with reference to the attribute “It seems to attract attention.”

Table 1 also provides information on knowledge of design, which can be used to develop higher UX products.

3.4. Acknowledgments

The authors wish to thank Dr. Inoue, Professor at Hiroshima International University, for supporting the analysis and reviewing the results of this study.

REFERENCES

- Hassenzahl, M., & Tractinsky, N. (2006). User experience-A research agenda. *Behavior & Information Technology*, 25(2), pp. 91-97.
- Virpi, R., Effie, Law., Arnold, V., & Jettie, H. (2011). User experience white paper. <http://www.allaboutux.org/files/UX-WhitePaper.pdf>(accessed 12-12-2017).
- Inoue, K. (2009). *Application of rough sets to affective engineering*. pp. 36-38, Kaibundo.
- Ogilvy, J. A. (1985). *The experience industry, SRI international business intelligence program*. Report No. 724.
- Joseph, B., Pine, II. & Gilmore, J. H. (2011). *Experience economy*. Diamond Inc.
- Schmitt, B. H. (2000). *Experiential marketing*. Free Press.
- Wada, M. (2002). *Brand Value Co-creation*. Doubunkan.
- Pawlak, Z. (1982). Rough sets. *International Journal of Information Computer Science*, 11(5), pp. 341-356.
- Mori, T., Tanaka, H., & Inoue, K. (2006). *Rough set and affective engineering*. Kainbundo.
- Inoue, K. & Hirokawa, M. (2003). Proposal of related analysis between Kansei words and cognitive form. *Bulletin of International Rough Set Society*, 7(1/2), pp. 55-59.
- Sekiguchi, A., Inoue, K., & Uenakada, A. (2010). Proposal for method of design evaluation by variable precision rough set. *Journal of Japan Society of Kansei Engineering*, Vol. 9, No. 4, pp. 675-685.
- Pawlak, Z. (1982). Rough sets. *International Journal of Information Computer Science*, 11(5), pp. 341-356.

Hassenzahl, M. (2004) . The interplay of beauty, goodness, and usability in interactive products. *ACM Human-Computer Interaction* 19, p.319-349

Hassenzahl, M. (2010) . *Experience design-technology for all the right reasons*. Morgan & Claypool

Yamazaki, K., Matsubara, H., & Takeuchi, K. (2016). *Human centered design*. pp. 67 Kindaikagaku.

A USER EVALUATION SYSTEM USING SENSORS OF SMARTPHONES

Ryo Yamaguchi^a, Jue Zhang^b and Naiwala P. Chandrasiri^c

^a Kogakuin University, Japan, em17022@ns.kogakuin.ac.jp

^b Kogakuin University, Japan, zhangjue@cc.kogakuin.ac.jp

^c Kogakuin University, Japan, chandrasiri@kogakuin.ac.jp

ABSTRACT

Currently, user evaluation systems in online shopping sites and content download sites mainly employ a 5-point evaluation scheme. This scheme was devised to facilitate statistical use by discretizing the continuous quantity of evaluation into 5 points. However, some think that framing the evaluation in terms of only 5 points reduces the dependability of resulting judgments. Therefore, we reasoned that if an evaluation scheme could be designed, which could capture individuals' Kansei evaluation easily and intuitively with continuous quantities, using smartphone sensors, this problem might be partially overcome. The main aim of the present study, then, was to develop a better evaluation system, which reflected the Kansei characteristics of a given user. To this end, we examined the relationship between user evaluation results and the vibration data collected using built-in smartphone sensors, such as accelerometers and gyroscopes, and investigated the error characteristics in the evaluation. In the prototype application we developed, when a user shakes the terminal, the strength of the vibration is measured with the built-in smartphone accelerometer. We conducted an experiment to compare the user evaluation results obtained by our application with those obtained by the conventional 5-point evaluation scheme. The results suggested that the evaluation based on the proposed application was effective because it showed a positive correlation with that based on the 5-point scheme.

Keywords: Kansei evaluation, smartphone, continuous quantity

1. BACKGROUND

Currently, a 5-point scale is the most common scheme used in evaluation systems for online shopping sites and content download sites. A very popular online application is the Google Play application, which is installed on Android devices. As of 2013, Android applications were downloaded more than 50 billion times in total from the Google Play Store, a content marketing site. The Facebook application, one of the applications distributed through Google Play, had been evaluated, on such a 5-point scale, more than 50 million times by December 2016. The 5-point evaluation scheme was developed to discretize evaluation, a continuous quantity by nature, into five points, and thereby make it easier to use the evaluation results for statistics and other purposes. However, some think that evaluations based only on a 5-point scale make it difficult to frame dependable judgments, and are confusing. We reasoned that an evaluation system capable of expressing individual preferences in a simple and intuitive manner, with relatively continuous quantity, could partially solve this problem.

Smartphones are mobile devices equipped with various features. One of these is typically a built-in accelerometer, which can detect subtle movement of the device. Also, gyroscopes and other sensors capable of detecting device movement are often installed in such devices. We hypothesized that if we could develop an evaluation system which measured the intensity of smartphone movement when the device is shaken, we could design a system to express individual preferences in an intuitive manner, with relatively continuous quantity.

The aims of the present study, then, were to determine the relationship between smartphone sensors, such as accelerometers and gyroscopes, and evaluation utilizing such sensors; collect mobile device vibration data to determine error in the evaluation, and analyze the characteristics of Kansei evaluation based on this data; and thereby develop a more sensitive and user-friendly evaluation system.

2. EXPERIMENT TO COLLECT VIBRATION DATA

2.1. Purpose of the Experiment

First, an evaluation based on one piece of data was performed, to determine the general effectiveness of evaluation based on the intensity of vibration. There are two main types of sensors that can detect the movement of a smartphone: an accelerometer and a gyroscope. We conducted the experiment in order to determine whether the maximum value, average value, or frequency value should be used, and how significant the difference was, in terms of the strength with which users shook the smartphone; and obtained device vibration data, using the built-in sensors, to determine:

1. Whether the accelerometer or the gyroscope should be used for such evaluation
2. Whether the maximum value, average value, or frequency value should be used

3. Whether there was a difference in the intensity of vibration among the subjects.

2.2. Measurement Application

To evaluate the intensity of vibration caused by shaking the device, it was necessary to determine the relationship between the intensity of vibration and respective sensor readings. For this purpose, an application was necessary that enabled the output of each sensor to be measured. The experiment aimed to make measurements with only one sensor at a time. Therefore, it was necessary to handle data collected by each sensor separately, for each sensor and for each method of data collection. Also, it was necessary to sort the data by subject, to determine whether there was a difference in the intensity of the vibration between individual subjects, and between male and female subjects. We thus developed an application that enabled the respective output of each sensor to be collected, stored in a database, and viewed.

Three-dimensional data was collected from the accelerometer and gyroscope, and the sensor output was collected roughly 50 times per second.

The average value was obtained by dividing the sum of the absolute values for the period from the start to the end of data collection, by the total number of data collections. To obtain the maximum value, a variable max with an initial value of 0 was created. If the value of max was less than the obtained value, the maximum value was determined by assigning the obtained value to max. The frequency was calculated as follows: if each of the three-dimensional values (x, y, and z) from the accelerometer was opposite in sign to the previously recorded value, 1 was added to the variable count with an initial value of 0. One back-and-forth motion in all directions (x, y, and z) was counted as one oscillation. Then, the frequency was expressed as: count divided by 6.

2.3. Method of the Experiment

The subjects performed the following steps:

1. Shake the device weakly for 5 seconds after a countdown of 3 seconds.
2. Shake the device moderately for 5 seconds after a countdown of 3 seconds.
3. Shake the device strongly for 5 seconds after a countdown of 3 seconds.

The subjects, 20 students in their 20s (14 male, 6 female), repeated steps (1) to (3) 10 times in a seated position. The mobile device used in the experiment was the Xperia Z5.

2.4. Results and Discussion

Five types of data collected with different methods of measurement were divided into three groups: Weak Shaking (-1), Moderate Shaking (0), and Strong Shaking (1), and a correlation

analysis was performed. The correlation coefficient was the highest for the intensity of vibration and average acceleration (Table 1).

Table 1: Correlation coefficients: the coefficients in yellow are more than 0.5 (Data Collection Experiment)

Correlation Coefficients					
No.	Maximum Acceleration	Average Acceleration	Maximum Angular Velocity	Average Angular Velocity	Frequency
1	0.830	0.909	0.817	0.869	0.578
2	0.947	0.937	0.917	0.931	0.898
3	0.822	0.964	0.913	0.907	0.898
4	0.735	0.904	0.798	0.881	0.770
5	0.934	0.919	0.901	0.918	0.907
6	0.914	0.923	0.820	0.924	0.887
7	0.902	0.799	0.415	0.604	0.820
8	0.903	0.944	0.897	0.903	-0.084
9	0.970	0.963	0.944	0.953	0.934
10	0.622	0.510	0.580	0.345	0.416
11	0.906	0.891	0.889	0.898	0.768
12	0.910	0.927	0.785	0.816	0.637
13	0.916	0.907	0.913	0.915	0.524
14	0.760	0.890	0.744	0.822	0.307
15	0.890	0.873	0.915	0.909	0.843
16	0.935	0.961	0.916	0.943	0.963
17	0.753	0.839	0.468	0.313	-0.518
18	0.688	0.784	0.637	0.577	0.086
19	0.958	0.946	0.950	0.959	0.880
20	0.671	0.835	0.366	0.258	-0.599
All Subjects	0.848	0.881	0.779	0.782	0.546

Table 1 shows that, generally, there was a high positive correlation, and the average correlation coefficient was the highest for average acceleration. Specifically, the correlation coefficients for maximum acceleration and intensity of vibration, and for average acceleration and intensity of vibration, were more than 0.5 for all subjects, suggesting a strong relationship between the acceleration and intensity of vibration felt by the subjects.

The coefficients for maximum angular velocity, average angular velocity, and frequency were high for most subjects and low for some subjects. There was a negative correlation between intensity of vibration and frequency, probably because, with respect to angular acceleration, some subjects shook the device without twisting the wrist, and with respect to frequency, some

subjects shook the device with a large amplitude to generate strong vibrations, causing the frequency to decrease. Given this, we inferred that these measures should be used for measurement with only one sensor, in consideration of the variation among the subjects.

Based on these results, the measure that best represented the intensity of vibration, measured with one sensor, was the average accelerometer value.

Table 2: Standard deviation of the average acceleration for individual subjects. The value in yellow is more than the standard deviation for all subjects

	Standard Deviation	Average Acceleration	Subject No.	
No.	1	2	3	4
Weak Shaking	1.213	0.424	2.079	2.147
Moderate Shaking	2.077	0.804	2.144	1.977
Strong Shaking	0.977	1.837	0.926	1.264
No.	5	6	7	8
Weak Shaking	0.665	0.757	1.795	1.064
Moderate Shaking	0.919	0.619	2.005	1.009
Strong Shaking	1.326	1.406	2.904	1.348
No.	9	10	11	12
Weak Shaking	0.773	1.042	0.411	1.525
Moderate Shaking	1.999	0.704	1.038	2.443
Strong Shaking	0.980	0.634	1.620	1.913
No.	13	14	15	16
Weak Shaking	0.434	0.575	0.521	0.712
Moderate Shaking	0.764	1.013	0.507	1.563
Strong Shaking	2.099	1.295	3.448	0.955

No.	17	18	19	20
Weak Shaking	1.784	3.235	0.351	1.784
Moderate Shaking	2.965	3.010	0.351	2.877
Strong Shaking	1.647	1.385	1.320	1.405

Table 3: Standard deviation of the average acceleration for all subjects, male subjects, and female subjects

Standard Deviation of Average Acceleration			
	All Subjects	Male Subjects	Female Subjects
Weak Shaking	2.525	2.681	0.940
Moderate Shaking	3.585	3.748	1.948
Strong Shaking	4.972	4.907	4.741

Given the above results, we focused on the average acceleration. Table 2 (male: blue, female: red) shows the standard deviation of the average acceleration for each subject, which was calculated for Weak Shaking, Moderate Shaking, and Strong Shaking, respectively. Table 3 shows the standard deviation of the average acceleration for all subjects, male subjects, and female subjects, also calculated for the three shaking modes.

Table 3 shows that the standard deviation increased for all subjects, male subjects, and female subjects, as the intensity of vibration increased. However, as shown in Table 2, the intensity of vibration that produced the largest standard deviation varied with the subject. The 59/60 standard deviation for individual subjects was less than the value for all subjects. These results indicate that the variation in the average acceleration among the subjects increased as the shaking force increased, regardless of gender.

Given the above, we considered it necessary to provide recognition capability in the application, to accommodate the variation among the subjects, instead of setting separate reference points for all subjects, male subjects, and female subjects.

3. EVALUATION EXPERIMENT USING THE EVALUATION APPLICATION

3.1. Purpose of the Experiment

Based on the results of the experiment in Section 2, we developed an evaluation application capable of recognizing the intensity of shaking by each subject in terms of the average acceleration, and conducted an evaluation experiment to determine whether the evaluation performed by the application corresponded to the Kansei of the subject.

3.2. Evaluation Application

The application was developed using the average acceleration as the index. Each subject performed five sets of three shaking actions (weak shaking, moderate shaking, and strong shaking), and then user registration, so that the application recognized the intensity of shaking by each subject (average acceleration). The first two sets were for practice and not recorded. When the subject tapped the “Start” button on the main screen, the application commenced measurement, collected data on the average acceleration (hereinafter referred to as “the current data”) when the smartphone was shaken, and temporarily recorded the data. The average of the average acceleration for weak shaking and the average acceleration for moderate shaking in the previous data was defined as Reference 1, and the average of the average acceleration for moderate shaking and the average acceleration for strong shaking was defined as Reference 2. The value of the current data was 0 to 25% when it was between 0 and Reference 1, 25 to 75% when between Reference 1 and Reference 2, and 75 to 100% when between Reference 2 and the maximum. The current data was stored in the database as “Weak” when the value was in the blue region, “Moderate” when in the green region, and “Strong” when in the red region. In this way, the application enhanced the recognition process.

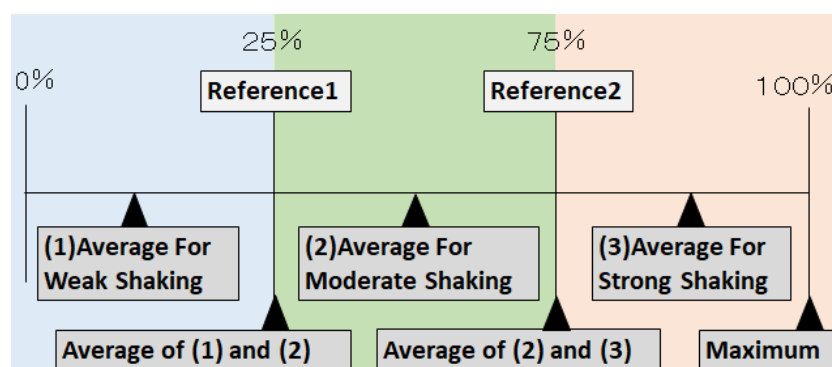


Figure 1: Algorithm for the evaluation application

3.3. Method of the Experiment

The subjects were 15 students in their 20s (10 male, 5 female). The experiment consisted of the following two sessions, in which the subjects used the application.

1. The subjects were asked 15 questions and answered, on paper, using the 5-point evaluation system.
2. The subjects were asked the same 15 questions, and answered using the proposed evaluation application.

If they performed the two evaluations sequentially, the results of the second evaluation may have been affected by the first. Thus, the subjects were each assigned a number, from 1 to 15, in the order in which they underwent the experiment. The odd-numbered subjects performed the 5-point scale evaluation on paper and then the application evaluation, while the even-numbered subjects reversed this order.

The subjects were presented with pictures of a common food and a landscape, and asked how much they liked the food and landscape.

3.4. Results and Discussion

To determine whether there was a correlation between the 5-point evaluation on paper and the application evaluation, correlation analysis was performed on each odd- and even-numbered subject, and all odd- and even-numbered subjects.

Table 4: Correlation coefficients: coefficients in yellow are more than 0.5 (Evaluation Experiment)

Correlation Function								
Odd-numbered	1	3	5	7	9	11	13	15
	0.840	0.940	0.880	0.846	0.232	0.940	0.831	0.875
Even-numbered	2	4	6	8	10	12	14	
	0.959	0.933	0.891	0.912	0.810	0.844	0.815	

Table 5: Correlation coefficients and correlation test results for all subjects, and for the odd- and even-numbered subjects

Correlation Coefficients			Correlation Test Results		
All Subjects	Odd-numbered	Even-numbered	All Subjects	Odd-numbered	Even-numbered
0.829	0.795	0.859	0.000	0.000	0.000
		Maximum		Correlated	Not Correlated

Table 4 shows the respective correlation test results for the 5-point and application evaluations, for each subject; while Table 5 shows the similar results for all subjects and for the odd- and even-numbered subjects. As shown in Table 5, all the values for all subjects indicate a high correlation, and the results for the 5-point evaluation are similar to those for the application evaluation. This indicates that the application algorithm can be applied to Kansei evaluation. The even-numbered subjects, who performed the application evaluation first, show a higher correlation than the odd-numbered subjects, who performed the 5-point evaluation first, suggesting that the application evaluation had a relatively strong effect on the subsequent evaluation, compared to the 5-point evaluation. Table 4 reveals a high correlation in the case of almost all the individual subjects; however, as there was no correlation in the case of one subject, the algorithm must be improved for universal applicability.

Table 6: Average and standard deviation in the application evaluation, with respect to the 5-point evaluation

5-point Evaluation	1	2	3	4	5
Average	15.729	28.062	45.020	69.179	87.990
Standard Deviation	4.513	14.485	20.706	16.190	12.861

Table 6 shows the average and standard deviation in the application evaluation, for all subjects, with respect to the 5-point scale evaluation. As we can see, the average is close to the 5-point score expressed as a percentage (10, 30, 50, 70, and 90), and the standard deviation increases toward a score of 3 in the 5-point evaluation. This indicates that the 5-point evaluation represents the mean value to a lesser extent than the application evaluation.

4. CONCLUSIONS AND ISSUES

The study reveals that the proposed application evaluation using smartphone sensors to measure vibration data can produce results roughly similar to those of an evaluation on a 5-point scale, and at the same time can reveal subtle differences between the two forms of evaluation. We have successfully developed a system that allows for intuitive evaluation. One drawback of the application evaluation, however, is that it takes slightly more time than the 5-point evaluation, with the registration of vibration data by each subject.

Among the issues to be addressed are the development of an algorithm that further reduces the gap between the results of the evaluation application and individual Kansei, and the design of a method that can reduce both the time and the fatigue involved in shaking the smartphone.

REFERENCES

- Kono, Y., & Muranaka, N. (2010). Estimation of Brain Activity area on Sensitivity Evaluation by Measuring EEG. *IEICE Technical Report 110(355)*, 69-72.
- Hashimoto, Y., Minami, T., Hasegawa, R. P., & Nakauchi, S. (2010). Effect on EEG responses of cognitive states to commodity characters. *Transactions of Japan Society of Kansei Engineering*, 10(2), 123-129.
- Harumi, M. (2010). Create kansei evaluation database using EEG. *Journal for Interdisciplinary Research on Community Life*, 1, p135-142 .
- Tsunai, Y., Kitamura, S., Mitsuya, R., Asano, J., Okamoto, R., & Kawai, T. (2013). Kansei evaluation method focusing on individual differences in preference for own avatar. *The Japanese Journal of Ergonomics*, 49, No. Supplement p. S336-S337.
- Tanaka, S., Mori, H., Kasuga, M., & Shoji, K. (2015). KANSEI Evaluation for High-definition Large-sized Images- Comparison of Viewers' Impressions between 4K and 2K Image. *Transactions of Japan Society of Kansei Engineering*, 14(2), 277-284.

DESIGNING USER EXPERIENCES FOCUSED ON MULTIMODAL PERCEPTION

SuKyoung KIM^a

^a*Sapporo City University, Japan, s.kim@scu.ac.jp*

ABSTRACT

Design disciplines and research have been rapidly transforming which includes not only objects but also services as the target of design. The paper presents a methodological-practical approach to determine the vectors of affective design which is one of the research on transformative design. The research has a twofold aim which are (1) to rethink the definition and vectors of design for practical usage (2) to verify more modifiable information and a significant value to be a key in enabling affective functionality through an experiment on multisensory integration using visual-olfactory stimuli. The findings of the research provide a new perspective on practical research on affective design in terms of effective and sustainable vectors.

Keywords: *multimodal, constructive perception, evaluation methodology, intuitive preference*

1. INTRODUCTION

Design has mainly been discussed in terms of the study of industrial design (Buchanan & Margolin 1995; Cross 2007) and engineering design (Pahl et al 2007). However, society is already saturated with various high-end technological products, and design is continually reconfiguring itself from object-centred to human-centred. Therefore, current design produces not only form or function based objects but also produce designs that involves user expectation from the objects or services and this is known as user experience design. As to the importance of experience, it is defined that *Kansei* and the validation process that gives clear understandings which contributes to subjective and intuitive evaluations to the objects or services with physiological and psychological approaches are invalid. Two questions that is answered in the study are: (1) how to determine a cause-and-effect relations of the sensory information and the evaluation results in accordance with our daily life (2) how to phase the perceived information in user experience design? The paper is organized as follows: First, it reviews a new design discipline towards an enhanced affective design, and presents the validated model of the subjectivity-modification process, which was validated by Kim et al. (Kim et al 2012; Kim & Cho 2016; Kim

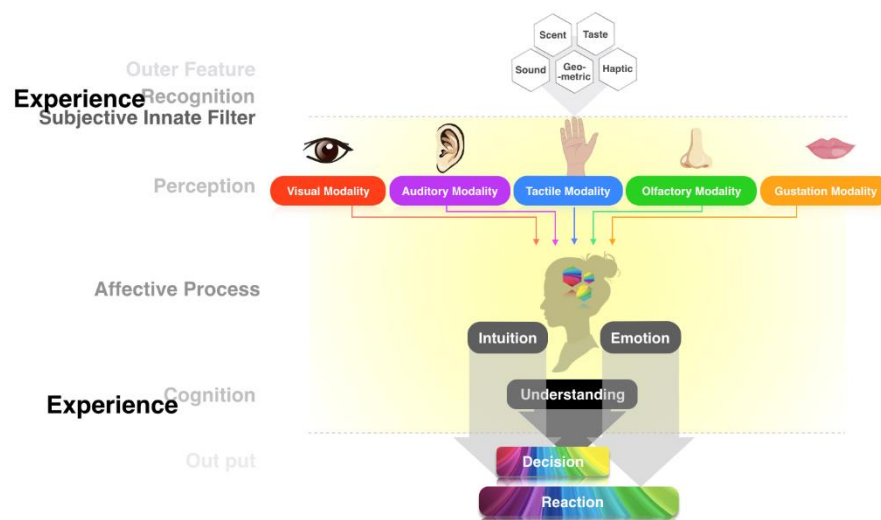
2017). Second, it verifies a cause-and-effect relations of the perceived information and the evaluation results using visual-olfactory stimuli; and establish a point of view on what can be improved aiming at proposing a conceptual framework for integrating user experience into objects. This approach strengthens the vectors of user experience by aesthetically pleasing added and clarifies the link between the product and the perceptual impacts on the users which attribute to user expectations.

1.1. Re-think Design

Currently, design is present in our daily lives. It means that designers do not only have to develop new products with which people pursue their lives but also have to decide what kind of life and society that these products support (Hummels & Frens 2009) in terms of the so-called transformative design. Therefore, it is to rethink the notion of the transformative design for the near future, it should be understood that focus should not be on the design per se, but focus on what design that is expected by users. User research is about understanding users and their needs and user experience design is designing a user's interactions with a product from moment to moment (Hassenzahl M). A user's experience is the cumulative effect of many factors, some that you can control, and some that you can't control (Bule 2013). How to design what the individual wants and needs? This question has fascinated researchers in the design field and continues to motivate them today. Design doesn't address a single issue anymore. Design has been more complex involving the notions of the user, eco, universal, sustainable and so on. What is design, and how does design fit the new era society? "Dividing" could provide an answer to this. Form and functions are two fundamental aspects of design, and it is expected that the two interact to impact user's evaluations of a product. Form and function based design is mainly evaluated by the baseline knowledge or previous experience (Gregan et al 2005; Hoeffler 2003; Meyers & Tybout 1989). A typical form design is conceptualised as the specific prototype in individual memory. Thus, if the form is more typical, users can have easy access to memory. In other words, more typical form leads to positive product evaluation due to its perceptual fluency. Perceptual fluency reflects the ease with which users can identify the physical identity of the stimulus on subsequent encounters, and involves the processing of physical features such as shape (Lee & Aparna 2004). In addition to that, perceptual fluency is influenced by several variables such as perceptual priming, clarification, presentation duration, or repetition (Reber et al 2004). Most of all, perceptual fluency is known to be enhanced through prior exposures (Lee & Aparna 2004). On the other hand, conceptual fluency reflects the ease with which the target comes to individual minds and pertains to the processing of meaning that is related to semantic knowledge structures (Reber et al 2004). Whereas perceptual fluency is not influenced by attention or elaboration, conceptual fluency benefits from elaboration at the time of exposure (Lee & Aparna 2004). In other words, perceptual fluency originated from "external feature context and subjective innate filter" whereas conceptual fluency originated from "the phase of the subjective innate filter (Kim & Cho 2017)". This will be detailed and elaborated in the following section.

1.2. Re-think Human Being

There can be no doubt that all human knowledge begins with experience. Humans experiences external features through their senses like eyes, ears, nose, and so on. As I. Kant said that although all our knowledge begins “with” experience, it does not mean that it arises “from” the experience (Kant 2008 a). Even human knowledge is a compound of that humans receive through impressions, it is undistinguished from that of a raw material and it takes a prolonged practice to make humans attentive to the knowledge and rendered humans to be capable of separating one from the other (Kant 2008 b), where accumulative knowledge is in relation to intuition. The unanswered question is how does an individual’s experience affects or be affected in relation to knowledge and intuition?.



The flow of affective process in the relationship of perception, cognition, and experience which presents subjectivity-modification process (Kim & Cho 2017; Kim 2017)

Figure 1 represents the process of *Kansei* information and outcomes. The term of *Kansei* has been developed in Japan in order to design feelings into products and according to Kim et al. (Kim & Cho 2017; Kim 2017) defined *Kansei* information as Figure 1 based on the previous *Kansei* engineering and design studies. It is postulated that individuals have a subjective innate filter considering the variety of subjectivity. This subjective innate filter separates individuals as “one individual” where by having a subjective innate filter, the inner and outer filter of an individual are separated. When human captors like the eyes, ears and nose receive a stimulus as an external feature and is considered as an outer filter, the sensor data integrates as *Kansei* information. *Kansei* information contains full perceptive data acquired by a subjective innate filter which are human sensors or modalities and the information synthesises through in the brain and comes out as reaction such as emotion or intuition. Hence, *Kansei* information as an integrated sensory data is assimilated (*Kansei* process) and is sent to the understanding process. *Kansei* presents as two types of outcome: emotion or intuition as *Kansei* information per se; decision as a result of understanding (Kim et al 2012; Kim & Cho 2017; Kim 2017). The two types of outcomes influence perceptual and conceptual fluencies as familiarity, preference, aesthetic feeling, and so on; and the two interact to impact user evaluations of a new product again through the individual

experience. As to the definition of *Kansei*, perceptual fluency originated from “external feature condition and subjective innate filter” whereas conceptual fluency originated from “the phase of the subjective innate filter”.

2. METHODS

2.1. Experiment Design

Experiments consist of three phases (1) stimuli-screening aiming to stimulate the screening for the main experiment (2) stimuli-producing for the main experiment and, (3) evaluation. In the first phase, visual and olfactory stimuli were verified its subjective sensory giving, such as sweetness, sourness, lightness, and so on. In the second phase, screened visual and olfactory stimuli were combined to form experimental stimuli according to visual-olfactory congruence degree. In the final phase, the subjects evaluated the prepared visual-olfactory stimuli using the same traits as the stimuli-screening.

2.2. Stimuli and Subjects

In the stimuli-screening phase, twenty-five essential oils and its representing photos were used as olfactory and visual stimuli. The essential oils were categorised into citrus (lime, orange, grapefruit, lemon, tangerine), floral (chamomile, lavender, jasmine, ylang-ylang, rose), herbaceous (tea tree, peppermint, eucalyptus, rosemary, basil), and woody (cinnamon, sandalwood, cedar-wood, cypress, juniper-berry) by five each (Figure 2).



Visual and olfactory stimuli which used in the stimuli-screening

Only verified visual and olfactory stimuli which presented its significance in the stimuli-screening experiment, were used in the second phase of the experiment. Which showed statistical significance in visual stimuli were, orange, lemon, tangerine, peppermint, eucalyptus, cinnamon, cedar-wood, cypress, and tea tree. The olfactory stimuli which showed a statistical significance were, cinnamon, lemon, orange, peppermint, grapefruit, basil, ylang-ylang, and chamomile. With those visual and olfactory stimuli, twelve visual-olfactory stimuli were prepared (Table 1). The olfactory stimuli, which presented a significant trait in the stimuli-screening experiment, were used in the main experiment, but L-l-, B-b-, L+l-, B+b- were excluded from the stimuli-producing process, as a reaction of disgust was reported by Japanese subjects during the stimuli-screening. The stimuli used in the main experiment were perfectly sealed in a jar with a lid. Screened essential oils were dropped in jars, and a prepared visual stimuli were firmly affixed to lids. Thirty university students participated in the experiment that consists of 20 males and 10

females with the age ranging from 19 to 22 years old (mean= 20.03, SD±0.99). All the subjects were Japanese natives.

Table 1: The attributes of visual-olfactory stimuli to be used for the main experiment

Stimuli factors		The matrix for stimuli-producing					
Visual	Olfactory	<i>SWEETNESS</i>	<i>FRESHNESS</i>	<i>SOURNESS</i>	<i>LIGHTNESS</i>	<i>BRIGHTNESS</i>	<i>PREFERENCE</i>
PV Positive Visual	PO Positive Olfactory	+s+s	+f+f	+so+so	+l+l	+b+b	+p+p
NV Negative Visual	NO Negative Olfactory	-s-s	-f-f	-so-so	-l-l	-b-b	-p-p
PV Positive Visual	NO Negative Olfactory	+s-s	+f-f	+so-so	+l-l	+b-b	+p-p
NV Negative Visual	PO Positive Olfactory	-s+s	-f+f	-so+so	-l+l	-b+b	-p+p

2.3. Procedure

The subjects were informed that this was a research concerned with the Semantic Differential of sensory perception; and were carried twice including the pre-test before conducting the main experiment. It aims to evaluate the visual-olfactory stimuli, the experimenter made sure that the subjects checked the number on the lid of the jar before writing the results of their evaluation on the SD questionnaire sheet. The subjects were instructed to rate using the subjective states, which are: Each trait on below the stimulus that you will use to rate your feelings about the stimuli. The evaluation traits are: *sweetness*, *freshness*, *sourness*, *lightness*, *brightness*, and *preference*. The evaluation implemented a 6-point Likert scale as follow: strongly disagree, disagree, slightly disagree, slightly agree, agree, strongly agree.

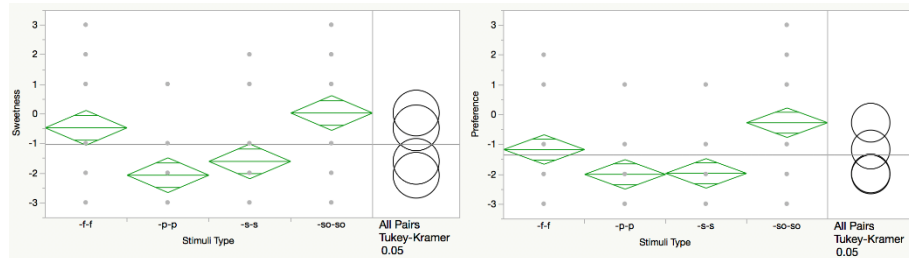
3. ANALYSIS & RESULTS

A one-way analysis of variance (ANOVA) was performed to investigate that (1) which sensory information affect stronger the evaluation values than another in each evaluation (2) which evaluation words in all six (*sweetness*, *freshness*, *sourness*, *lightness*, *brightness*, and *preference*) present a statistical significance either in general or specific.

3.1. In the NVNO Compositions

While as the evaluation words, *freshness* (p=.3136), *sourness* (p=.9601), *lightness* (p=.5838), *brightness* (p=.2293) don't present any statistical significances with the NVNO compositions, *sweetness* and *preference* present the significances (p<.0001). In an evaluation, the word *sweetness*, -so-so presents a significant difference from -p-p (p<.0001) -s-s (p=.0009). Also, -f-f shows a significant difference from -p-p (p=.0012), -s-s (p=.0388). In the evaluation, the word *preference*, -so-so presents a significant difference from -p-p (p<.0001), -s-s (p<.0001) (Figure 3).

It is reasonable to expect that *SOURNESS* consists of NVNO (NVNO-*SOURNESS*), has an affective factor to move on the contrary to *FRESHNESS*, *PREFERENCE*, and *SWEETNESS* consist of NVNO, in *sweetness* and *preference* evaluations.

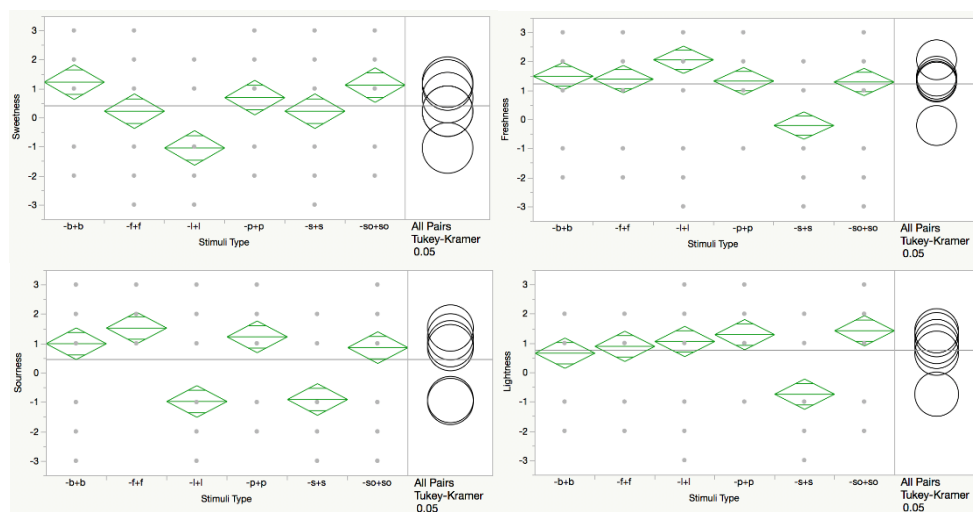


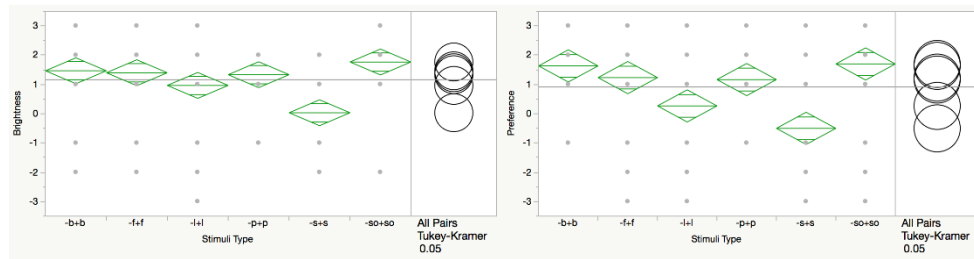
The significant values in the NVNO Compositions

3.2. In the NVPO compositions

Sweetness ($p < .0001$), *freshness* ($p < .0001$), *sourness* ($p < .0001$), *lightness* ($p < .0001$), *brightness* ($p < .0001$), and *preference* ($p < .0001$) presents a significant difference with the NVNO compositions. In the evaluation, the word *sweetness*, -l+l presents a significant difference from the others. In the evaluation, the word *freshness*, -s+s presents a significant difference from the others. In the evaluation, the word *sourness*, -f+f, -p+p, -b+b, and -so+so presents a significant difference from -l+l, -s+s ($p < .0001$, $p = .0001$). In the evaluation, the word *lightness* and *brightness*, -s+s presents a significant difference from the others. In the evaluation, the word *preference*, -s+s presents a significant difference from -so+so, -b+b ($p < .0001$), -f+f ($p = .0003$), -p+p ($p = .0005$); also -l+l presents a significant difference from -so+so ($p = .0049$), -b+b ($p = .0086$) (Figure 4).

SWEETNESS consists of NVPO (NVPO-*SWEETNESS*), affects all evaluation words except *sweetness* whereas in the evaluation, the word *sweetness*, *LIGHTNESS* consists of NVPO (NVPO-*LIGHTNESS*) has a significant difference from the others. In the evaluation, the word *sourness*, NVPO-*LIGHTNESS* and NVPO-*SWEETNESS* shows a statistical significance from the others.



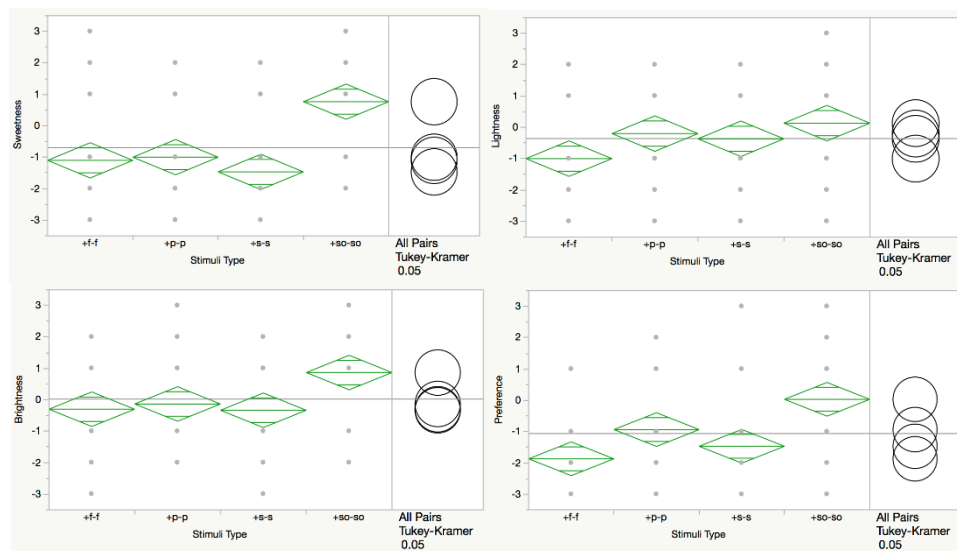


The significant values in the NVPO Compositions

3.3. In the PVNO compositions

While *freshness* ($p=.1732$), *sourness* ($p=.1846$) don't present any significances in the PVNO compositions, evaluation words *sweetness* ($p<.0001$), *lightness* ($p=.0454$), *brightness* ($p=.0074$), and *preference* ($p<.0001$) present the significances. In an evaluation of the word *sweetness*, +so-so presents a significant difference from +s-s, +f-f, +p-p ($p<.0001$, $P=.0001$). In an evaluation of the word *lightness*, +so-so presents a significant difference from +f-f ($p=.0302$). In an evaluation of the word *brightness*, +so-so presents a significant difference from +s-s ($p=.0145$), +f-f ($p=.0186$). In an evaluation of the word *preference*, +so-so presents a significant difference from +f-f ($p<.0001$), +s-s ($p=.0009$) (Figure 5).

The results show that *SOURNESS* consist of PVNO (PVNO-SOURNESS), has a statistical significance in the evaluation words *sweetness*, *lightness*, *brightness*, and *preference*.



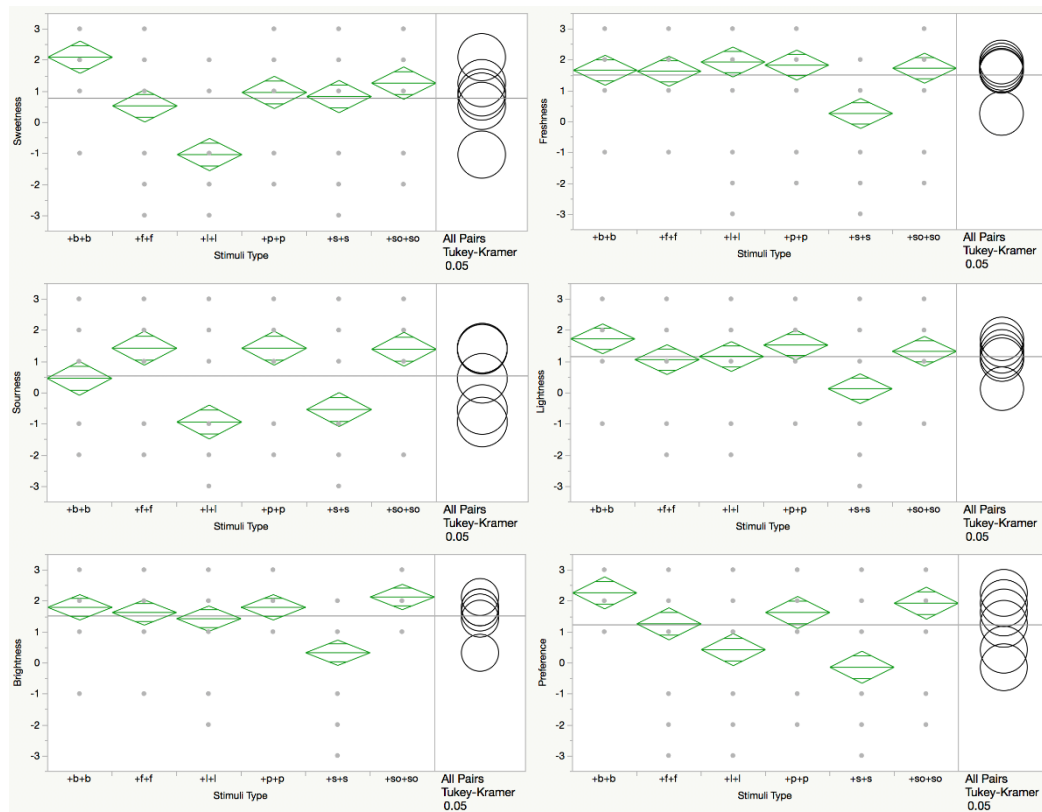
The significant values in the PVNO Compositions

3.4. In the PVPO compositions

Sweetness, *freshness*, *sourness*, *lightness*, *brightness*, and *preference* values present the significances ($p<.0001$). In an evaluation of the word *sweetness*, +l+l presents a significant difference from +b+b, +so+so, +p+p, +s+s. ($p<.0001$) and +f+f ($p=.0006$). Also, +b+b presents a significant difference from +f+f ($p=.0006$), +s+s ($p=.0106$), +p+p ($p=.0319$). In an evaluation of the word *freshness*, +s+s presents a significant difference from +l+l ($p<.0001$), +p+p ($p=.0002$), +so+so

($p=.0006$), $+b+b$ ($p=.0012$), $+f+f$ ($p=.0017$). In an evaluation of the word *sourness*, $+l+l$ presents a significant difference from $+f+f$, $+p+p$, $+so+so$ ($p<.0001$), $+b+b$ ($p=.0059$). Also, $+s+s$ presents a significant difference from $+f+f$, $+p+p$, $+so+so$ ($p<.0001$). In an evaluation of the word *lightness*, $+s+s$ presents a significant difference from $+b+b$ ($p<.0001$), $+p+p$ ($P=.0009$), $+so+so$ ($p=.0075$), $+l+l$ ($p=.0340$). In an evaluation of the word *brightness*, $+s+s$ presents a significant difference from $+so+so$, $+b+b$, $+p+p$ ($p<.0001$), $+f+f$ ($p=.0002$), $+l+l$ ($p=.00032$). In an evaluation of the word *preference*, $+s+s$ presents a significant difference from $+b+b$, $+so+so$, $+p+p$ ($p<.0001$), $+f+f$ ($p=.0030$). Also, $+l+l$ presents a significant difference from $+b+b$ ($p<.0001$), $+so+so$ ($p=.0011$), $+p+p$ ($p=.0030$) (Figure 6).

The results show that PVPO-SWEETNESS has a significance in all evaluation words except *sweetness*. PVPO-LIGHTNESS has a significance in the evaluation words *sweetness*, *sourness*, and *preference*.



The significant values in the PVPO Compositions

4. DISCUSSION & CONCLUSION

From the results, it shows that (1) NVNO-SOURNESS shows a contrary effect to NVNO-FRESHNESS, NVNO-PREFERENCE, and NVNO-SWEETNESS in sweetness and preference evaluations (2) NVPO-SWEETNESS affects all evaluation on all words except *sweetness* whereas, NVPO-LIGHTNESS has a significant difference from the others with *sweetness*. In an evaluation word *sourness*, NVPO-LIGHTNESS and NVPO-SWEETNESS show significant differences from the

others (3) The results present that PVNO-SOURNESS has a statistical significance in the evaluation words *sweetness*, *lightness*, *brightness*, and *preference* (4) The results show that PVPO-SWEETNESS has a significant difference in all evaluation words except *sweetness*. PVPO-LIGHTNESS has a statistical significance in the evaluation words *sweetness*, *sourness*, and *preference*.

Table 2: The visual-olfactory values showing a significance in each evaluation

<i>Sweetness</i>	<i>Freshness</i>	<i>Sourness</i>	<i>Lightness</i>	<i>Brightness</i>	<i>Preference</i>
PVPO-LIGHTNESS	PVPO-SWEETNESS	PVPO-SWEETNESS PVPO-LIGHTNESS	PVPO-SWEETNESS	PVPO-SWEETNESS	PVPO-SWEETNESS PVPO-LIGHTNESS
NVNO-SOURNESS					NVNO-SOURNESS
PVNO-SOURNESS			PVNO-SOURNESS	PVNO-SOURNESS	PVNO-SOURNESS
NVPO-LIGHTNESS	NVPO-SWEETNESS	NVPO-SWEETNESS NVPO-LIGHTNESS	NVPO-SWEETNESS	NVPO-SWEETNESS	NVPO-SWEETNESS

The findings as of Table 2 present that (1) PO-LIGHTNESS as the quality of having weight, affects the evaluation words *sweetness* and *sourness*. Also, PO-LIGHTNESS as the quality of having weight, affects the evaluation of the word *preference* only with PV-LIGHTNESS (2) PO-SWEETNESS is more affective that PV-SWEETNESS or NV-SWEETNESS. PO-SWEETNESS has negative effects on the evaluation of the word *sweetness*. It is reasonable to expect that PO-SWEETNESS is more effectible stimuli except as the same value as *sweetness* (3) NO-SOURNESS affects in *sweetness* and *preference*. PVNO-SOURNESS affects positively on the evaluation of *sweetness*, *lightness*, *brightness* and *preference*.

The goal of the present paper is not to solve daily life problems related to housing, food, ageing, transports or work, but is to acquire a place for creating a “pleasing” feeling in our daily lives in the design process for transformation as the debate on the acknowledgement of the methods to apply an individual feelings or emotions to design, that includes products can’t be fully designed and pre-determined. Through the research, it is verified that negative feelings from visual information is modifiable with positive olfactory information in the case of *LIGHTNESS* and *SWEETNESS* conditions. Furthermore, negative feelings from olfactory information affects *sweetness* feelings. What does *sweetness* mean for humans? And what do *SWEETNESS*, *SOURNESS* and *LIGHTNESS* mean for human beings in their daily lives? Further research will be focused on these issues.

ACKNOWLEDGEMENTS

This work was supported by JSPS KAKENHI16H07097.

REFERENCES

- Buchanan, R., & Margolin, V. (1995). *Discovering design: Explorations in design studies*. University of Chicago Press
- Bule, L. (2013). *The user experience team of one: A research and design survival guide rosenfeld media*. 1st edition (July 9) p 9
- Cross, N. (2007). *Designerly ways of knowing*. Birkhäuser Basel
- Gregan-Paxton, et al. (2005). When categorization is ambiguous: Factors that facilitate the use of a multiple category inference strategy. *Journal of Consumer Psychology*, 15(2), pp 127-40
- Hassenzahl, M. (n.d.). Chapter 3. *User experience and experience design*. The Encyclopaedia of Human-Computer Interaction (2nd Ed)
- Hoeffler, S. (2003). Measuring preferences for really new products. *Journal of Marketing Research* (November) pp 406-20
- Hummels, C., & Frens, J. (2009). The reflective transformative design process. *Proceeding of CHI EA 2009: Extended Abstracts on Human Factors in Computing System* pp 2655-58
- Pahl G, et al. (2007). *Engineering design—A systematic approach* (Springer)
- Kant, I. (2008). *Critique of pure reason*. Penguin Classics; Revised edition 37 (a), 23 (b)
- Kim, S., et al. (2016). Integrating affective values to sustainable behaviour focused on Kansei engineering. *The International Journal of Sustainable Engineering UK*, 9(6), pp 378-389
- Kim, S., & Cho, Y. (2017). towards enhanced affective design: Rethinking the notion of design. *The proceeding of International Conference on Design Engineering and Product Innovation*
- Kim, S. (2017). Design for transformation by minding the gap between visual and olfactory perception. *World Design Summit 2017* (Montreal Canada 10.16-20)
- Lee, A., & Aparna, A. (2004). The effect of conceptual and perceptual fluency on brand evaluation. *Journal of Marketing Research*, 41, pp 151-65
- Meyers-Levy, Tybout. (1989). Schema Congruity as a Basis for Product Evaluation. *Journal of Consumer Research*, 16(1), p 39
- Reber, R., et al. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, 8(4), pp 364-82

SENSATION AND PERCEPTION IN SURFACE USING KANSEI SURFACE PROPERTIES, ENGINEERING

L Eriksson^{1,2}, B-G Rosen^{2,1}, M Bergman¹

¹Jönköping University, Industrial Design, Product Development Department

²Halmstad University, Functional Surfaces Research Group

lars.eriksson@ju.se

ABSTRACT

Aesthetic properties of a product add significantly to meaning and relevance of a product. In this study, Affective Surface Engineering is used to illustrate and model the link between customer expectations and perception to controllable product surface properties. The results highlight the use of the Soft metrology concept for linking physical- and human factors contributing to the perception of products. In conclusions of the study, future research in Soft metrology is proposed to allow understanding and modelling of product perception and sensations.

Keywords: *Surface Texture, Affective Engineering, Industrial Design, Kansei, Surface, Perception*

1. INTRODUCTION

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations. Consumer decisions when choosing a product comprise of a complexity of aspects including experience controlled by our five senses, fulfilling of functional requirements, and gestalt, describing the sum of the product properties. Here, tools and methods to measure customer satisfaction and link it to physical properties of products are of great interest.

The widely implemented ISO 9001 series are based on seven quality management principles whereof the first is **Customer focus**. *“Sustained success is achieved when an organization attracts and retains the confidence of customers and other interested parties on whom it depends. Every aspect of customer interaction provides an opportunity to create more value for the customer.*

Understanding current and future needs of customers and other interested parties contributes to sustained success of an organization” [1].

Form, colour, gloss, material and texture selection are examples of critical product properties; and communicate a meaning to the customer. Well-polished metal surface and finely woven clothes may be examples of product properties specially designed to be appealing to the human sense of visual feedback and touch from products aiming at an exclusive high-quality market [2].

Material- and manufacturing selection is a complex process involving stakeholders from designer to, producer and user groups. Zoom into the material beyond what we can see with the naked eye, and the micro structure will expose a landscape in the sub mm scale affecting us as customers and users in a subtle way. When observing patterns, regularities in this semantic landscape and see relationship and correlations to certain experiences, these can obviously be represented by clustered words, here called Kansei words.

The aim of the paper is to present the importance and context of “Affective Engineering” and to support the discussion of continued research in the field –addressing the problem of the absence of a current joint approach to affective surface engineering in general.

2. EMOTIONS AND PRODUCT EXPERIENCE

2.1. From stimuli to sensation

The combined sensation of a products’ surface gloss, colour, haptic properties like “friction”, “elasticity”, “hardness”, and “temperature”, create an intended message to the customer received as a stimuli (R) by the human five senses, transformed to psychological sensation (S). The Psychological Sensation (S) was expressed in “Fechner’s law” as: $S=k \log R$ (1) where k is a constant and the Sensation following a logarithmic function where small differences in stimuli create a larger variation of sensation than for changes of stimuli at higher values [3].

Later S.S. Stevens at Harvard developed a similar model – “Stevens’ power law”, sensitive to that different types of stimuli follow different curve shapes to Psychological sensation: $S=al^b$, (2) where a is a constant, b is a stimuli exponent varying with the type of stimulation (visual, haptic, smell, taste, or audio) and l is the stimulus energy related to Stimuli (R) the “Fechner’s law” in eq.1 above [4]. So to convey a “message” strong enough to the customer, thresholds for the lowest detection level of changes in stimuli and the function relating the stimuli to psychological sensation are important to understand.

Questions needed to be answered related to surface engineering are the minimum roughness of a handle the customer can sense and the differences of texture roughness allowing a handle with two textured parts to be perceived as having the same haptic roughness sensation, i.e defining

thresholds for texture sensation and tolerance in relation to customer expectations and satisfaction.

2.2. Aesthetics and semantic scales to rate attitude

Aesthetics can be explained as the human perception of beauty, including sight, sound, smell, touch, taste, and movement, and the interpretation of the impression. But can also be explained as how a product present itself, its expression. Hidden factors controlling appreciation of beauty have been discussed by philosophers since the Ancients and was established as a subject of science when Osgood et al introduced the semantical differential method used to quantify people's perception of a product [5]. Here, a semantic scale composed of polar opposite adjective pairs separated by a five to seven point rating scale is used. For example, a customer could rate the perception and interpreted attitude to a product by grading adjective pairs (rough to smooth, cold to warm, dark to bright) on 7 grade scales. Semantic scales could then be evaluated using e.g. principal component analysis (PCA), to draw general conclusions of attitudes and separate them from more specific and subjective interpretations of surface properties.

2.3. Motivation and need

However, one important component affecting the Aesthetics and attitude to the products is the customers' need or motivation. Motivation and need of a customer was discussed by Maslow [6]. Here, 5 levels of motivation (Biological- and psychological needs, Safety needs, Belonging and love needs, Esteem needs and Self actualisation) were accentuated. If the psychological sensation (S) triggered by the physical stimuli matches the customers' expectation at the present motivation "level", the attitude to the product would be positive.

3. THE INTENDED PRODUCT MESSAGE

3.1. Designing the customer motivation

Schutte [7] added to the discussion of needs of the customer also the pleasures of motivation by Jordan's "4 pleasures" [8] -Physio – to do with the body and the senses. Psycho – to do with the mind and the emotions. Socio – to do with relationships and status and Ideo – to do with tastes and values. Jordan's 4 groups complete Maslow's five steps and their fulfilment at the different motivation levels is of importance when designing customer motivation into the product.

3.2. Design parameters and intention –the Affective Engineering Equalizer

Our motivation for- and how we perceive a product is strongly linked to the customers' "buy" decision. Industrial design methodology aims at creating this motivation and pleasurable product experience including meaning and message for the customer [9,10,11].

The aesthetic and pleasing properties of a product are of major importance in order to create motivation, interest, meaning and relevance of a specific product for the customer. Since there almost always exist alternative competitive products that fulfil basic required functionalities, the

intended design of product properties towards increased customer motivation is one way of “making a difference” and standing out from the competition. The “Equalizer” introduced by Bergman et al. [12] in fig. 1 below, is a tool to visualize the relative importance of design element properties (form, material, colour and surface); how they are used and tuned for a given product to create the intended motivation, meaning and message, i.e. the aesthetics and core values, intended by the industrial designer.

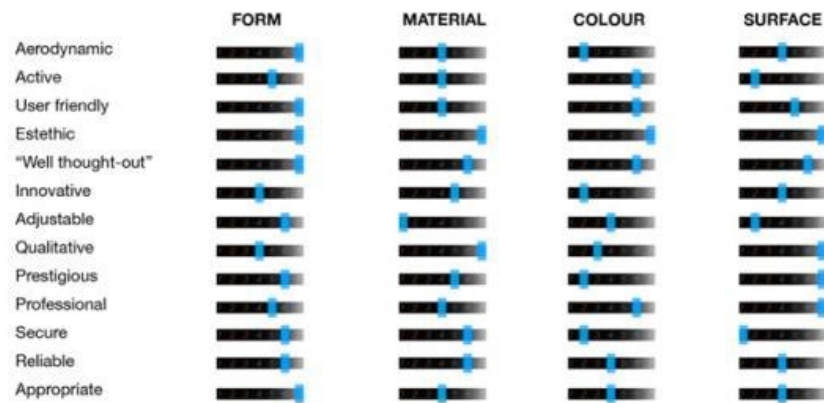


Fig. 1. The Equalizer with the design elements (horizontal scale) and the product intended core values or “product message” (vertical scale) and how the “tuning” of the “equalizer” setting creates the total perception and aesthetics of a product [12].

In the example from figure 1 above, the 13 core values are adjectives decided by the designers to define the product message of a roof-mounted bicycle carrier for the automotive industry

[13]. The design element surface is decided to have its highest importance on “user friendliness”, “aesthetics”, “well-thought out”, “quality”, “prestige”, and “professional” and consequently surface properties like gloss, average roughness, texture, on the final product needed to be verified towards those core values for the successful product.

3.3. Ideaesthesia, and semantics, connecting design elements and product experience

Ideaesthesia can be defined as the phenomenon in which activations of concepts results in a perception-like experience [14] To objectively and transparently judge and measure how the specification of physical design elements create the expected subjective customer perception, i.e. creating ideaesthesia, is a complex task involving both physical metrology and perceptual evaluations. An example of ideaesthesia is the experiment made by the psychologist Wolfgang Köhler in 1929 [14], showing the

strong correlation between the visual shape of an object and the speech sound (see below figure 2, top and middle) named the “Bouba-Kiki” effect. The word Lumumba is normally connected to the top and middle right “soft-large radii contour shape” image and the word Takete with the top and middle left “sharp angle, straight line contour shape” image. Today, a strong belief in the industrial designers’ expertise and intuitive ability to make judgement exists and is regarded as “tacit” knowledge based on skills, ideas and experiences hard to formalise for an organisation.

A tool used frequently within the discipline of industrial design and strongly related to the ideaesthesia, to explain and formalise aesthetic knowledge is “Semantics” , - the study of meaning and the relation between design elements and signifiers, like words, and symbols, and the correlation in between.

As an example of design semantics connecting design elements to core values –adjectives, is the “softening” of the perceived visual sensation in figure 2 from a sheet metal surface by mimicking a “soft” natural hair texture (bottom left) with the Angel Hair™ texturing¹ (bottom mid), compared to the more traditional “hard” “Taketeish” brushed steel texture (bottom right).



Fig. 2. Lumumba–Takete or Bouba-Kiki words (top and middle) and the meaning of form which has a strong connection to product experience. Takete to the left and Lumumba to the right. Beside is a typical soft hair texture (left) and the Angel Hair™ (middle) steel texture, mimicking hair and a brushed uni-directional steel texture (right).

3.4. Perceptual Product Experience, modelling the products’ intended message

Perceptions involve any or all of the five senses. Understanding the structure of how this works can create a more robust and controlled process when designers create new concepts for a predicted user experience. The Framework of Perceptual Product Experience (PPE framework) [9,16] considers perceptual product experience as composed of three core modes; the sensorial mode including perceptions of stimuli experienced with any of the receiver senses, the cognitive mode, we understand, organise, and interpret and make sense of what we perceive, and finally the affective mode concerns itself with experiences that are affective: feelings, emotions, and mood states, as result of product perceptions (see fig. 3, mid, below).

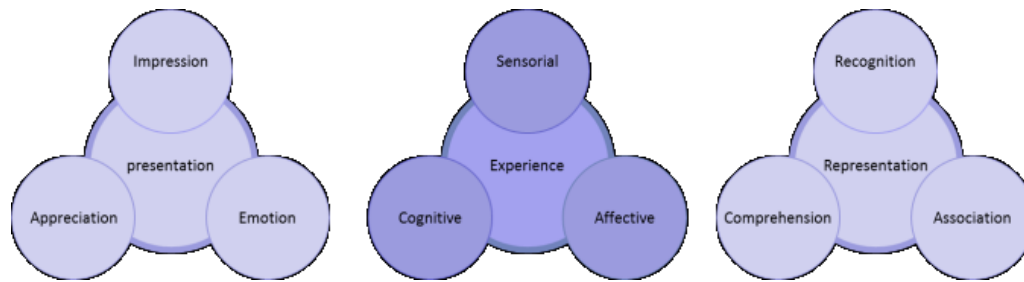


Fig. 3. The Framework of Perceptual Product Experience (PPE), after [9,16].

The PPE model in figure 3 below, illustrates a model for the intended product communication between the Producer and the Consumer. I.e. how the industrial designers' intended product message, semantics, expressed as core values, adjectives and converted into design elements with controlled properties creating consumer sensations, and ideally results in ideaesthesia, a pleasurable experience of the product at the customers motivation level.



Fig.4. The figure illustrating a model for Intended product communication linked to the PPE Framework.

4. A “SOFT METROLOGY” FRAMEWORK TO MEASURE TOTAL APPEARANCE

4.1. Soft metrology –the measurement of customer satisfaction

Soft Metrology, is defined as “the set of techniques and models that allow the objective quantification of certain properties of perception, in the domain of all five senses” [17]. Soft metrology addresses a broad range of measurement, outside of the traditional field of physical metrology [17].

- psychometric measurement or perceived feeling (color, taste, odour, touch),
- qualitative measurements (perceived quality, satisfaction, comfort, usability),
- econometrics and market research (image, stock exchange notation), sociometry (audience and opinion),

- measurements related to the human sciences: biometrics, typology, behavior and intelligence.

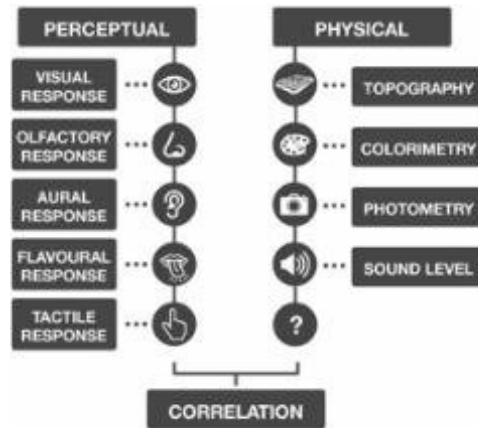


Fig.5. Soft metrology, correlating the objective physical measurements to human subjective perceptions, after [17].

Here the human would be considered as a measurement system defining sensitivity, repeatability and reproducibility and comparing the results with those obtained by methods from traditional “hard” physical metrology.

The notion of subjectivism can of course be discussed further related to figure 4 above. Parts of what is described as subjective, specific human responses in the figure above, can actually be described as universal and general perception, though subjective. Perceptions that can be generalized and therefore universal can be explained as “agreements” of how things are, like a clear distinction between milk, yoghurt and wine, not to be mixed up with preferences of the same in different contexts or time of the day.

The area of soft metrology has got a lot of attention and departments was formed both at the standards institutes NIST in USA and NPL in England [17,18,19] an European project - Measuring the Impossible (MINET) 2007-2010 with 22 partners from Europe and Israel including industries and academia as well as the national standards institutes in Great Britain, NPL and in Sweden SP [20]. In 2013 also L. Rossi published her doctoral thesis – “Principle of Soft Metrology and Measurement procedures in humans” stating the importance of the field [21].

4.2. Total appearance

Appearance is according to American Society for Testing and Materials (ASTM) [22] defined as “The aspect of visual perception by which objects are recognised”.

The visual appearance of an object is a result of the interaction between the object and the light falling upon it. Colour appearance is a result of the light reflection and adsorption by the pigments. Gloss is created by the reflection of light from the surface, and translucency is a result of the light scattering while the light passes through the object (fig. 6). The described complexity of the object's appearance causes different measurement technologies and instruments to be employed when attempting to quantify it [17]. Texture is a complementary component of the visual appearance and also needs to be considered.

The concept of total appearance, has been introduced to extend the concept of the appearance of an object. The total appearance, however, would require a description of the shape, size, texture, gloss and any other objects' properties possible to detect by our 5 senses (visual, haptic, smell, sound and taste) and interpreted by the brain as a "total appearance" of an object [17,23].

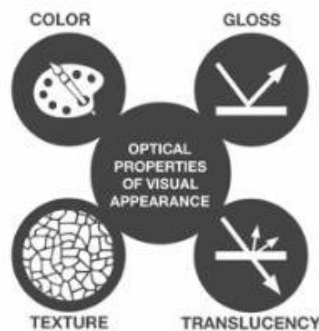


Fig.6. Visual appearance is one aspect of the total appearance. Here, the four basic optical properties (colour, gloss, texture and translucency) of visual appearance are grouped together.

The total appearance (fig. 7) could also be described as a combination of three aspects of appearance:

Physical aspect-physically detectable by our senses, Physiological aspect - creates a sensation via cortex (the neural effect when human receptors are subjected to the physical stimuli and convey signals to the cerebral cortex), creates a sensation via cortex

Psychological aspect created when sensations are interpreted by the cortex,

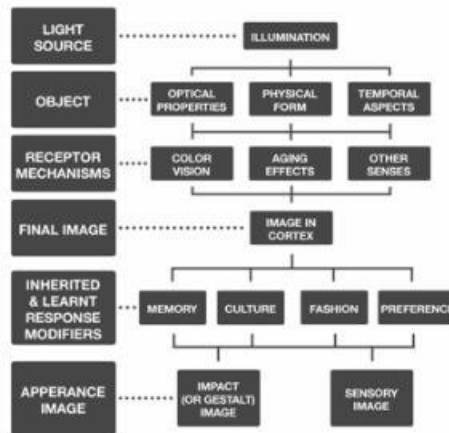


Fig.7. The concept of total appearance, after [17].

-the impact image, and the sensory image. The impact image is the initial recognition of the object or scene (the gestalt), plus an initial opinion or judgement. For the sensory appearance image, three viewpoints are used to create the total appearance, sensory, emotional and intellectual. The sensory viewpoint describe thoughts associated with the design elements of the object. The emotional viewpoint works the same, while the intellectual viewpoint covers other aspects associated to the object and situation rather than sensory or emotional associations [24,25].

Total appearance is closely related to the models of Intended product communication, and the Perceptual Product Experience (PPE) framework and could be used when quantifying customer perception and satisfaction using soft metrology to correlate physical and human factors contributing to products appearance images.

5. AFFECTIVE ENGINEERING, - TO MEASURE TOTAL APPEARANCE AND CONTROL THE CUSTOMER SATISFACTION

5.1. Quality Function Deployment and Kano to understand psychological sensation

After Osgood's publications [5] more methodologies e.g. Quality Function Deployment, QFD, and the Kano model were developed with similar motivation [26,27]. Those methods are very capable of dealing with psychological sensation but not as capable when it comes to translating the subjective sensation into design parameters i.e. real product features influencing the perceived sensation.

5.2. Kansei engineering –from subjective sensations to design parameters and total appearance

By using the framework of "Kansei-" Engineering (KE) [28,29,30,31]. as an approach and focusing on finding correlations between the functions; customer requirements, function requirements, design requirements and process requirements; a higher level of user quality and a methodology for soft metrology as discussed above could be obtained. According to Nagamachi the Kansei concept includes; "a feeling about a certain something that likely will

improve one's quality of life". KE can also be defined as a customer-oriented approach to product development. The basic idea is that; the client's feelings shall be observed already at the phase of idea generation in the product development process, which then facilitate the project later on when a concept reaches the production stage.

Kansei engineering handles 6 different phases/steps [12,28,29,30,31]., starting with the definition of the products' domain and context, see figure 8 below:

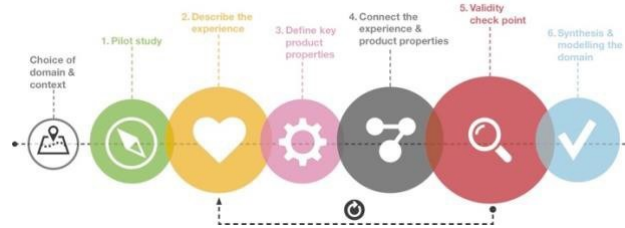


Fig.8. The Kansei based research approach and 6 different phases.

The 6 phases range from a pilot study where the product or service is defined including specification of the product and market, to synthesis and modelling the result of the given study. A full project ranging over all the 6 phases of Kansei engineering will result in a model or prediction of the total appearance or a limited sector of the total appearance, e.g. visual appearance or total appearance of the texture of a product within the domain selected in phase 1 of the project. Visual appearance is limited to optical factors of the product appearance while the total appearance of the texture of a product includes visual-, haptic- and other sensory aspects of the total appearance of the micro- or nanometre texture experience.

Below in following sections the Kansei methodology briefly described generally in picture 8, will be detailed and exemplified with results from current and past cases and studies to illustrate the potential of an application of affective engineering concepts on product surfaces.



5.3. Phase 1, The Pilot study, defining the domain

In this phase it is important to define product domain and users. Define and analyze: WHAT, WHO, WHERE, WHY, WHEN & HOW.

In the Pilot study The Design Compass" and persona studies as well as mood boards are used in order to make the definitions right.



5.4. Phase 2, Describe the experience

Define the Product experience (Span the semantic space) – In this phase it is important to find psychological emotions and expected total appearance and perception related to a product expressed as adjectives -"Kansei words", and grouped in logical clusters (see fig.10).

The idea of describing the product experience using adjectives is about framing the emotional functions, i.e. defining the expected perception and total appearance. To be able to do that there

is a need to “span the semantic space”, collect the expressed “emotions”, by collecting adequate describing words, which the user expresses when interacting within the product domain.



5.5. Phase 3, Define key product properties

Define Key Product Properties (Span the space of properties) – In this phase it is important to find physical product properties that affect the user. Analyse the properties of the domain • Define properties that affect • Isolate significant properties.

When the identification of the core-values and Kansei words is made, the next step is to identify properties, design elements, of the existing product that can be controlled and affect the product towards those core values. The design elements should be appropriately measurable using standardized methods and parameters like the surface texture field-, stratified- and feature parameters in accordance with acknowledged ISO 25178 series of standards.



5.6. Phase 4, Connect the experience and product properties

Connect the experience,-the Kansei adjectives, and Product physical properties– By using qualitative studies on focus groups connections between Kansei words and design elements can be made. An important tool to visualize the connection between Kansei words and design elements contributing to the total appearance is the “equalizer”.

For a given domain identified in step 1, the key product properties –design elements from phase 3 are connected to the Kansei words from phase 2, in this 4’t step by, for example, using focus groups.



5.7. Phase 5, Validity checkpoint

Validity Checkpoint – When the correlation in the Synthesis in step 4 is established, it is important to verify the results by statistical tests, experiments or virtual simulation.

The validity checkpoint is about an overall validation of the concepts total appearance, verifying quantitatively the Kansei words from phase 2 and their connection to the design elements obtained in phase 4.



5.8. Phase 1, Synthesis and modelling the domain , – Design and validation of a “prediction model”.

The final step is intended to create a model that combines, refines and describes the results from the previous five phases in the Kansei methodology. Hence, to assemble a model bridging the emotional semantic- and product properties’ space.

In this step, a design manual can be made in order to link design elements with Kansei words. [36, 37]. The design manual basically linked surface geometrical properties (the significant design elements and properties) to the Kansei words according to the results demonstrated in step 5

above. . In practice this resulted in designer rules collected in a physical booklet for the context of sauna wall panels.

6. CONCLUSIONS AND FUTURE

The aesthetic and pleasing property of products is one of the major design dimensions in order to create a meaning and relevance of a product. The correlation of objective characterization of material properties in relation to human response is the main component in Soft Metrology, a concept previously introduced and known, naming the methodology with the power of enabling affective surface engineering.

- Total experience can be used when quantifying customer satisfaction using Soft metrology correlating physical- and human factors contributing to products appearance images.
- Soft Metrology allows the objective quantification of certain properties of perception, in the domain of all five senses, i.e, a quantification method for measuring total appearance.
- Affective surface engineering using the Kansei method is effective to connect the expected sensation, using Soft metrology methods, to validated design parameters.
- The Affective-, Kansei surface engineering methodology has a great potential to help organisations to maintain customer focus by allowing industrial designers to understand and model a desired perception and total appearance of a product.

The results from the paper discuss a current direction in product development and industrial design where surface engineering and the concepts of soft metrology, total appearance and affective, Kansei, engineering are combined. Future possibilities to increase the generality and applicability lies firstly in the development of soft metrology to enable detailed understanding and modelling of the customer perception and total appearance.

Secondly, the development of software tools supporting and optimizing the 6 phases of Affective, Kansei, surface engineering will increase the accessibility and interest for the method and increase the number of performed case studies, thus increasing the knowledge in this emerging research area.

Thirdly, there exist a possibility and a need of further research into the development of the word “metrology” in soft metrology, where multisensorial physical data will be linked to human multisensorial perceptual data. Finally, the question of “How and to what level can we quality assure soft metrology data in turn assuring the quality of affective-, Kansei engineering approaches?” need to be addressed in future studies.

Acknowledgements

The authors wish to thank the companies A.Zahner Company MO USA, Tylö AB Sweden, Getinge Sterilization Sweden, for financial support as well as expert input. We would also like to thank Digital Surf France for the support with the Mountain Map software. The conducted research is financed and part of the Vinnova, The Swedish Governmental Agency for Innovation Systems, project “Robust injection moulding of automotive components with desired surface properties (SW: Robust formsprutning av fordonskomponenter med önskade ytegenskaper).

REFERENCES

- [1] ISO 9001:2015 (2015) Quality management systems — Requirements.
- [2] Nagano H, Okamoto A and Yamada Y (2013) Visual and Sensory Properties of Textures that Appeal to Human Touch International J. Affective Engineering 12 3 pp 375–384
- [3] Fechner G T (1897) *Vorschule der Aesthetik* (Leipzig, Germany: Breitkopf & Härtel)
- [4] Stevens S S, Galanter E H (1957) Ratio Scales and Category Scales for a dozen perceptual continua, J. Exp. Psychol. 56 pp 328–334
- [5] Osgood C E, George J S and Tannenbaum P H (1943) *The Measurement of Meaning* (Urbana IL USA: University of Illinois Press)
- [6] Maslow A H (1943) A theory of human motivation Psychological Review 50 4 pp 370–96
- [7] Schütte S (2013) Evaluation of the affective coherence of the exterior and interior of chocolate snacks Food Quality and Preference 29 pp 16–24
- [8] Jordan P W (2002) *Designing Pleasurable Products: An Introduction to the New Human Factors* (London, England: Taylor & Francis) (ISBN 041529887-3)
- [9] Monö R (1997) *Design for Product Understanding* (Stockholm, Sweden: Liber) (ISBN 9789147011056)
- [10] Krippendorff K (2006) *The Semantic Turn – a New Foundation for Design* (Boca Raton, Florida, USA: CRC Press) (ISBN 9780415322201)
- [11] Vihma S (1995) *Products as Representations: A Semiotic and Aesthetic Study of Design Products* (Helsinki Finland: Helsinki University of Art and Design)
- [12] Bergman M, Rosén B-G and Eriksson L (2012) Surface appearance and impression Proc. Int. Conf. on Kansei Engineering and Emotion Research (KEER 2012) (Penghu, Taiwan 22–25 May) ed Feng-Tyan Lin (ISBN 978-986-03-2488-4)
- [13] Claesson O (2008) *Nästa generation takmonterad cykelhållare (SW: Next generation roof mounted bike carrier for cars)* Master thesis (Jönköping University, Jönköping Sweden)
- [14] Köhler, W (1929) *Gestalt Psychology* (New York: Liveright)
- [15] Gómez M E, Iborra O, de Córdoba M J, Juárez-Ramos V, Rodríguez Artacho M A and Rubio J L (2013) The Kiki-Bouba effect: A Case of Personification and Ideasthesia J. Consciousness Studies 20 1–2 pp 84–102
- [16] Warell A (2008) *Modelling Perceptual Product Experience – Towards a Cohesive Framework of Presentation and Representation in Design Design & Emotion 2008* Proc. 6th Int. Conf. Design & Emotion (Hong Kong, Hong Kong Polytechnic University, 6–9 October)
- [17] Pointer M R (2003) *New Directions – Soft Metrology requirements for Support from Mathematics, Statistics and Software: recommendations for the Software Support for Metrology programme 2004–2007* NPL Report CMSC 20/03 (Teddington: National Physical Laboratory) (ISSN 1471-0005)
- [18] Krynicki J C (2006) Introduction to “soft” metrology: A CIE challenge of Soft Metrology, 18th IMEKO World Congress Metrology for a sustainable development, (Rio de Janeiro, Brazil, 17– 22 September)

- [19] Eugène C (2008) Measurement of “Total Visual Appearance”: A CIE Challenge of Soft Metrology 12th IMEKO TC1 & TC7 Joint Symposium on Man, Science & Measurement (Annecy, France, 3–5 September)
- [20] European Commission (2007) Measuring the Impossible EUR22424 European Communities (ISBN 92-79-03854-0)
- [21] Rossi L (2013) Principle of Soft Metrology and Measurement Procedures in Humans Ph.D. Dissertation (Politecnico di Torino, Turin, Italy)
- [22] ASTM E284 (2002) Standard terminology of appearance, American Society for Testing and Materials.
- [23] McKnight M E, Martin J V, Galler M, Hunt F Y, Lipman R R, Vorburger T V and Thompson A (1997) Workshop on advanced methods and models for appearance of coatings and coated objects, J. Res. of the National Institute of Standards and Technology 102 (4) pp 489-498
- [24] Hutchings J B (1977) The Importance of visual appearance of foods to the food processor and the consumer I, Journal of Food Quality, 1 (3) pp 267-278
- [25] Hutchings J (1995) The continuity of colour, design, art, and science I, The philosophy of the total appearance concept and image measurement, Color Research & Application, 20(5) pp 296-306
- [26] Akao Y (1994) Development History of Quality Function Deployment The Customer Driven Approach to Quality Planning and Deployment (Minato, Tokyo Japan: Asian Productivity Organization) p 339 (ISBN 9283311213)
- [27] Kano N Nobuhiku S Fumio T and Shinichi T (1984) Attractive quality and must-be quality J. Japanese Society for Quality Control (in Japanese) 14 2 39–48 (ISSN 0386-8230)
- [28] Nagamachi M and Lokman A M (2011) Innovations of Kansei Engineering (Boca Raton, Florida, USA: CRC Press) (ISBN 1439818665)
- [29] Nagamachi M (1997) Kansei engineering and comfort Int. J. Ind. Ergonomics 19 pp 79-80
- [30] Nagamachi M (2002) Kansei engineering as a powerful consumer oriented technology for product development Applied ergonomics, 33 3 pp 289-294
- [31] Lokman A M (2010) Design & Emotion: The Kansei Engineering Methodology Malaysian J. of Computing 1 1 pp 1-12 (ISSN: 2231-7473)
- [32] Rosén B-G, Bergman M, Skillius H, Eriksson L and Rake L (2011) On Linking Customer requirements to Surfaces – Two Industrial- and Engineering Design Case Studies Proc. 13th Int. Conf. on Metrology and Properties of Engineering Surfaces (Twickenham Stadium, Teddington, UK, 12-15 April) ed R Leach pp 131-135
- [33] Bergman M, Rosén B-G, Eriksson L and Anderberg C (2014) Surface design methodology: challenge the steel J. Phys.: Conf. Ser. 483 011001 doi:10.1088/1742- 6596/483/1/011001
- [34] Bergman M, Rosén B -G , Eriksson L and Anderberg C (2014) Surface Design Methodology – The Cleanability Investigation KEER2014 Proc. 5th Kansei Engineering & Emotion Research (Linköping Sweden 11-13 June) ed S Schutte
- [35] ASME (2009) Bioprocessing Equipment (BPE)
- [36] Bergman M, Rosén B-G and Eriksson L (2015) Affective Surface Engineering – the art of creating emotional response from surfaces. Proc. 15th Int. Conf. on Metrology and Properties of Engineering Surfaces (Charlotte, USA, 2-5 March) ed C J Evans
- [37] Rosén B-G, Fall A, Rosén S, Farbrot A, Bergström P (2013) Topographic modelling of haptic properties of tissue product J. Phys.: Conf. Ser. 483 011001 doi:10.1088/1742-6596/483/1/012010.

A CASE STUDY OF THE FASHION SHOW CURATORIAL AND EXPERIENCE MARKETING THE PERSPECTIVE OF THE ACTOR NETWORK THEORY

Hui Huang SHU ^{*a}, Chiang Chang TZU ^b

^a National Taiwan University of Arts, Taiwan, shhuang@textiles.org.tw

^b National Taiwan University of Arts, Taiwan, chang.tc0214@msa.hinet.net

ABSTRACT

The aim of this study is to explore the fashion show of the QUALIA design and business experience marketing through the actor network theory (ANT). This study uses case study to explore business sponsorship fashion show activities. The participants can build through the atmosphere, emotional space to create, meticulous fashion curatorial design, to experience the meaning of culture and creativity. This study establishes the action network process of the fashion show activity and the commercial experience marketing innovation service. Different from the past fashion show focused on specific people or things concerned. Follow the different actors observe the dynamic changes in the participation process. The results thinking from network of actors both human and non-human actors interact with each other. Through the heterogeneous network staggered links. In this study we constructed the action network elements of fashion show and experience marketing. The commercial fashion show experience marketing activities, through the ANT heterogeneous network staggered links, (includes brand, designer etc.) active participants, and (exhibition supermodel, media celebrity etc.) passive participants to maintain the relationship between the actors. The actor's network translation process, both the human and non-human actors interact with each other, the actor's active role in the value of the interests of the action, but not necessarily equal relationship. And through the expansion of the actors to create a stronger network system, can be fashion industry network structure and relationship to effectively adjust and change. Construction of fashion experience marketing value connotation of the action network service network system.

Keywords: Fashion Show, QUALIA, Actor Network Theory (ANT)

* Corresponding author.

1. INTRODUCTION

Fashion show is to connect clothing, performers, story situations, in specific space with hardware equipment, carrying extra skills, to achieve the design of the creative theme and purpose of the presentation. The use of catwalk on the stage, the decorations, performance techniques, combined with the participants of the inherent emotional perception. Fashion show through the curator design to create the situation and tell the story, will people, things, emotions into the art and design creative experience. Fashion show curator in cultural and creative life plays an important role, is to build the audience and designers, brands and consumers, business and media communication between the communication bridge, not only to provide fashion trends and life style aesthetic experience, but also for the designer, brand or business to create more business value and enhance the image.

Relating to the theme of fashion show curator of the author of this series of studies, Shu Hui, Ming Chw & Tzu Chiang (2016) proposed Qualia into the Fashion catwalk case analysis, cultural and creative thinking is through the sensible fashion show curatorial structure, culture is the source of design thinking. The pursuit of sensibility and creative fashion show, cultural creativity is to create the root cause of moving goods. Modern fashion show must be designed to create a "touching goods" design thinking, into a "sensual creative" service field environment. At the same time from the perspective of sensory design to explore the fashion industry curator design activities of the application. Pointed out that the fashion show of the audience's perception of QUALIA emotional, including attractiveness, beauty, creativity, delicacy, and engineering of the five major levels. The target audience can internalizes the awareness of culture and creativity through atmosphere building, story-telling, perceptual-space creating, touching-experiences shaping from curatorial design of fashion industry.

The brand offers unique opportunities through experiential events to attract the target audience as a strategy for brand marketing. More brands to create service value, the audience in the experience to strengthen brand identity and brand perceived quality. Yang B. T. & Tang H. L. (2016) from the point of view of experiential marketing into the fashion show full range of dynamic experience. This paper puts forward five structural priorities of experiential marketing, which are sensory experience, association experience, action experience, thinking experience, emotional experience factor. Easy to plan for a better experience both different fashion dynamic show, and creating a unique brand value. Therefore, this study to commercial sponsorship fashion show curatorial activities as a case study, through the ANT to explore the relationship between fashion show design and business experience marketing. In the actor network system, the human and non-human actors interact with each other. The purpose of the study is to understand the fashion show marketing innovation, to construct the action network of the dynamic fashion show curator design, and to explore the connotation and value relationship of experiential fashion show curatorial.

2. LITERATURE REVIEW

2.1. Fashion show and experience marketing

The fashion show includes many elements, such as active space design (including event location, stage design, stage backplane vision, lighting, music, special effects, seating arrangements, line planning), public relations promotion (including invitations cards, celebrity participation, tickets, press releases, event posters, social networks, webcasts), performers (including model selection, performance training, walking show choreography, live performance), and brand (including brand goods, merchandise style, modelling with), and others (including the band with the staff, preservation, gifts, meals, cock-tail party) and many more elements of the design experience (Yang B. T. & Tang H. L. 2016).

The experience of creative life industry includes the creativity of service and activity, high quality beauty including field, and product creativity. Facing the experience of economic trends, fashion life industry how to use "experience" to create economic benefits and deep cultural value, is definitely worth in-depth discussion. Schmitt, B. (1999) marketing creates five different types of experiences for customers which are distinguished that marketers can create for customers. Senses can attract people's attention, emotion to make the experience into a personal connection, thinking to strengthen the understanding of the experience, action to arouse people's experience of the input, and the association which develops the experience into a broader context of meaning. Experience is achieved through the providers' action, and the goal of experiential marketing is to create experiences that integrates personal experience into the overall process.

Hui-Yun Yen & Rung-Tai Lin (2012) design is a series of communication activities, cognitive communication gap can't open then the design can be successful. Therefore, the fashion show design which landscape environment to provide visual, auditory and other stimulus. The essence of the exhibition is the spread of culture, and art is also a medium. Participate in the fashion experience and artistic enjoyment, thinking about how to experience the process, touching the strategy, through the emotional landscape and sensory products, shaping and deeply moved the customer moved. According to Brad Nierenberg, experiential marketing is trying to attract them to engage in a dialogue and two-way interaction between the consumer and brand to establish contact and interaction, business can be experienced through the activities to convey marketing strategies and ideas.

2.2. Actor network analysis the composition of the fashion show

Actor Network Theory (ANT) is a sociological analysis method proposed by French sociologists Michel Callon & Bruno Latour (1981). ANT is a heterogeneous network that studies the interaction between people and non-human actors. The construction of scientific knowledge and technology, not only by the social (interests) to decide, but at the same time by the people (society) and non-human (tools, objects, research, etc.) constitutes a variety of heterogeneous

components. They do not have a causal relationship but construct each other and co-evolve, forming a network dynamic process of heterogeneous actor network to jointly determine the construction of the expansion. Latour (1983) argues that actors are independent resource points that require the process of translation, that is to say participants must have a consistent purpose and consensus, the relationship within the network agreed to the establishment of the situation. Through the translation process is to link the scattered resource owners, and gradually expand into a strong network of actors. Callon (1986, 1991) the actor network is the result of a translation, the general consensus reached by the actors must depend on the breadth and intensity of the network being built. The key core mechanism of translation is problematization, interestment, enrolment and mobilization.

This study explores the relationship between fashion show in social life and industry. The actors of fashion show include fashion brand, designer, performer, construction worker, audio and video producer, media celebrity and consumer. The non-humans actors consists of costume exhibits, display environments, music and lighting, commercial announcements, thematic marketing and event promotion. This is a fashion show with a variety of forms of expression such as the way to publish fashion information, to provide participants with pleasure and satisfaction with the experience. From the idea of cultural and creativity, this study presents the elements of fashion show and the viewer's perception process. Fashion is by changing the design concept, color, material, modeling and other creative exhibits, through the apparels, the model to the dynamic performance performances, show people extended to the design of the main body, the use of stage, lighting, environmental space and other service landscape. Through the music, dance, drama, multimedia video design patterns to create the situation, telling-stories. The performers and participate in the audience as a whole into the art and design of the creative experience. Its composition includes the creation of moving products, creating emotional field, moved after the generation.

In the past related fashion show and exhibition curator issues, the literatures puts more attention in the analysis of clothing design applications, stage performances, fashion modeling, brand commercial and fashion awareness. In contrast, the development of today's social trends in the creative industry, mostly to fashion and art of cross-border cooperation, commodity experience also increases the value. Analysis of QUALIA Fashion show trends with ANT. The elements and characteristics of human and non-human complex heterogeneous network actors help to understand the relationship between fashion show and the relationship between the design and the relationship between action and initiative. The process of interrogation embedded interests and value, help the actors to take a positive action strategy or new development direction, and promote the network system to link and reach sustainable development.

3. RESEARCH METHOD

In this study fashion designers and business cooperation to deal with the fashion show as the subject of research, cross-industry brand sponsorship activities for the new experience marketing. Case studies are sponsored by the theme of the dynamic event activities, through the construction of professional activities landscape, as the brand activities of the participants experience platform for the activities of the curator of the action participants to study. Sample selection of internationally renowned drinking brand in 2015-2016 sponsored designer fashion shows of the theme activities for the study. The reason is that fashion activities play a leading aesthetic trend and creative life. Past fashion shows the majority of the focus of individual events, mostly for the design of creative meaning or commercial promotion. Based on the view of the actor network, this study is not only concerned about the translation mechanism of the active actors and the network dynamics and processes generated by them. In particular to highlight the development of foreign trade activities and the actors involved in the brand association and create value of the activities of the experience of perception.

The samples were purposive sampling, and sampling conditions for the 2015-2016 brand sponsorship fashion event. For the brand industry, fashion designers, event curators, media workers, models and consumers, a total of 10 interviews, respondents A to J number of each interview time of 30 minutes. The study interview project was based on the QUALIA sensory emotion of ABCDE, and to understand the fashion show and brand experience marketing project the real situation. At the beginning of the study, for the fashion show curator, fashion designer and sponsor brand industry, three people by semi-structured interviews with pre-test. In order to compare the translation mechanism of the fashion dynamic activity attribute and the brand personality, and finally build the emotional fashion show of the actor network experience marketing service system.

4. CASE ANALYSIS

4.1. QUALIA perspective fashion show curatorial

A study conducted by Rung-Tai Lin (2011) examined a cultural product design model that internalizes the awareness of culture and creativity through atmosphere building, storytelling, perceptual-space creating, and touch-experience design. QUALIA design provides a deep understanding of the link between target audience behaviours and new ways of interpreting feature-responses. To investigate the effect of QUALIA empirically, it is necessary to analyse participants' emotions and interactions within the fashion show. This article analyses the psychological processes that produce the various emotional expressions that occurred throughout the fashion show of emotions references the emotional expressions produced in the fashion show and analyses the psychological processes.

The sense of Qualia life and emotional satisfaction, through the emotional value of the five sense of quality: Attractiveness, Beauty, Creativity, Delicacy and Engineering, touch the deepest emotions of consumers, build a unique and increase the value of goods and services, and then lead to the joy of the customer's heart and moved (Lin Rungtai, 2010 a; Lin, R. & Lin, C.L.2010; Lin, 2008 a, c). In this study, the emotional perception experience of the participants in the fashion show is analysed from the perspective of the perceptual design (Fig.1). Including the charm of the feeling, aesthetics, creative touches, delicacy feeling, and fields engineering perception of the five major levels.














Definition Brand Q & TW Designers Fashion Show in Taipei IN Style, 2015-2016 Venue: Song-Shan Cultural Park in Taipei, Taiwan					
Aspects of QUALIA	Connotation	Design Element			Participant Emotional
Attractiveness	Type attraction Brand image design style Brand Equity				Famous Designer Fashion luxury brand Brand fans and VIPs
Beauty	Clothing Fashion Exhibit Design Sense emotion Aesthetic style				Supermodel Luxury design Visual beauty Fashion shopping experience
Creativity	Novelty Interesting Surprise Pleasure Sense				Famous Actress Vocal Performance Art Ballet Dance
Delicacy	Services Internal space Event Planning				Professional trade fair Business Exchange Media Interview
Engineering	Field experience Atmosphere tone Comfortable				International trade show Professional show International runway

Figure 1: Qualia fashion show curatorial

4.2. Fashion show ANT translation mechanism

Fashion show participants include brand buyers, VIPs, media workers, fashion critics, journalists, columnists, fashion ladies, political and business elites. Target audiences can be divided into four categories: clothing buyers, media workers, celebrities, consumers. Fashion buyers have strong epidemiological capacity to predict future market trends, for buyers to establish a strong relationship with the fashion brand. Because it will be beneficial to both sides, it is very important for media workers to provide timely business news and important trends. Celebrities and ladies are trendy leaders, through mass media such as televisions, newspapers, fashion magazines, social networks, internet celebrities and fashion bloggers.

This study can take a break from the ANT point of view to focus on a single event or for a specific person, to clarify the fashion show QUALIA design consensus and advocate of the problem (Fig. 2). This article follows the context of the different actors. The actors have to go through obligatory passage point of the solution, observe the generation and transformation of these actors. In order to understand the actors involved in the brand dynamic show, construct each other together constitute the interdependent network dynamic process. This study takes the fashion show in creative life industry as the research object, exploring the experience elements and relevance of the predictive fashion shown through the perspective of the action network.

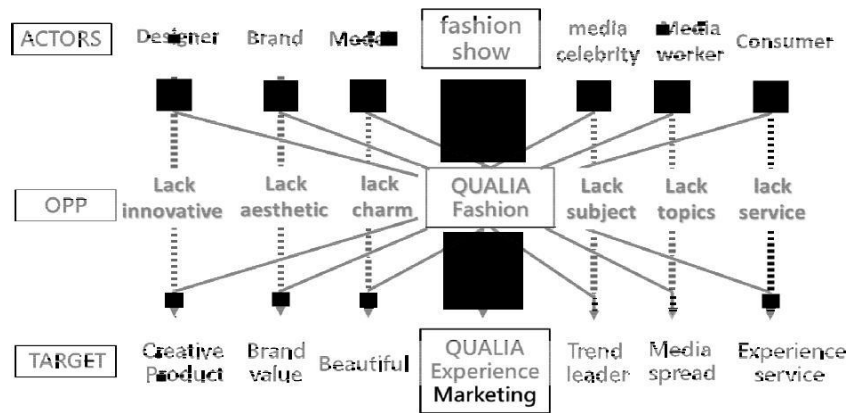


Figure 2 : QUALIA fashion show ANT obligatory passage point

QUALIA show curatorial construction process, this stage of the actor members of the common interests and benefit of the translation mechanism, the process meaning:

1. problematization: First define the main actors in the fashion show activities and related actors, including designers, brand operators, models, performers, media workers and consumers. QUALIA design is network actors are concerned about the issues, as the fashion industry curator design basis, its objectives and problems have their own need to break through. Different actors based on different interests, through the proposed initial recommendations consensus.

2. interment : Through different actors to get a consensus between each other and the relationship between reciprocity, the main task of this stage is through the realization of the benefits of fashionable activities of the interests of reciprocity, to strengthen the network within the actors. But also to the fashion industry experience the issue of marketing more clearly, resulting in mutually beneficial interests of reciprocity and interest, and can attract foreign investors willing to join the fashion industry-related art performers and mass consumers to build an expanded industrial network relationship.

3. enrolment: The fashion show experience marketing through sensual design into a clear guide. Network of actors to reached consensus and co-operation in their own interests under the multi-party consultation process, to achieve a common partnership to promote the creation of moving products, emotional landscape, perception of the task of the partnership.

4. mobilisation: When fashion show through the qualia curatorial and other actors linked to the network interaction. The development of fashion industry to form a network of institutional alliance relations, indeed through the provision of innovative services to offer the translation process, will give different actors positioning and tasks. Fashion industry through the launch of more relevant actors to join, to continue promote synergies and alliances.

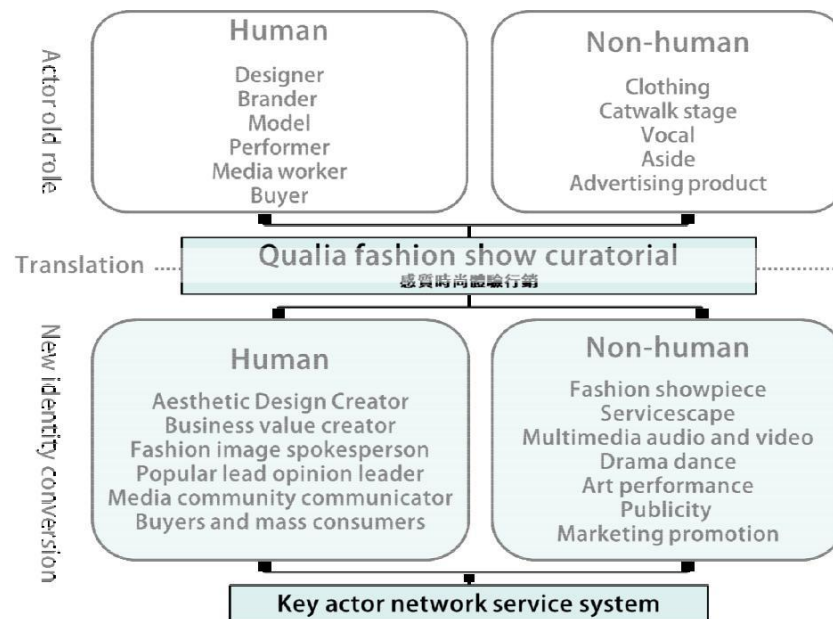


Figure.3: Qualia fashion show actor network service system

The empirical results of this study, the construction of dynamic show feeling curiosity experience service, ANT to expand the organization of the network and the flexibility of member tasks. To provide the fashion industry's sensual design, emotion innovation, integrated experience services. Promote the development of fashion industry the actor network service system (Fig. 3), by mobilizing more actors to join the network system, for the industry to seek new opportunities for transformation and development.

5. CONCLUSION AND SUGGESTION

In this study, through ANT, researcher constructed the connotation and value of the development of fashion sensory experience. Network link interactive point of view that you can get rid of only the role of the participants in the imbalance, which can be more balanced fashion industry QUALIA of curiosity design and experience marketing. Experience marketing the human roles (including designer, brand, model, entertainer, media worker, buyer), and non-human roles (clothing, activities arena, music, narration to explain, advertising products), are included in the same important position. All involved human and non-human actions are cooperative relations. Have the opportunity to cohesion of consensus and recognition, to promote the value of collaborative creation.

Lin Rungtai (2013) said through the design pattern to create the situation, tell the story, write the script, then design products provide a sense of perceived value to the fashion viewers. The fashion show is a dynamic form of communication platform, fashion show is based on "clothing display" as the basis, and to link exhibits, performers, storyboards, in specific space with hardware equipment and external skills. In order to achieve the design of the creator of the theme, purpose, beautiful presentation, use the stage decoration, performance techniques and participation the audience's emotional perception, through the "curator design" to create the situation and tell the story.

The results show that the commercialization of fashion show experience service innovation, thinking from the network of actors both human and non-human actors interact with each other. Through the heterogeneous network staggered links. A sense of quality shaping is an important translation mechanism, through the sense of QUALIA as a key actor to transform the new role of connotation. Brand fashion show curatorial in the creative life plays an important role, is to build a brand, designers, media and consumers between the fashion industry communication and communication's bridge.

Conclusion the case interviews 10 actors in the QUALIA experience marketing translation mechanism process. The main key actors are the role of identity and task conversion, including the new identity of the actors into aesthetics design creative, business value creators, fashion image endorsement, popular lead opinion leaders, media community communicators, buyers and mass consumers etc. endorsement and identity. Expand and increase the participation of new actors, such as fashion apparel exhibits, sensory field and environment, multimedia audio and video, drama dance, art performance, media promotion and marketing promotion, and expand the relationship between the network, these changes show a consistent direction of cooperation. Through the action of the operator to build a fashion sense of curiosity, key actor of the network service system, not only to achieve the fashion industry experience the formation of sensory value, while promoting the network system, the key actors can also perform their duties, coordination and cooperation, so as to expand the experience of marketing new service network system.

This article from the fashion show experience marketing to discuss the design and performance characteristics of fashion show. Fashion show outside the level of internal cognitive emotions, into the emotional experience of the introduction of fashion show elements, converted into tangible fashion creative goods and exhibition field, and the development of fashion show design of commercial services. The establishment of fashion dynamic show of the actor network architecture process. Set the "QUALIA Curatorial" as the OPP of the network actor and is the translation mechanism of the common interest benefit of the actors. The process is decided by the actors, next the marketing activities of the brand industry is to determine the scope of integration of technology, such as the venue and stage design, public relations to promote the scope of the show performers, other field experience element design.

Fashion experience marketing from the network of actors thinking, which although both human and non-human actors are mutual influence, but not necessarily equal relationship. The QUALIA design of the expansion of the heterogeneous network links. The case of the actor network system translation process, there are also conflict of the restructuring process. Show clothing and supermodel ladies may lose focus design focus, triggered other negative media topics. The common benefit interests of the actors can maintain the relationship between the actors and create a stronger network system. Can effectively adjust and change the fashion industry network structure and relationship.

The conclusion is that the fashion show is both the exchange of fashion culture and a form of art exhibition. Participants can build through the atmosphere, emotional space to create, meticulous fashion curatorial design. In the social network to experience the human and non-human network of actors will be the perfect combination of culture and business services model.

This paper is based on ANT empirical research, as Murdoch (2000) pointed out that ANT only provides the theoretical basis for rethinking the method that it doesn't solve the problem of real development tools. The problem is still in the original economic context to assess, ANT application still need more case studies to observe and verify. This article applies ANT to expand the fashion industry clothing show the breadth of experience marketing, which break the experience of marketing from the product side, technical, business or industrial environment side of the thinking. Actor network of human and material coexistence is not subject to space constraints. Through the case, it can be understood that the fashion industry experience marketing service innovation key value creation and interaction, is to build a fashion industry network ecology and value to create the concept of the system. The experience marketing service network model to output replication, so that different industries to build the same process and effect.

REFERENCES

Callon, M., & Latour, B. (1981). Unscrewing the big Leviathan: how actors macro-structure reality and how sociologists help them to do so. *Advances in social theory and methodology: Toward an integration of micro-and macro-sociologies*, 277-303.

Callon, M. (1986). The sociology of actor-network: The case of the electric vehicle. In *Mapping the dynamics of science and technology: Sociology of science in the real world*, eds. M. Callon, J. Law, and A. Rip, 19-34. London: Macumillan.

Callon, M. (1991). Techno-economic networks and irreversibility. In J. Law (Ed.), *A sociology of monsters: Essays on power, technology and domination*, pp. 132-161. London, UK: Routledge.

Yen, H. Y., & Lin, R. T. (2012). A study of value-added from qualia to business model of cultural and creative industries. *Journal of National Taiwan College of Arts*, (91), 127-152.

Latour. B. (1983). Give me a laboratory and I will raise the world. In *Science observed: Perspectives on the social study of science*, eds. K. D. Knorr-Cetina, and M. Mulkay, 141-70. London: Sage Publications.

Lin, R. (2008). Designing "Emotion" into modern Products. *International Symposium for Emotion and Sensibility 2008*, June, 27-29, KAIST, Korea. p11.

Lin, R. & Lin, C.L. (2010). From digital archive to e-business – a case study of turning "art" to "e- business". *Proceedings of 2010 International Conference on E-Business*, Athens, Greece.

Lin, R. (2011). *From Service Innovation to Qualia Product Design*.

Murdoch, J. (2000). Networks – a new paradigm of rural development? *Journal of Rural Studies*, 16, 407-419.

Lin, R. T. (2011). From service innovation to qualia product design. *Journal of Design Science, Special Issue*, 3-31.

Schmitt, B. (1999). Experiential marketing. *Journal of marketing management*, 15(1-3), 53-67.

Hui, S., Chw, M., & Chiang, T. (2016). Qualia into the fashion show case analysis. *In International Conference on Cross-Cultural Design*, pp. 193-204. Springer International Publishing.

Yang B. T. & Tang H. L. (2016). Experiential marketing factors of fashion shows. *Taiwan Textile Research Journal*, 26(1), 34-44.

DIFFERENCE BETWEEN JAPANESE AND FRENCH TASTES IN WOMEN'S T-SHIRTS FOR SPORTSWEAR

Marsac EVA^a, KyoungOk KiM^b and Masayuki TAKATERA^{b*}

^a *Ecole Nationale Supérieure des Arts et Industries Textiles (ENSAIT), France, eva.marsac@ensait.fr*

^b *Division of Kansei and Fashion Engineering, Institute for Fiber Engineering (IFES), Shinshu University, Japan, kimko@shinshu-u.ac.jp, takatera@shinshu-u.ac.jp*

ABSTRACT

This study investigates the differences in taste in training t-shirts for women, between Japanese and French people. A questionnaire survey on the impression of the t-shirts' appearances was conducted using the 3D simulations that we created. A sensory test was made on 24 different designs (type of sleeve, bodice length and fitting), on 51 examinees (26 Japanese and 25 French) who voluntarily participated. The results shown that for both Japanese and French people, very short t-shirts were the most appreciated and that the sleeveless and the tank top ones were the most appropriated for practice. It pointed out that people like cool, modern, showy, short, special, elaborated and feminine in design. Also, we noticed that for the Japanese people, casual clothes that are suitable for exercise, are not suitable to be worn outside of a gym, but this was not notable for the French people. This research will be valuable to sportswear industries and enable them to better target their client.

Keywords: *sportswear, t-shirts, design, sensory analysis, PCA*

1. INTRODUCTION

Nowadays, people are getting more and more concerned about remaining healthy and active. A growing number of consumers are taking part in sport and exercise. Because of this new behavior, the demands of sportswear garments have recently been simulated all over the

world. Moreover, wearing those garments have become a trend, called “athleisure”. It refers to a style based on wearing sportswear garments on a daily basis [1, 2]. Sportswear garments have to be comfortable and must enable the consumers to do sport in the best conditions. Indeed, producing this type of garment must take into consideration the technical properties of the material used. However, the companies that sell those type of products must also be careful about the design, since people care about their appearance while doing sport. Even if we can notice the development of the sportswear’s field over the world, trends are influenced by societies’ conceptions regarding decency, hygiene, esthetic and freedom [3, 4]. Depending on those conceptions, fashion and tastes differs all around the world. Thus, the culture has an impact on the preferences and on the feelings of the people [5-8]. A same product can be seen differently from one country to another. In this study, we investigated the taste of the Japanese and the French regarding different t-shirts for training for women using 3D simulations that we created. To understand the differences of tastes in sportswear garments, we chose several pairs of adjectives, and we asked people to give a remark depending on their impression on the different designs. Understanding the preferences and the evaluations of the Japanese and the French will help designers and manufacturers to make clothing that satisfy customers in each country.

2. EXPERIMENT

To clarify differences in tastes between the Japanese and the French, we investigated the evaluation of 24 types of women’s t-shirts; the fittings (loose or fitted), lengths (long, mid-length, short, or very short) and the type of sleeves (half sleeves, sleeveless, or tank top) as shown in Table 1. The evaluation was carried out using a semantic differential method and a seven-point scale with simulated t-shirt images.

We prepared a questionnaire on Google Form (Google Inc. CA, United States). In the evaluation, a front view, side view, and back view of each t-shirt were presented. We selected 19 pairs of adjectives that are related to visual feelings, preferences, and physical appearance as shown in Table 2. The questionnaire was translated into Japanese and French, and the adjectives were defined. This experiment was conducted for 51 participants (26 Japanese and 25 French in their 20s). The scores obtained were processed through employing principal component analysis (PCA), to understand the relationship between the different designs and the different adjectives. We performed 2 PCAs using XLSTAT (Addinsoft, Paris) to summarize the evaluation structure of each t-shirt (for the French and Japanese participants).

We made basic patterns of a t-shirt and a skirt according to a pattern making book [9]. All patterns were created referring to the French size 38 (bust 88 cm, waist 68 cm, hip 94 cm, and height 165.5 cm). We created a wearer model corresponding to size 38 and simulated t-shirts and a skirt with the created patterns using simulation software (CLO Enterprise, Yuka & Alpha Co., Ltd., Japan). The examples of the simulation are shown in Figure 1.

Table 1: Description of the 24 t-shirts

Fitting	Length	Sleeves	Name of the t-shirt	Fitting	Length	Sleeves	Name of the t-shirt
loose	long	half	t-shirt 1	fitted	long	half	t-shirt 13
		no	t-shirt 2			no	t-shirt 14
		tank	t-shirt 3			tank	t-shirt 15
	mid-length	half	t-shirt 4		mid-length	half	t-shirt 16
		no	t-shirt 5			no	t-shirt 17
		tank	t-shirt 6			tank	t-shirt 18
	short	half	t-shirt 7		short	half	t-shirt 19
		no	t-shirt 8			no	t-shirt 20
		tank	t-shirt 9			tank	t-shirt 21
	very short	half	t-shirt 10		very short	half	t-shirt 22
		no	t-shirt 11			no	t-shirt 23
		tank	t-shirt 12			tank	t-shirt 24

Table 2: Pairs of adjectives used in the questionnaire

Japanese	English	French	Initial
個性的-一般的な	special-common	spécial - commun	S-C
カジュアルな-フォーマルな	casual-formal	décontracté - formel	C-F
男らしい-女らしい	masculine-feminine	masculin - féminin	M-F
古典的な-現代的な	classic-modern	classique - moderne	C-M
目立たない-華やかな	discreet-showy	discret - voyant	D-S
流行遅れの-格好良い	out of style-cool	démodé - à la mode	OOS-C
心地が悪そう-心地がよさそう	seems uncomfortable-seems comfortable	a l'air inconfortable - a l'air confortable	U-C
低俗な-エレガントな	provocative-elegant	provoquant - élégant	P-E
スポーティーではない-スポーティーな	not a sporty style-sporty style	style pas sportif - style sportif	NS-S
みすばらしい-こざいいな	scruffy-neat	négligé - soigné	S-N
シンプルな-精巧な	simple-elaborate	simple - travaillé	S-E
ジム以外で着られない-ジム以外でも着られる	not adaptable to be worn outside a gym-adaptable to be worn outside a gym	inapproprié à être porté hors d'une salle de sport - approprié à être porté hors d'une salle de sport	NOG-OG
トレーニングに相応しくない-トレーニングに相応しい	not adaptable for practice-adaptable for practice	inapproprié à la pratique sportive - approprié à la pratique sportive	NP-P
短い-長い	short-long	court - long	S-L
きつい-ゆったり	fitted-loose	moulant - ample	F-L
露出が少なすぎる-露出が多すぎる	not enough skin is exposed-too much skin is exposed	la peau n'est pas assez découverte - la peau est trop découverte	NESE-TMSE
魅力的でない-魅力的な	not attractive-attractive	pas beau - beau	NA-A
嫌い-好き	I do not like-I like	je n'aime pas - j'aime	DL-L
着たくない-着たい	I do not want to wear it-I want to wear it	je ne veux pas le porter - je veux le porter	DW-W

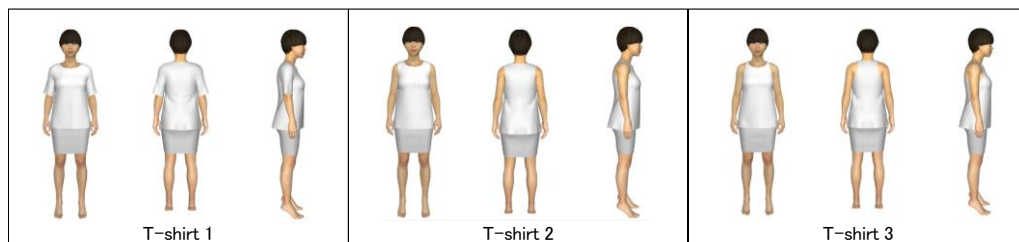


Figure 1: Examples of simulation

3. RESULTS AND DISCUSSION

Figures 2 and 3 show the relationship between the first and second principal component scores of t-shirts for French and Japanese participants. We repartitioned the t-shirts according to their position on the graphs. For the French, the contribution ratio of the first principal component was 57.8% while the contribution ratio of the second principal component was 15.3%. The graphs explained 73.1% of the data. For the Japanese, the contribution ratio of the first principal component was 59.6% while the contribution ratio of the second principal component was 15.5%. In Figures 2 and 3, we label the axes of the first and second principal components as short and long, and loose and fitted. In Figure 2 for French participants, we clearly identify three groups of t-shirt design that correspond to a special type of design: very short shirts (t-shirts 10, 11, 12, 22, 23, and 24), fitted shirts with half sleeves (long, mid-length, and short) (t-shirts 13, 16, and 19), and loose shirts (long and mid-length) (t-shirts 1–6). In Figure 3 for Japanese participants, the t-shirts were more scattered and it was more difficult to clearly identify groups. However, we found a certain repartition of the designs when considering larger areas: the very short t-shirts (t-shirts 10, 11, 12, 22, 23, and 24), the half sleeve t-shirts (long, mid-length, and short) (t-shirts 1, 4, 7, 13, 16, and 19), and the loose sleeveless and tank top t-shirts (long, mid-length, and short) (t-shirts 2, 5, 8, 3, 6, and 9).

Figures 4 and 5 show the correlations between the adjectives for French and Japanese participants. In Figure 4, we label axes of the first and second principal components as out of style and cool, and casual and formal. In Figure 5, we label the axis of the first principal components as showy and discreet. For the French participants in Figure 4, *Feminine*, *elegant*, *attractive*, *I like*, *cool*, *modern*, *showy*, and *too much skin exposed* were correlated with *provocative*, *not adaptable to be worn outside a gym*, *short*, and *special*. Additionally, *neat*, *seems uncomfortable*, and *fitted* were correlated. We finally observed that *sporty style* and *adaptable for practice* were correlated with *casual*. Loose (long and mid-length) also had a relationship with *seems comfortable* for the French participants. The French participants also described the very short (sleeveless and tank top) shirts as *provocative*. For the Japanese participants, *feminine*, *I like*, *neat*, *modern*, *attractive*, *cool*, and *showy* were correlated with *short* and *special*. We also observed that *sporty style*, *adaptable for practice*, and *too much skin exposed* were strongly correlated with *not adaptable to be worn outside a gym* and *casual*.

Comparing the t-shirt repartition and the adjectives of the French and Japanese participants, the Japanese participants thought that the half-sleeve shirts (very short) were *neat*. Whereas French participants considered only fitted half-sleeve shirts to be in the same group, Japanese participants considered all half-sleeve shirts (loose and fitted, long, mid-length, and short) to be in the same group. They described this type of design as *formal*, *common*, *not a sporty style*, and *not adaptable for practice* but *adaptable to be worn outside a gym*. However, t-shirt 7 was closer to the very-short half-sleeve shirts. The Japanese participants wanted to wear this t-shirt. Like the French participants, the Japanese participants grouped loose (long and mid-length) together. The difference was that the Japanese participants included short shirts and excluded half-sleeve shirts. The Japanese participants thought that this type of design was *classic* and *provocative*, in addition to the other adjectives given by the French participants. The Japanese participants did not want to wear those designs.

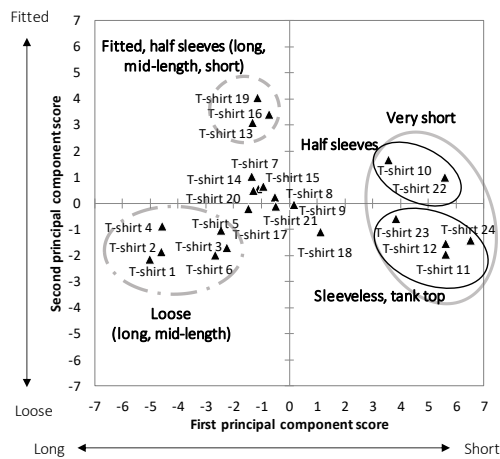


Figure 2: Relationship between the first and second principal components scores of t-shirts for French participants

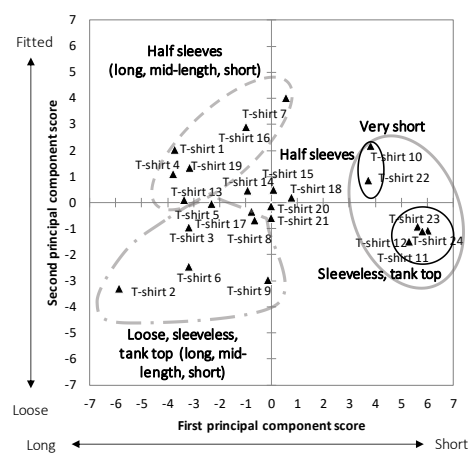


Figure 3: Relationship between the first and second principal components scores of t-shirts for Japanese participants

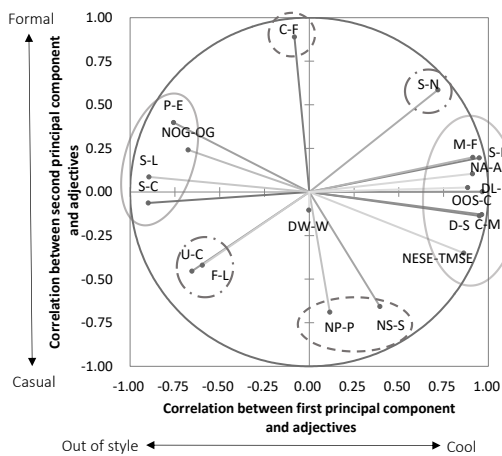


Figure 4: Correlation between the first and second principal components, and the adjectives for French participants

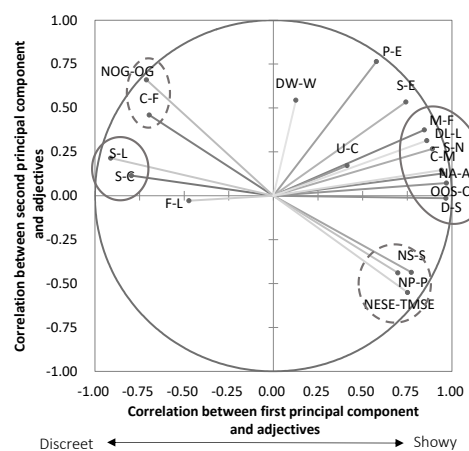


Figure 5: Correlation between the first and second principal components, and the adjectives for Japanese participants

4. CONCLUSION

The groups have similarities but there are differences between French and Japanese evaluators. The results shown that for both Japanese and French people, very short t-shirts were the most appreciated and that the sleeveless and the tank top ones were the most appropriated for practice. It pointed out that people like cool, modern, showy, short, special, elaborated and feminine design. Also, we noticed that for Japanese people, casual clothes that are suitable for exercise, are not suitable to be worn outside of a gym, but this was not notable for the French people. This research will be valuable to sportswear industries and enable them to better target their clients.

Acknowledgments

This work was supported under KAKENHI grant numbers JP24220012, JP17H01955, and JP16K16255 from the Ministry of Education, Culture, Sports, Science, and Technology of Japan.

REFERENCES

- Euromonitor International. (2017). *Sportswear in Japan*. retrieved from: <http://www.euromonitor.com/sportswear-in-japan/report>
- Euromonitor International. (2017). *Sportswear in France*. retrieved from: <http://www.euromonitor.com/sportswear-in-france/report>
- Noémie Aulombard. (2014). « Abou Ndiaye, *L'ordre vestimentaire : de la distinction par l'habillement à la culture de l'élégance* », retrieved from: <http://lectures.revues.org/14446>
- Au, J., G. Taylor, & E. W. Newton. (2003). How are European and Japanese Fashion Designers Inspired?. *Journal of the Textile Institute*
- Kim, K. O., Takatera, M., Zhu, C., & Otani, T. (2015). *Comparison of Japanese and Chinese clothing evaluation by experts taking into account marketability*
- Kim, K. O., Miyatake, K., Sano, K., Takatera, M., & Otani, T. (2014). "Research on Jacket Patterns and Specifications of Ready-to-wear for High-end in Italy and Japan"
- Kim, K. O., Nozawa, A., and Takatera, M. *Comparison of elegance of Japanese and European Jackets*.
- Otani, T. , Kim, K. O., Miyatake, K., Sano, K., & Takatera, M. (2014). "Characteristics of the Design and Production Process for Italian- and Japanese-Made Tailored Jackets in the Global Market"
- Devenir Modéliste, Le vêtement féminin*. (2009). ESMOD Editions, Paris, pp.88-91, pp.74-83, pp.144-145 and pp.32-39.

EVALUATION OF PSYCHOLOGICAL AND PHYSIOLOGICAL RESPONSES UNDER GRADUAL CHANGE OF THERMAL CONDITIONS WITH AIM TO CREATE INDEX TO EVALUATE THERMAL COMFORT OF CLOTHES

Tomohiro UEMAE¹, Mayumi UEMAE¹ and Masayoshi KAMIJO¹

¹*Shinshu University, 3-15-1 Tokida, Ueda, Nagano 386-8567, Japan
uepond@gmail.com*

ABSTRACT

Temperature and humidity at the periphery of the human body is a direct factor that influences thermal comfort. This paper describes the evaluation of thermal comfort through measurement of the physiological and psycho-logical responses to changes in the microclimate surrounding the human body. We investigated the validity of considering the results of physiological response and psychological response separately in the evaluation of thermal comfort. The temperature and humidity was changed using 2 patterns: from neutral to hot, and from hot to neutral. We measured peripheral blood flow as the physiological response and sensory test as the psychological response to changes in the microclimate. The threshold of physiology and psychology were deduced from the data of peripheral blood flow and sensory test, and the physiological thresh-old was higher than the psychological threshold. The result of our study indicates that establishing a thermal comfortable index reflecting the results of psychological and physiological responses to clothing climate is needed.

Keywords: *Psychophysiological response, Thermal comfort, Clothing comfort*

1 INTRODUCTION

This study aims to suggest an index to describe thermal comfort in the microclimate within clothing. Our previous paper reported that the thermal comfort is different depending on the direction of the climate change through the measurement of physiological and psychological responses (Uemae & Kamijo, 2010). There is a tendency that people easily get a feeling of discomfort in human's thermal comfort sensation in the case of "from neutral to hot" for the temperature and humidity around the human body, comparing with the case of "from hot to neutral". On the other hand, people easily get a

comfortable feeling in the case of “from hot to neutral”, comparing with the case of “from neutral to hot”. Therefore, we concluded that it is necessary to consider the change direction of the thermal environment to propose the evaluation index of thermal comfort in the microclimate within clothing.

In this paper, we would like to discuss differences between physiological response and psychological response for thermal stressors. Previous studies have demonstrated that that human being has two perception abilities. One is unconscious, another is conscious (Horiba et al., 2000). In the thermal comfort sensation, although we do not feel the thermal sensation, physiological responses react when given thermal stimulus. The challenge of this paper was to show psychological and physiological responses to a gradually changing thermal stimulus presented to the body in the experimental approach. From these results, we discuss the necessity to consider a thermal comfort assessment index from the point of view of both psychological responses and physiological responses.

2 EXPERIMENT

2.1 Environmental setting

The experiment was conducted in a thermo-hygrostat chamber in which the temperature and humidity can be controlled freely. The participants sat down on a chair in the centre of the chamber. Figure 1 shows the size of the chamber and participant position in it. This chamber has a down flow system to circulate air set to a certain temperature and humidity. The heat exchange between the human body and the environment consists of conduction, radiation and convection. In this study, only heat exchange with the air near the skin is considered as thermal stimulation. In this experiment, conduction is negligible, because the clothes worn by participants are only short pants and underwear. We confirmed that the wind velocity near the skin is weak by using an anemometer (KANOMAX JAPAN INC.). We measured the wind velocity at a height of 60cm at the centre of the floor of the experimental chamber. The measured results are shown in Table 1. The wind velocity was small enough to ignore convection, based on comparing the threshold value as the thermal condition in the microclimate within clothing reported in the previous research (Harada & Morishita, 1997).

Table 1. The results of wind velocity in working environmental chamber

	Report	Measurement		
		Ave	Max	Min
Wind velocity (m/sec)	0.25 ± 0.15	0.03	0.23	0.01

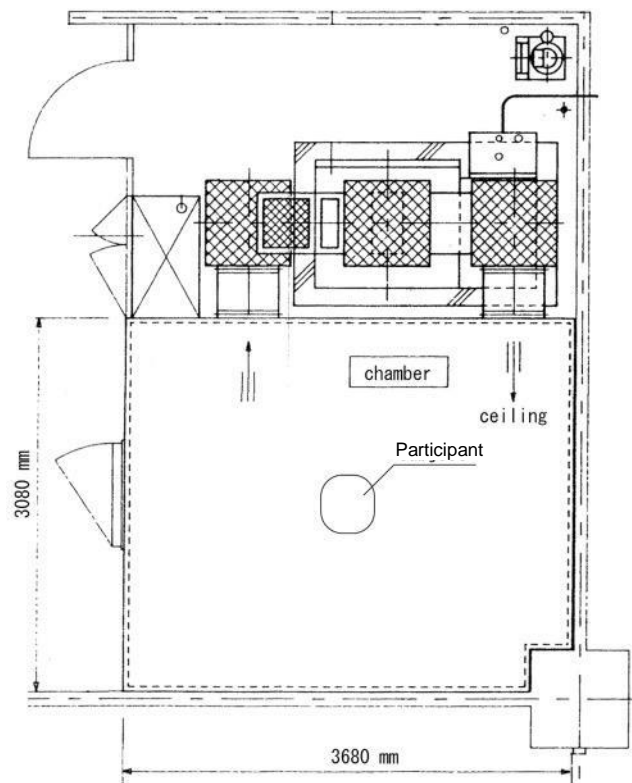


Fig.1. The chamber and participant position

2.2 Experimental setting

Table 2 shows the twelve experimental environment patterns. The experiment setting consists of changes in temperature and humidity, and the change of direction was set in two patterns: one from neutral thermal condition to high thermal one, and the other from high thermal condition to neutral one. The temperature was increased (or de-creased) by 2 degrees Celsius every 30 minutes. The humidity was increased (or de-creased) by 10%RH every 30 minutes. Patterns A and C are a pair of settings with opposite temperature change directions. Patterns B and D are a pair of settings with opposite humidity change directions. For Patterns A and C, during the experiment of temperature change, humidity was controlled at a constant level of one of three humidities (30%RH, 50%RH, or 80%RH), and for Patterns B and D, during the experiment of humidity change, temperature was controlled at a constant level of one of three temperatures (28°C, 32°C, or 36°C). In this paper, we would like to discuss the four patterns of thermal change.

Table 2. Settings of experiment environment

Direction	Variable	Setting of Variation							Constant	Ex No.	Pattern	
		Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7				
to High	Temperature	28°C	30°C	32°C	34°C	36°C	38°C	40°C	Humidity	30%RH	Ex1	A
		26°C	28°C	30°C	32°C	34°C	36°C	50%RH		Ex2		
		24°C	26°C	28°C	30°C			80%RH		Ex3		
		40°C	38°C	36°C	34°C	32°C	30°C	28°C		30%RH	Ex4	
to Neutral		36°C	34°C	32°C	30°C	28°C	26°C		50%RH	Ex5	B	
		30°C	28°C	26°C	24°C				80%RH	Ex6		
to High	Humidity								Temperature	28°C	Ex7	C
		30%RH	40%RH	50%RH	60%RH	70%RH	80%RH	32°C		Ex8		
								36°C		Ex9		
								28°C		Ex10		
to Neutral		80%RH	70%RH	60%RH	50%RH	40%RH	30%RH		32°C	Ex11	D	
									36°C	Ex12		
		0~30	30~60	60~90	90~120	120~150	150~180	180~210				
Experimental time (min)												

2.3 Procedure

All participants were started from Step 1 shown in Table 2. Figure 2 shows the experimental procedure of Ex3 shown in the table as an example of the experiment. The total experimental time of Ex3 was 120 minutes from Step 1 to Step 4. The humidity was controlled to a constant 80%RH, and the temperature was increased 2 degrees Celsius every 30 minutes. The participant was sitting down on the chair for 30 minutes in every step. The sensory test, electrocardiogram (ECG), peripheral blood flow (BF), and temperature and humidity near the skin (ambient to body) were measured during the time from minute 25 to 30 in every step.

2.4 Participants

The participants were 16 healthy males (Table 3). Each participant experienced an experiment of pair settings of “from neutral to hot” and “from hot to neutral” for temperature changes. The experiment was conducted for 2 days: On the first day, the participant experienced the experiment of pattern A, and then experienced pattern B at the same time on another day, because humans have a circadian rhythm (Iriki, 2003). For example, “Ex1 and Ex4” were carried out as a pair of experiment settings. These 12 experiment settings shown in Table 2 had carried out 6 times in 2 years, because it is well-known that the human body has seasonal variations about thermal sensation and thermal physiological responses (Ishigaki, Matsubara, Gonda, & Horikoshi, 2001; Sato, Yamano, Nakanishi, & Nakajima, 1998; Tsuzuki, Isoda, & Yanase, 1991). Since the experiments

were carried out a total of 72 times, there were 6 participants' data for each experiment setting. For all participants, we carried out informed consent, and we conducted the experiments after all of participants gave their consent to the meaning of this study.

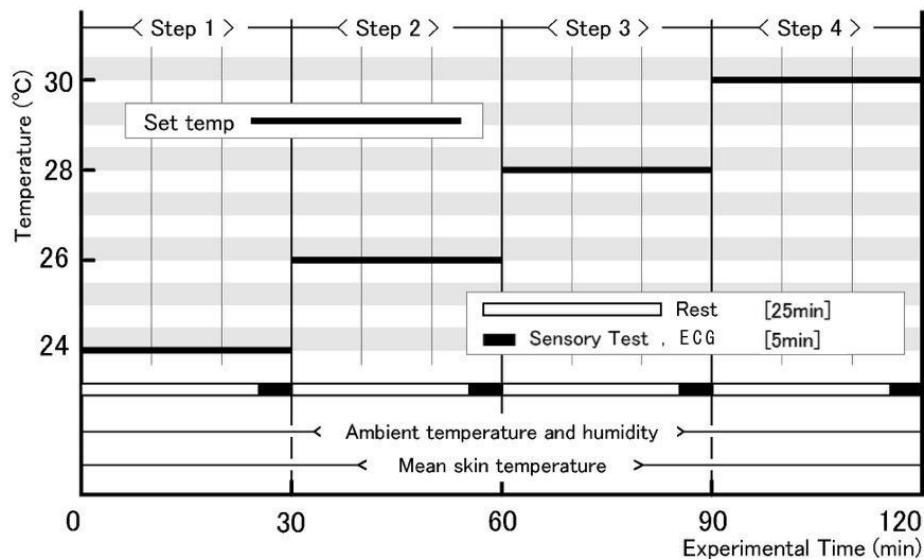


Fig. 2. Experimental procedure of Ex3

Table 3. Characteristics of participants

Participants	Age	Height (cm)	Weight (Kg)	BMI	Body fat (%)
Ave	22.0	173.6	60.9	20.2	13.9
SD	1.2	6.8	6.5	1.8	3.8

N = 16

2.5 Measurement Items

Ambient temperature and humidity near the skin

In our study, ambient temperature and humidity near the skin were measured in order to consider psychological/physiological responses to thermal stimuli from the air near the skin. The temperature and humidity sensors were placed at the positions marked with ■ shown in Figure 3. The sensors were placed in positions of 2cm away from skin at 3 parts: chest, back, and leg. We obtained the average from the 3 measured data as the result. Temperature and humidity were recorded to the data logger (Thermo Recorder TR-72, T&D Inc.) via temperature and humidity sensors (TR-3110) at a 1/20Hz sampling frequency.

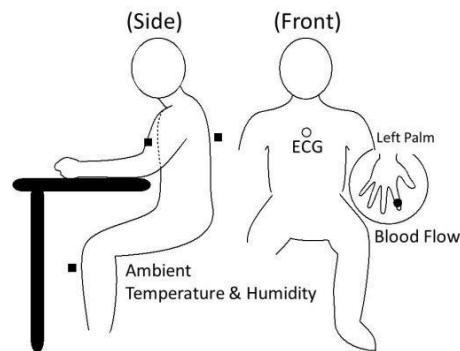


Fig. 3. Sensor positions of temperature, humidity, ECG and Blood flow

Heart Rate

It is well-known that the index of autonomic nerve activity is effective to evaluate stress by thermal stimuli (Sokejima & Kagamimori, 1998). In particular, heart rate (HR) is the most popular index to evaluate thermal stress. Electrocardiogram (ECG) was derived from the precordial leads with the MP 100 (BIOPAC SYSTEMS Inc.) system at 100Hz sampling frequency. We calculated the average of HR in each thermal environment setting.

Sensory test

Participant evaluated thermal comfort sensation every 30 minutes in each thermal environment setting by using the semantic differential method of a 7-point equal-interval ordinal scale: +3 = very comfortable, +2 = comfortable, +1 = slightly comfortable, 0 = neither, -1 = slightly uncomfortable, -2 = uncomfortable, -3 = very un-comfortable.

There are two kinds of thermal comfort: positive and negative directions. Negative thermal comfort means no uncomfortable feeling with hot or cold. The comfort in this study means the negative thermal comfort (Miyata, 1998).

3 Results

The scatter diagrams of Figure 4 shows HR and thermal comfort sensation with respect to temperature and humidity, respectively. Figure 5 shows the data of Figure 4 interpolated and smoothed. An ellipse with a diameter of 1 degree Celsius and 5% RH was set on the temperature and humidity axis. The average value of the HR data contained in the ellipse was obtained in the temperature and humidity range where the data existed. In Table 4, the temperature and humidity range is divided by a grid of 2 degrees Celsius and 10% RH, and the average value of the grid where two or more HR and thermal

comfort sensation data exists is shown. The difference between psychological response and physiological response can be seen by comparing the two diagrams.

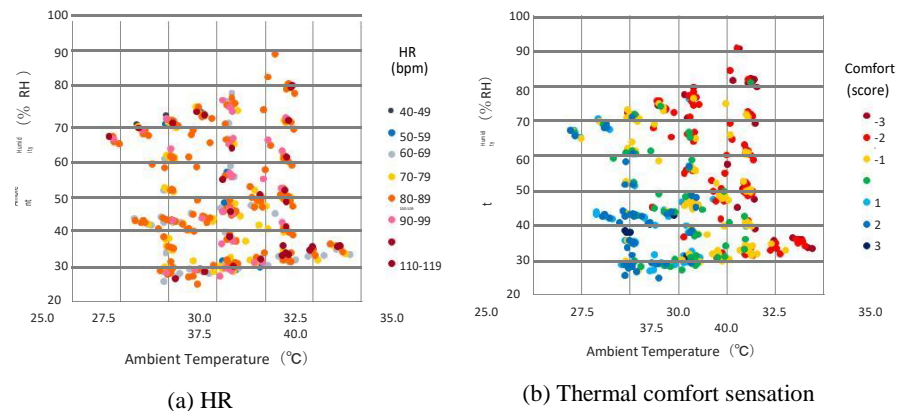


Fig. 4. Scatter diagrams of HR and thermal comfort with respect to ambient temperature and humidity

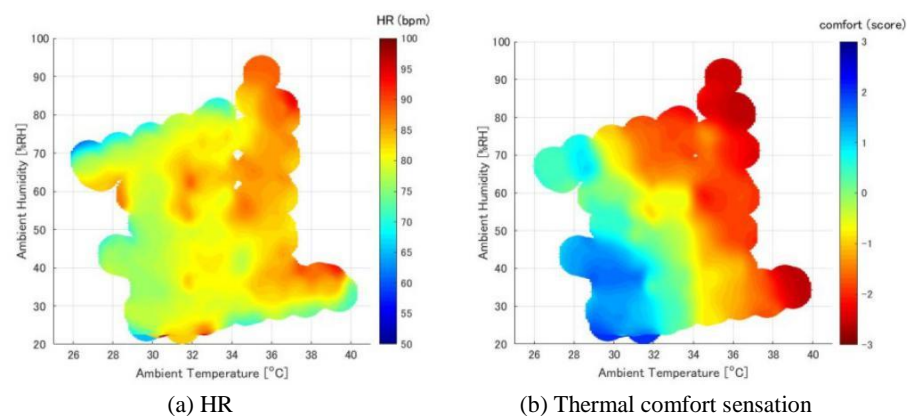


Fig. 5. Maps of HR and thermal comfort with respect to ambient temperature and humidity

Table 4. Results of HR and thermal comfort with respect to ambient temperature and humidity[illegible]

HR increased as the temperature near the skin increased and was not affected by humidity change. The thermal comfort sensation was uncomfortable as the temperature and a humidity near the skin were higher. This result indicated that the thermal comfort sensation was affected by both temperature and humidity. We obtained different results between psychological response and physiological response by the thermal stimuli near the skin for temperature and humidity.

4 Discussion

Comparing the results of HR and thermal comfort, we confirmed that physiological responses and psychological responses change differently with changes in temperature and humidity near the skin. We considered that the reason is that autonomous body temperature control is performed by the function of the body's homeostasis maintenance mechanism when the temperature near the skin is high. In order to encourage heat dissipation and prevent body temperature from rising, heat is transferred to the periphery by increasing the flow of blood. Since HR is one of the physiological responses controlled by the autonomic nerve system, HR became higher. However, since humidity changes do not affect human body temperature, it is not a trigger to promote autonomous body temperature regulation, so humidity changes did not affect the change of HR as much. On the other hand, the thermal comfort sensation is quite responsive to changes in humidity and temperature. It is well-known that rising skin surface temperature causes perspiration. We surmised that to feel sweat induced the uncomfortable feeling. The detailed reasons are subjects for future research. From these results, it was suggested that indices for evaluating thermal comfort in clothes should include indices of both physiological responses and psychological responses.

5 Conclusions

With reference to the creation of indices for evaluating thermal comfort in clothes, we examined how the psychological index and the physiological index respond to gradually changing thermal stimulus presented to the body. The conclusions are shown below.

The changes of HR as a physiological index were greatly affected by changing temperature, and were hardly affected by changing humidity. That is because HR is the result of autonomous temperature regulation trying to maintain homeostasis of body temperature. The thermal comfort sensation as a psychological index was affected by both changing temperature and changing humidity. We concluded that it is necessary to include both psychological indices and physiological indices as indices for evaluating thermal comfort in clothes.

In the future, it is necessary to create the clothing thermal comfort assessment models composed of physiological index and psychological index, in order to design garments with excellent thermal comfort.

Acknowledgments

This study was supported by Grant-in-Aid for Scientific Research (B) (16H02888) by the Ministry of Education, Culture, Sports, Science, and Technology of Japan.

REFERENCES

- Harada, T. & Morishita, R. (1997). Ase, Suibun heno taiou, [Countermeasure for sweat and moisture]. *International Journal of Clothing Science and Technology*, 38(7), 362-368.
- Horiba, Y., Kamijo, M., Sadoyama, T., Shimizu, Y., Sasaki, K., & Shimizu, H. (2000). Effect on brain activity of clothing pressure by waist belts. *Kansei Engineering International*, 2(1), 1-8.
- Iriki, M. (2003). *Taionseirigaku Tekisuto*, [Text of the temperature physiology]. Tokyo: Bunkodo.
- Ishigaki, H., Matsubara, T., Gonda, S., & Horikoshi, T. (2001). Experimental trial on the seasonal differences of the combined effect of air temperature and humidity on the human physiological and psychological responses. *Journal of Architecture, Planning & Environmental Engineering*, (543), 49-56.
- Miyata, H. (1998), *Shin Seirishinrigaku*, [Physiological psychology] (pp. 145-150), Kyoto, Kitaohji Shobo,
- Sato, M., Yamano, H., Nakanishi, T., & Nakajima, T. (1998). Seasonal variation of dynamic properties in sweating activity. *Sen'i Gakkaishi*, 54(6), 309-314.
- Sokejima, S. & Kagamimori, S. (1998). Evaluation of effect of thermal environments on autonomic nervous system. *Journal of Clinical and Experimental Medicine*, 184(12), 938-940.
- Tsuzuki, K., Isoda, N. & Yanase, T. (1991). Effects of air temperature and clothing on thermophysiological responses and thermal comfort vote during rest and physical exercise. *Journal of Home Economics of Japan*, 42 (6), 537-544.
- Uemae, T. & Kamijo, M. (2010). Influence of close ambient changes to the climate of the human body on thermal comfort. *Journal of Textile Engineering*, 56(2), 55-63.

A STATISTICAL STUDY ON FEMALE FASHION COORDINATES IN JAPAN

Tsubasa KAWAKATSU^{*a}, Masashi YAMADA^{*b}

** Graduate School of Engineering, Kanazawa Institute of Technology, Japan*

{^ab1302224@planet.kanazawa-it.ac.jp, ^bm-yamada@neptune.kanazawa-it.ac.jp}

ABSTRACT

Female fashion magazines published in Japan are often grouped by the colors of title logos; red-letter magazines and blue-letter magazines. And the fashion coordinates appeared in the magazines are called red-letter style and blue-letter style, respectively. In the present study, fashion coordinates appearing in 16 magazines issued throughout one year were analyzed by the corresponding analysis. The results showed that the red-letter style coordinates uses feminine items, like frilly blouses, mini-skirts, pumps and handbags with flower, small polka dot and hound's tooth check patterns, which were made of organdy, lace, chiffon and thick fabric materials. The blue-letter style coordinates use casual or sporty items such as parkas, half pants, sneakers and backpacks with camouflage patterns embroidery, small flower patterns, and paisley patterns, which were made of satin, fleecy stitch and boa.

Keywords: *female fashion coordinates, fashion magazine, correspondence analysis, red-letter style, blue-letter style*

1. INTRODUCTION

Female fashion magazines published in Japan are often grouped by the colors of title logos; red-letter magazines and blue-letter magazines. The first female fashion magazine, "CanCam", was published in 1982, and other fashion magazines, "JJ", "Ray" and "Vivi" were published following "CanCam". They presented fashion coordinates for young office workers and university students. It is said that males are attracted to females who wear these coordinates. The title logos of these magazines are colored red, and the fashion coordinates appearing in these magazines are called "red-letter style". Contrarily, the fashion magazines, "mini", "mel",

“KERA”, “Soup.” use blue title logos. The fashion coordinates in these magazines are called “blue-letter style”, and emphasize the unique personalities of females. It is said that females rather than males are attracted to this fashion.

2. METHODS

First, Japanese female fashion magazines appearing in the chart of the total number of copies during July 2011- June, 2013 (Ad link, n.d.) were listed up. Then, the magazines which were categorized as teens’ general-interest magazines, young-adults’ magazines and career ladies’ magazines, were eliminated from the list. Magazines not issued monthly were also eliminated. The remaining 16 monthly magazines listed in Table 1 were surveyed in the present study. Table 1 also shows the fashion style for each magazine described in the chart. The style of “street fashion” corresponds to so-called “blue-letter style”. Color photographs, which show whole-body fashion coordinates in the initial special pages of the 16 magazines published from May 2015 to April 2016, were used in the present study. The magazines which is described as street style in Table 1 corresponds to the blue-letter style magazines.

Table 1: Fashion magazines surveyed in the present study

magazine	Publisher	style
SWEET	TAKARAJIMASHA,Inc.	high end
Soup	J International	street (blue letter style)
mini	TAKARAJIMASHA,Inc.	street (blue letter style)
mer	Gakken Plus Co.,Ltd.	street (blue letter style)
SPRING	TAKARAJIMASHA,Inc.	street (blue letter style)
KERA	J International	street (blue letter style)
non•no	SHUEISHA	girly
mina	SHUFUNOTOMO Co.,Ltd.	girly
vivi	Kodansha Ltd.	red letter style
CanCam	SHOGAKUKAN Inc.	red letter style
Ray	SHUFUNOTOMO Co.,Ltd.	red letter style
JJ	Kobunsha Co., Ltd.	red letter style
MORE	SHUEISHA	career ladies, conservative
With	Kodansha Ltd.	career ladies, conservative
steady.	TAKARAJIMASHA,Inc.	career ladies, conservative
S-cawaii	SHUFUNOTOMO Co.,Ltd.	gal

Fashion items were divided into tops, jackets, pants, overalls, skirts, bags, shoes, hats/caps, accessories belts and socks and these items were subdivided into 170 categories except for belts and socks. There were 23 categories for tops, 25 for jackets, 21 for pants, six for overalls, fourteen for skirts eleven for dresses, eleven for bags, 24 for shoes, ten for hats/caps and 25 for accessories. For each of the belts and socks, two categories (wore or not wore) were used. The number of each category for the fashion items were counted. Then, materials of the fashion items were divided into 27 categories, and the patterns used in the fashion item were divided

into 24 categories listed in Table 2. There were 162 combinations between the fashion-items of tops, jackets, pants overalls, skirts and dresses hats/caps and the 27 kinds of materials and 144 combinations between the 6 fashion-item categories and the 24 kinds of patterns. The number of each combination were also counted. The numbers of 172 fashion-item categories, and the 316 combination categories were used in the analysis, in the present study. A cross-tabulation table was constructed with the 16 magazines in rows and the 480 categories in columns, and was used in the correspondence analysis.

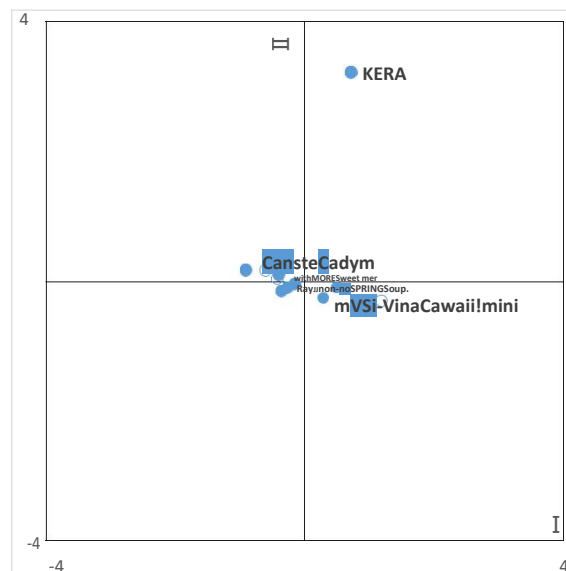
Table 2: Categories of materials and patterns

	knit, suede, fur wool, shaggy, mouton, boa, corduroy, cashmere, camel, sliver, material velours, lace, chiffon, cotton, linen, mesh, organdie, tulle, satin, denim, thick, fleecy stitch, leather, chino, not listed, others
pattern	flower pattern, small flower pattern, large polka dot, small polka dot, border, stripe, check, gingham check, botanical pattern, fruit pattern, tropical pattern, tribal pattern, paisley pattern, print, logo, brand logo, nordic, leopard pattern, hound's tooth check, camouflage, embroidery, not listed, plain, others

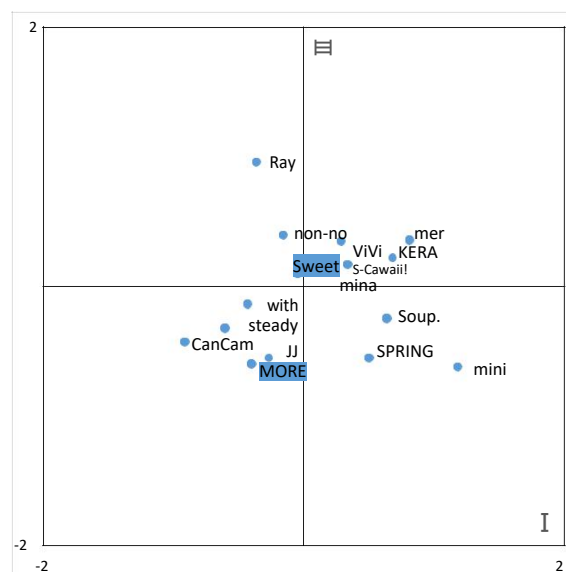
3. RESULTS AND DISCUSSION

The results of the correspondence analysis showed that the three-dimensional solution accounted for 53.7 % of the data variance. The correspondence analysis plots the 16 magazines in the three-dimensional space. The close proximity of the magazines in the space implies that the numerical distributions of the categories are similar among these magazines. Contrarily, magazines placed far apart implies that the distributions are quite dissimilar. As well as the magazines, the fashion items, materials and patterns are plotted on the same three-dimensional space. For example, a fashion item plotted near a magazine can be interpreted that coordinates in the magazine frequently use that item. Using these correlations, the characteristics of the fashion coordinates in the different styles are revealed, in the present study.

The three axes of the space were labeled I, II and III respectively. The 16 magazines were plotted on the I-II plane (panel (a)) and the I-III plane (panel (b)) in Fig. 1. Figure 1 shows that so-called red-letter style magazines listed in Table 1, such as "CanCam", "Ray" and "JJ", are placed in the left side on the I-axis. The blue-letter style (street style) magazines such as "mini", "mer" and "KERA" are placed on the right side on the I-axis. The magazines, which are not categorized in the red-letter style or blue-letter style in Table 1, are placed between the two groups. They are called "intermediate style" magazines and the coordinates appearing in the magazines are called "intermediate style" coordinates, in the present study.



(a) I-II plane



(b) I-III plane

Figure 1: Plots of the 16 magazines

Figure 2 plots the examples of fashion-item categories in the same three-dimensional space. Figure 2 shows that feminine items, like a frilly blouse, a mini skirt, pumps and a handbag, are placed on the left side on the I-axis. On the right side, casual or sporty items such as parkas, half pants, sneakers and backpacks are placed on the left side. This implies that the feminine items are frequently used in the red-letter style coordinates and the casual or sporty items are frequently used in the blue-letter style coordinates. Figure 2 also shows that T-shirts, blouses,

clutch bags are placed in the center on the I-axis. This implies that these items are used both in the red-letter and blue-letter style coordinates. These fashion items are also frequently used in the intermediate style coordinates.

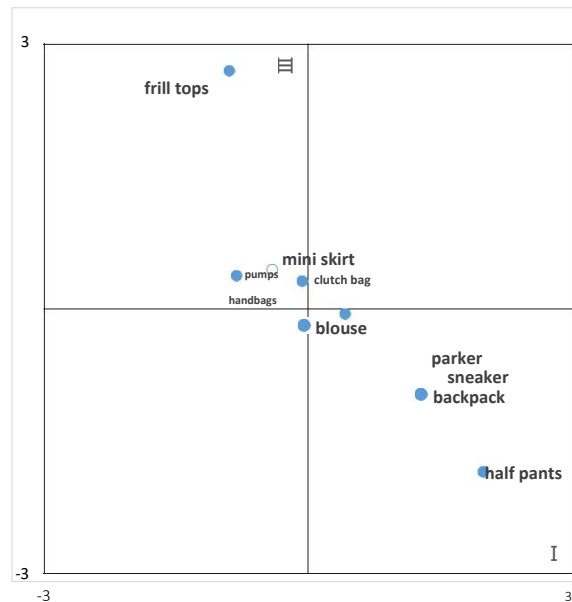
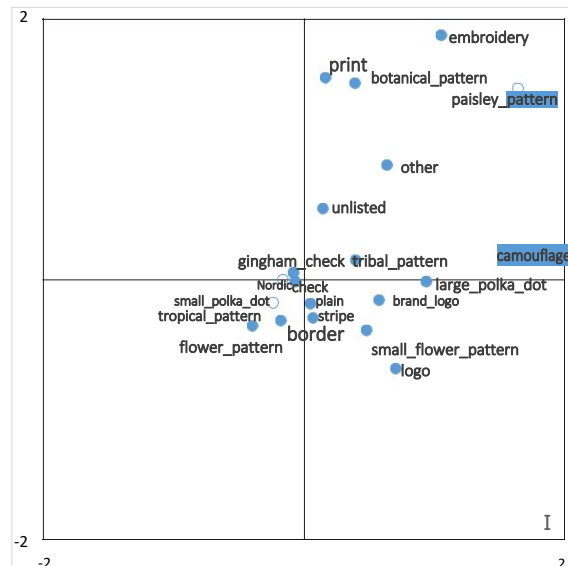
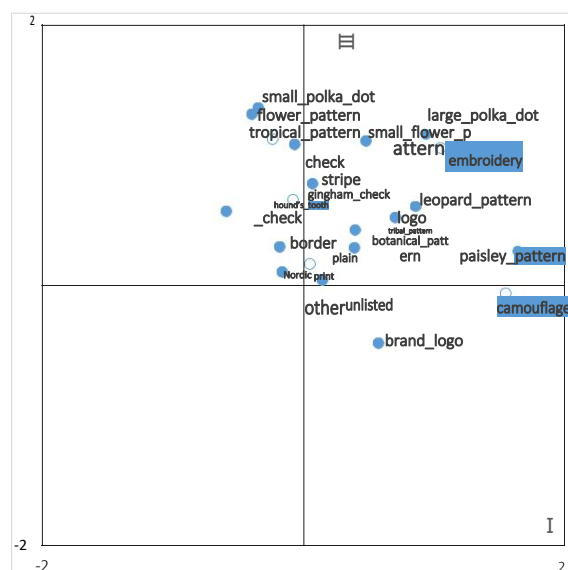


Figure 2: Plots of examples of the fashion items

Figure 3 plots the patterns on the three-dimensional space. Figure 3 shows that the flower pattern, small polka dot and hound's tooth check are placed on the left side on the I-axis. These feminine patterns are often used in the red-letter style coordinates. The camouflage pattern embroidery, small flower pattern and paisley pattern are placed on the right side on the I-axis. These patterns often appear in the blue-letter style coordinates. In Fig. 1, "Ray" is plotted in a high position and "mini" is in a low position. In Fig. 3, the flower pattern is placed in a similar position to that of "Ray" in Fig. 1. Moreover, the camouflage patterns is placed in a similar position to "mini" in Fig. 1. In fact, the flower patterns frequently appear in "Ray" and the camouflage patterns appear in "mini", respectively. Moreover, the embroidery and small flower pattern are placed in near position of "mer" and the paisley pattern is placed in a near position of "KERA". In fact, embroideries and the small flower patterns often appear in "mer" and paisley patterns appear in "KERA", respectively.



(a) I-II plane

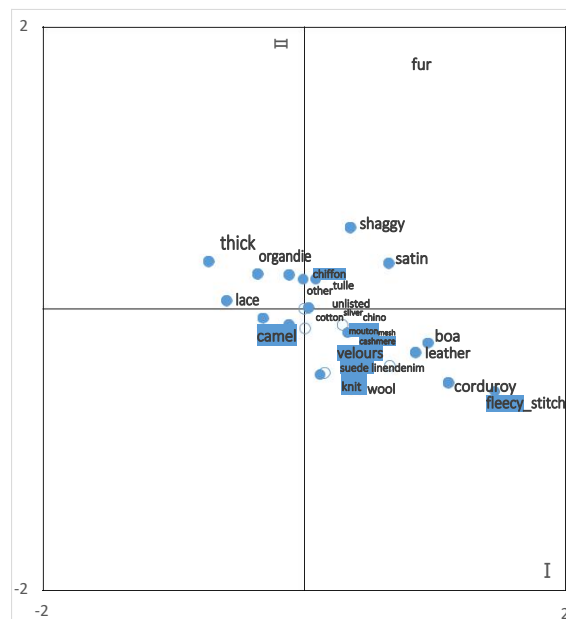


(b) I-III plane

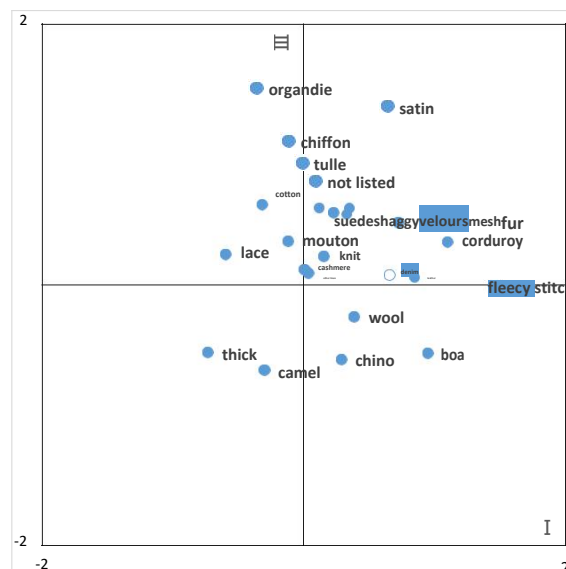
Figure 3: Plots of the patterns

Figure 4 plots the materials in the three-dimensional space. Figure 4 shows that organdy, lace, chiffon and thick fabric are placed on the left side. In fact, these materials are often used in the red-letter style magazines, such as “Ray” and “CanCam”. Satin, fleecy stitch and boa are placed on the right side in Fig. 4. They often appear in the blue-letter style magazines, such as “KERA”, “mer” and “Soup”.

In Fig. 4, Panel (b), thin and cool materials, such as organdy, satin, chiffon and lace, are placed at the top, and thick and warm materials such as thick fabric, boa and knit, are placed at the bottom. This suggests that the III-axis corresponds to seasons; the top corresponds to spring and summer, and the bottom corresponds to autumn and winter. In Fig. 3, Panel (b), flower patterns, gingham check and botanical pattern, which are suitable to spring and summer are placed at the top. Nordic pattern, hound's tooth pattern, which are suitable to autumn and winter, are placed at the bottom on the III-axis. Figure 1, Panel (b) plots “Ray” at the top and “mini” at the bottom side. In fact, fashion coordinates in “Ray” frequently use chiffon materials with flower patterns and “mini” frequently uses thick materials with camouflage patterns even in summer issues.



(a) I-II plane



(b) I-III plane

Figure 4: Plots of the materials

In Fig. 1, Panel (a), only “KERA” is placed at the top and the other magazines are placed in the center on the II-axis. This implies that “KERA” shows unique coordinates, which are dissimilar to the other magazines. Actually, coordinates in “KERA” often uses unique fashion items, such as pairs of corsets, wristbands and button pins and unique combinations of fashion items, such as a skirt with pants or a dress with a skirt. In Fig. 3, Panel (a), unique patterns of leopard patterns and fruit are placed at the top. This was because the frequency of the appearance of these patterns was the highest in “KERA”.

4. CONCLUSIONS

In the present study, female fashion coordinates appearing in 16 magazines were analyzed by the correspondence analysis. The magazines, fashion items, patterns and materials were plotted in a three-dimensional space. The plots showed that the I-axis divided so-called red-letter style magazines and blue-letter style magazines. The II-axis separated the magazine “KERA” from the other magazines. The III-axis corresponded with seasons. The results showed that the red-letter style coordinates use feminine items, like frilly blouses, mini-skirts, pumps and handbags with flower patterns, small polka dots and hound’s tooth check patterns, which were made of organdy, lace, chiffon and thick fabric materials. The blue-letter style coordinates use casual or sporty items such as parkas, half pants, sneakers and backpacks with camouflage patterns embroidery, small flower patterns, and paisley patterns, which were made of satin, fleecy stitch and boa.

5. REFERENCES

Ad link co. ltd. (n.d.). *The chart of the total number of copies during July 2011- June, 2013*. Retrieved April 25, 2016, from http://www.adlink.co.jp/shiryou/wofa1107_1306.pdf.

Benzécri, J.-P. (1992.). *Correspondence analysis handbook*. New York: Marcel Dekker.

Uruma, M. (2014). *Encyclopedia of textiles*. Tokyo: Natsume-sha.

AN EVALUATION CASE STUDY OF SUN HAT DESIGN FOR COLLEGE STUDENTS BASED ON KANSEI ENGINEERING

Jiawei, ZOU^a, Weizhen, WANG^{*b,a} and Xin CHEN^a

^a*National Demonstration Center for Experimental Fashion Design and Engineering Education, Dalian Polytechnic University, China, 982347362@qq.com*

^b*Advanced Institute of Science and Technology, Japan, s1620443@jaist.ac.jp*

ABSTRACT

This Paper puts forward a complete design thought based on the principle of Kansei Engineering, in the context of college students' demand for transformation and by combining with summer sun hat products and adopting questionnaire method. According to description of college students on sensory evaluation factor composition of sun hat and sensory evaluation characteristics of specific products; on the one hand, this Paper has analyzed relation between comprehensive sensory factors of sun hat and sensory mentality of college students; on the other hand, it tries to increase interestingness of design by characteristics of thermochromic materials for presenting different colors under different temperatures. According to experiment result, thermochromic material is applied to design process of sun hat and has obvious visual expressive force on color and surface texture effect, etc. and can endow texture with thermochromic characteristics. Research of this Paper aims at exploring a kind of new design thought for cloth design and development.

Keywords: *kansei engineering, demand of college students, sun hat, thermo chromic materials*

1. INTRODUCTION

Currently, the clothing market is in great demand of sun hats. There is no more innovation on design, which requires to change in the process of product design. The innovation of clothing

* Corresponding author.

products is to make a comprehensive evaluation for the product on the basis of the sensory organs of the wearer, which will indeed let the user enjoy practical and comfortable experience and improvement.

In academic, Moody, et al.,(2010) have studied female consumers' preference on clothing in the fitting process as well as the relation between customers' personality and emotion. The result shows that the wearer's emotion significantly relates to clothing preference, while the wearer's personality characteristics also relate to clothing preference. The expert knowledge base of costume design shall be established by using the fuzzy mathematical method to collect the data matching with consumers' preference. Example study shall be conducted for decomposition and description of clothing product's sensory data (Wang and Chen, 2008). Researchers (2014) have designed a style of sun hat that is inlaid with a flexible cable by sewing at the edge of the hat. The flexible cable turns the edge part upward through the sensor, which avoids the discomfort caused by the contact between the sweaty rear neck skin and sun hat.

In the fashion field, many brands also blend the assessment method of kansei engineering in product's R&D. Coolbit is comparatively representative. Its design philosophy is to add a rubber cooling patch at the back of the hat, which may cool the motor nerve of rear human brain through heat evaporation. Moreover, its design also has another highlight as it is detachable and convenient for cleaning. According to the evaluation of users, we can see that the wearers are satisfied for the sense of touch, color matching, and parent-child style that can enhance family interaction.

This paper changes sentimental appreciation into measurable data, considers the compatibility, novelty, and rationality of sun hat design and reflects contemporary college students' culture, character index, and epochal characteristics by taking heat discoloration as medium, basing on the evaluation method of kansei engineering and in accordance with research data; it uses new heat discoloration textile material as the innovation highlight, breaks the traditional simple and stiff image of sun hat and smoothly connects with clothing market.

2. RESEARCH PURPOSE

Main purpose of the research is to use the assessment method of kansei engineering in combination with new textile fabric to boost the development of sun hat that caters to college students. With coming of information and experience age, college students are taken as subjects of sensibility consumption. Product information received by users include rational information and kansei information. Product's rational information means its function, material, technology etc., which is the foundation for product existence, while kansei information means product's shape, color, usage mode etc., which embodies product's design culture and style (Du and Gao, 2007). Sensibility and rationality are usually relative. However, the rational information and kansei information conveyed by products are interactive.

Innovation in this paper lies in how to establish the communication channel between designers and users as well as the feeling, evaluation, demand exploitation of college students for new textile fabric and to optimize the rationality and the science of heat discoloration textile material design process so as to meet college students' aesthetic need and psychological need.

The paper regards kansei engineering as the experimental tool to set up the sensory evolution theory of heat discoloration textile material, in accordance with college students' evaluation and analysis method for heat discoloration textile material and explores college students' sensory evaluation and preference for sun hat.

3. HYPOTHESES

Heat discoloration costume design aims at allowing people to enjoy better experience. Good experience may occur when the wearer communicates with costume of new fabric. In consideration of costume getting closer to the wearer's thinking logicity and wearing ways, the change of costume color can embody the relation between color and psychology and boost the connection between people and product. The image quantification made by kansei engineering for sun hat provides rational basis for follow-up design.

H1. The possibility that kansei engineering can achieve image quantification of sun hat.

Currently, the research of kansei engineering in costume industry mainly focuses on women's wear and men's wear, and there is not too many researches are made on hat design. However, it is possible that the research method of kansei engineering can be applied to sun hat design.

H2. Kansei engineering can combine with heat discoloration textile material so as to establish the emotional relation between heat discoloration textile material and college student.

If college students face various kinds of sun hats, sensibility response of college students can be reflected by rational evaluation. College students' sensibility can be conveyed to costume design through heat discoloration textile material.

4. EXPERIMENT METHOD

The research is divided into two experiments. The procedure of finished sun hat design and producing is the first experiment. Firstly, extract semantic words group in questionnaire form and extract design element of prototypical sun hat according to ten pairs of words group. Implement design experiment based on variance analysis. The second experiment is comparative evaluation, which compares prototype hats with other typical sun hats.

4.1. Trial group



Figure 1: The selection the of experimental samples

4.2. Experiment method

Questionnaire consists of 10 pairs of words group constituting sensible image of hat (see Table 1). The Experiment adopts Richter scale and evaluates sensible image of hat by adopting 5 score evaluation method. At the same time, issuance of questionnaire has implemented initial statistics analysis on consumption behavior and preference degree of college students.

Table 1: Ten selected pairs of opposite adjective used to assess the perception of the sun hat

No.	1	2	3	4	5
Phrase	Concise	Modern	Colorful	Fashionable	Edgy
	Changeable	Conservative	Solid	Traditional	Dull
No.	6	7	8	9	10
Phrase	Common	Smooth	Novel	Uninhibited	Technological
	Exaggerated	Rough	Plain	Prim	Handmade

Table 2: VARIANCE analysis

	Cluster		Error			
	Mean Square	df	Mean Square	df	F	P.
Concise/ Changeable	9.750	2	.532	17	18.315	.000
Conservative/ Modern	3.750	2	.768	17	4.885	.021
Novelty/ Plain	.942	2	.580	17	1.622	.227
Elegant/ Hyperbolic	.842	2	.404	17	2.084	.155
Edgy/ Dull	2.267	2	.557	17	4.070	.036
Tradition/ Fashionable	.375	2	.532	17	.704	.508
Technology/ Handmade	.750	2	.791	17	9.948	.407
Smooth/ Rough	10.875	2	.438	17	24.815	.000
Uninhibited/ Prim	4.208	2	.399	17	10.547	.001
Colorful/ Solid	4.442	2	.451	17	9.849	.001

Table 2 is variance analysis table and it can be seen from analysis result that 6 P-value variances have obvious relevance to establishment of sensibility intention space of sun hat. Extracted factors include changeable-concise, conservative-modern, colorful-solid, edgy-dull, smooth-rough, and uninhibited-Prim factors. Extract design element to factor by semantic words. Sensible images of sun hat can be divided into 6 factors, such as temperament factor, function factor, eye-catching factor, leisure factor, concise factor, and youth factor.

5. PROTOTYPE PRODUCTION SCHEME OF SUN HAT

5.1. Design feature of heat discoloration sun hat

At the present market development stage, heat discoloration material is less used in hat design. The sensory characteristics of such material is that its fiber is short and differs in length,

with hard hand feeling and smooth surface. The style features of such fabric is natural, comfortable, warm, breathable, moisture absorption, with gentle luster, and the sense of warmth. Therefore, we need to research and develop the application of such emerging and less used material in sun hat design. This paper combines heat discoloration material with kansei engineering and deeply analyzes it, which has great practical significance and theoretical significance for the development trend of hat industry. Structural design of sun hat shall include a cap peak with proper width, sweatband, tail buckle or Velcro tape. On design of hat brim width, by referring to test result of Diffey research and Kansei Engineering, it is proper that hat brim width does not exceed 7.5cm, so that it will not influence sight and can prevent nose and face from direct sun exposure(Diffey and Cheeseman, 1992). The crown is entirely open, which can avoid ruining the wearer's hair style. The tail buckle part of the hat shall use Velcro tape, which not only ensures that the hat will not separate itself from the head when the wearer lowers head or raises head, but also allows the wearer to adjust the size of hat at any time according to his/her need. Wind strings are added at the both sides of hat, which can be removed at any time. It functions identically and is suitable for people who work outdoors for a long time and make sure that their hats are not blown away in case of strong, windy days or rainy days (Stone, 2003) .

5.2. Sun hat pattern Figureure

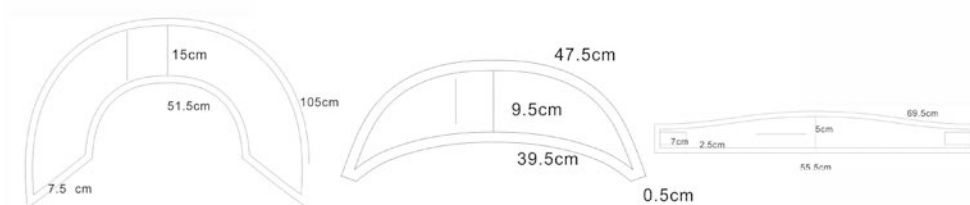


Figure 2: Sun hat pattern

5.3. Material selection

Hat material selection is one of the important factors that decides the quality of hat. Heat discoloration textile is used for outer material of the hat. Safe textile that is not harmful to human takes precedence. For example, heat discoloration or photosensitive discoloration reaches to ideal effect through fiber addition, coating, and other methods. The design principle of heat discoloration clothing is to cause fabric's internal structure change discoloration ability, which results in color change. When temperature reduces, the color recovers as before. In the process of design, it refers to Schütte (2005) and Lee et al (2002) research for the relation between function technology and emotion expression and blends heat discoloration fabric in clothing research and development, which makes sun hat design get closer to college student's emotional need--seeking different clothing experience.

5.4. College students' emotional design factor

College students' psychological activities include two aspects, i.e., sensory feeling and rational evaluation. Sensory feeling refers to the process that college students conduct comprehensive reflection for the property and all aspects of the sun hat through their feeling, intuition, memory, image, thought and other activities; emotion refers to the influence of all aspects' features of the sun hat on college students' mental emotion. Rational evaluation is made by college students through trying to exclude the influence of external interference factors (Chen ,2007). For product design, traditional cognitive approaches have tended to underestimate the user emotions which acts as a critical component of artifact sense making(Spillers,2004). Figure. 3 is the structure of college students' mental activity.

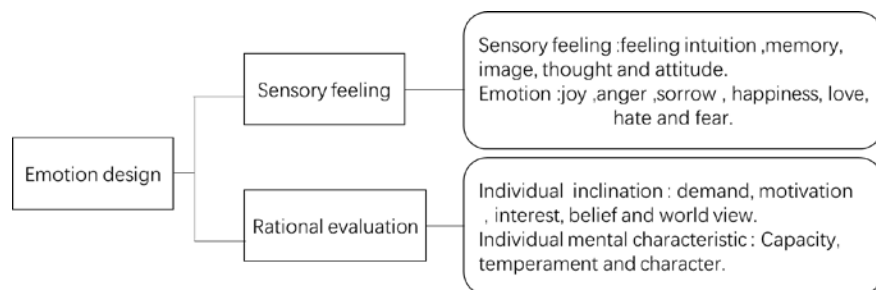


Figure 3: The structure of college students' mental activity

6. COLLEGE STUDENTS' EMOTIONAL DESIGN FACTOR

Figure. 4is a finished sun hat picture. Figure. 5 shows heat discoloration effect. When the cloth cover temperature is at room temperature, the fabric is shown as pink(a); when it is shone by sunlight for 30min, the color of cloth cover changes from pink to white(b); when it is directly shone by sunlight after 1 hour, the color of cloth cover is pure white (c). Breathable mesh yarn is chosen for lining, which absorbs more sweat and prevents sweat stain from immersing in fabric. The adjustable Velcro tape is added at the back of hat, which makes it more comfortable.

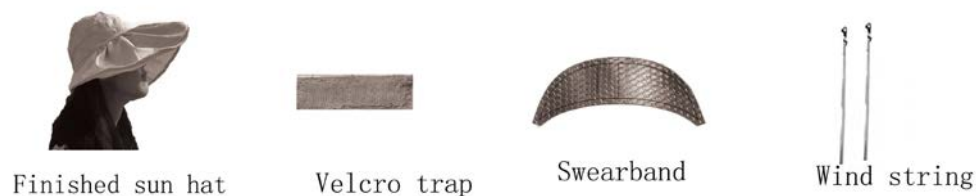


Figure 4: Finished sun hat picture

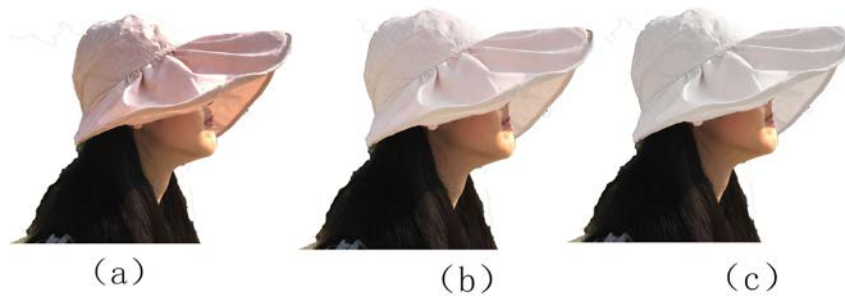


Figure 5: Heat discoloration effect

6.1. Kansei evaluation I

Semantic words have analyzed influence of thermochromic sun hat on mental reaction of college students for established sensibility intention space. The research result shows: (1) it is taken as design element for sun hat according to 6 factors extracted from results of variance analysis.

(2) Fabric is the only objective part of the product that can be seen and touched by people. As fabric is with unique vision and touch semantics and has a comprehensive effect on college students' physiology and psychology, it gradually becomes one of the communication media used by designers to express product image and to indirectly "communicate" with college students.

(3) College students widely consider that sun hat shall be comfortable, pretty, and durable as well as make the wearer look refreshed and vigorous, while they pay less attention to gorgeous and luxury degree and do not like grotesque and exaggeration. Only comfortable, fashionable, pretty sun hat that makes the wearer look refreshed and vigorous can meet the wearing and aesthetic needs of college students and be well received by them.

6.2. Head Kansei evaluation II

Cluster analysis method is used to conduct cluster analysis in accordance with different sentimental demands of college students for sun hat image, and further analysis is made for all kinds of college students' different recognition degrees for sentimental demands through multiple comparison of means. The design in this paper is partial to female sun hat from style to color. However, the color for male sun hat is designed to use cool tone to highlight the handsome and mature male image. In comparison with female hat design, multifunction becomes the central point of design. The feature of sun hat obtained from analysis blends in design so as to make designers pay more attention to functionality, fissionability, and collectability of sun hat in the design process, which is more in line with the aesthetic demand of college students.

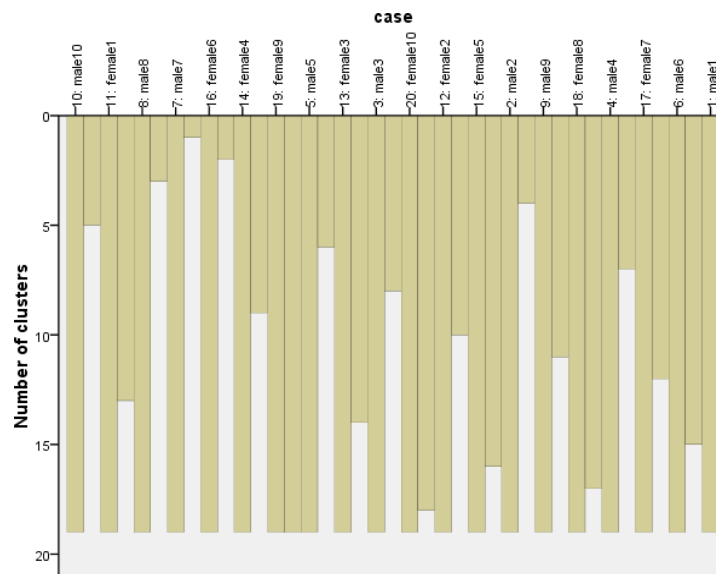


Figure 6: Evaluations of different genders on the image of sun hats

The following results are obtained by utilizing SPSS software and according to different demands of college students on sun hat functions. Figure. 6 is icicle Figure and tested group can be divided into 3 kinds of groups: comfortable type, leisure type and fashion type. Right icicle length of male 7 is less than 3, so male 7 and female 6 are in the same group; because right icicle length of male 8 is less than 3, he is in the same group with female 1, male 10, and female 4 and others are in the same group; three kinds in total. Analysis result shows that different-type sun hat appearance has aesthetic difference and there is obvious difference on evaluation and preference of different-gender college students.

7. CONCLUSION

On the basis of kansei engineering, this paper explores and evaluates the sensible image of college students for sun hat by using cluster analysis method, tries applying kansei engineering to sun hat design and explores to apply appropriate and specific design method and step of kansei engineering theory to costume design. By taking sun hat as the entry point, the previous exploration method is concretely applied to set up a kansei word database of sun hat and a sensory evaluation scale. Then through the college students' sensory evaluation for sun hat product, it sorts and analyzes a sun hat style represented by each sensation. The relationship between sun hat design factors and heat discoloration is established through adopting variance analysis method, factor analysis, and other statistical analysis methods, which realizes multi-dimensional evaluation and system analysis for sun hat.

(1) This paper puts forward the concept, acquisition, and analysis method of sensible image quantification of sun hat in summer and provides the approach for evaluating and analyzing aesthetic feeling of heat discoloration fabric. This Paper explores and evaluates sensible image of college students group on sun hat by adopting variance analysis method

based on Kansei Engineering and evaluates experiment by Richter Table and quantifies experiment by data analysis method. The experimental process and analysis method of heat discoloration fabric's aesthetic feeling evaluation are demonstrated by means of example study, while the relation between sun hat design factor and kansei engineering is established. The design result demonstrates that heat discoloration fabric can be applied to the research and development of sun hat industry as well as other clothing products' evaluation and design.

(2) The relation between heat discoloration fabric and college students' feeling evaluation is established; the aesthetic feeling of different materials is defined; the relation between college student' preference and aesthetic image is analyzed. Representative product sample and image words are selected to conduct sensory evaluation experiment on the basis of kansei engineering and new textile fabric and to conduct quantitative analysis for aesthetic evaluation data. Evaluation factor of sun hat is concluded, while the feature of heat discoloration fabric as well as the aesthetic evaluation and preference of college students between different genders for sun hats are explored.

REFERENCES

- Chen Yan (2007), *Image Research of Surface Material of Mobile Phone*, (Doctoral Dissertation, Jiangnan College).
- Chen, Y., & Wang, L. C. (2008). Fuzzy Logic of Matching Sense on Fashion Image. In *Natural Computation, 2008. ICNC'08. Fourth International Conference on IEEE*, 7, 85-89.
- Diffey, B. L., & Cheeseman, J. (1992). Sun protection with hats. *British Journal of Dermatology*, 127(1), 10-12.
- Du, Y. & Gao, D. (2007), *Presentation of Traditional Culture and Ethnic Elements in Modern Designs*, *Film Literature*, 433(4), 42-44.
- Lee, S., Harada, A., & Stappers, P. J. (2002). Pleasure with products: Design based on Kansei. *Pleasure with products: Beyond usability*, 219-229.
- Moody, W., Kinderman, P., & Sinha, P. (2010). An exploratory study: Relationships between trying on clothing, mood, emotion, personality and clothing preference. *Journal of Fashion Marketing and Management: An International Journal*, 14(1), 161- 179.
- Spillers, F. (2004). Emotion as a cognitive artifact and the design implications for products that are perceived as pleasurable. *Experience Dynamics*.
- SUN HAT: U.S. Patent 20,140,053,316[P]. 2014-2-27.
- Stone, J., Kim, J. H., Branson, D. H., & Peksoz, S. (2003). An exploratory study of experimental sun hat designs. *Fashion & Textile Research Journal*, 5(6), 565-573.

Schütte, S. (2005). Engineering emotional values in product design: *Kansei engineering in development* (Doctoral dissertation, Institutionen för konstruktions-och produktionsteknik).

TACTILE SENSATIONS INDUCED BY IMAGES OF CLOTHES WITH MOTION PARALLAX

Miki KUMAMARU^a, Atsushi OSA^a and Ken MATSUDA^b

^a Graduate School of Science and Technology for Innovation, Yamaguchi University, Japan,
{w030vg, osaa}@yamaguchi-u.ac.jp

^b Graduate School of Business Administration, the University of Kitakyushu, Japan,
matsuken@kitakyu-u.ac.jp

ABSTRACT

In recent years, the number of Internet users has been increasing and this is due to the spread of information communication devices. Approximately 80% of the Japanese population uses the internet. Furthermore, over 90% of companies uses the Internet, with the number of companies offering electronic commerce (e-commerce) services increasing each year. However, since 2009, the number of such companies has not progressed. According to a report, the principal reason that consumers cited for not using e-commerce was that they “want to purchase products after seeing the real product.” In the current study, proper attention was given to clothes, which had a high sales share in e-commerce. The differences in the visually-induced tactile sensation between users seeing real clothes, compared to when they saw images of clothes are investigated. The current study also proposed techniques, for image editing and presentation, to reduce these differences. 9 thin sweaters were used as an experimental stimulus. Images of the clothes with motion parallax was developed using an application software on a tablet-type device. The participants evaluated the tactile sensation evoked by each stimulus on 11 items with adjective pairs. Findings revealed that the presentation of images with motion parallax evoked visually-induced tactile sensations that were like those evoked when they saw a real sweater. The perceptions of fluffiness, irregularity, and roughness, in particular, were better in the motion parallax condition.

Keywords: *Motion parallax, Tactile sensation, Clothes, E-commerce, Semantic differential*

* Corresponding author.

1. INTRODUCTION

In recent years, the number of internet users have been increasing owing to the spread of information communication devices. According to a report by the Ministry of Internal Affairs and Communications(<http://www.soumu.go.jp/johotsusintokei/whitepaper/ja/h28/html/nc252110.html>), approximately 80% of the Japanese population use the internet. It is mainly used for email, weather forecasts, and electronic commerce (e-commerce), at rates of 79.6%, 60.0%, and 58.7%, respectively. In addition to that, over 90% of companies use the internet, with increasing numbers of companies offering e-commerce services each year. However, since 2009, the number of such companies has plateaued, as consumers feel that purchasing using e-commerce is associated with a greater risk, than purchasing in real stores. Thus, it is necessary to reduce the risk to expand e-commerce.

The risk in e-commerce includes risk associated with perception. In previous studies conducted by Matsuda (2014) & Morimoto (2014), that focused on clothes, which sold better on an e-commerce platform (http://www.meti.go.jp/policy/it_policy/statistics/outlook/h28report2.pdf), and revealed differences between visual-induced tactile sensation of users who could feel the real shirt, in comparison to those who viewed images on a LCD display monitor. The still images could not transfer the tactile sensations to the observers. Thus, we proposed image processing methods to evoke similar tactile sensations to the images to those evoked in users with access to real clothes. However, further improvement was required since the efficiency was insufficient.

Kobayashi et al. reported that when participants saw some objects in an LCD display monitor with 3-D glasses, the binocular parallax due to the 3-D glasses was effective in reproducing feelings of tactile (Kobayashi, 2010). However, since they are special equipment, 3-D glasses are not popular among daily life. In addition to binocular parallax, however, motion parallax also exists. Motion parallax is the relative difference produced by the motion of the object image on the retina; it allows the perception of depth in humans. When watching motion pictures, this depth cue is used unconsciously. No special equipment is required. In 2015, Fyuse (<https://Fyuse/>) was released as an application software to acquire images with motion parallax and display them. It also works on Android and iOS platforms, allowing users to easily capture and display images with a sense of greater depth.

In the current study, differences in the visually-induced tactile sensation between users who saw the real clothes and those who viewed the images of clothes with motion parallax are investigated. The purpose of this study was to propose techniques for image editing and presentation to reduce those differences.

2. METHOD

2.1. Participants

A total of 16 university students (8 female and 8 male students), aged 20–27 years (average: 22.9 years), participated in the current study.

2.2. Stimulus

Nine types of thin sweaters were prepared for the experiment (Figure 1), and were photographed as still images and images with motion parallax. Images with motion parallax were captured using Fyuse in a dark room, under two white fluorescent lamps, which were focused on the diagonal upper front of the sweater (Figure 2). When the images were captured using Fyuse, the iPad air was located at a distance of 113 cm from the sweater. Furthermore, the PC camera platform was rotated from -30° left to 30° right of the iPad, at the same distance from the sweater. The brightness of the real sweaters and the images on the iPad were then measured using a luminance meter (KONICA MINOLTA, CHROMA METER CS-200). The brightness of the images was manipulated to match the brightness of the real sweater.










Sweater	Material	Number of experiment sample image and color		
		1(white)	2(gray)	3(black)
A	Cashmere 100%			
B	Wool 100%			
C	Wool 100%			

Figure 1: Image of the sweaters that were used in the current experiment

2.3. Procedure

Each participant evaluated the tactile sensation induced by the stimuli using a seven-point scale in a dark room under the same white fluorescent lamps that were used to capture images. The following four presentation conditions were used: 1) seeing a still image of a sweater; 2) seeing images of a sweater with motion parallax, which were acquired using Fyuse; 3) seeing a real sweater, and 4) touching a real sweater. The following 11 tactile items were evaluated: smooth-rough, uneven-even, coarse-fine grained, itchy-not itchy, slick-not slick, cool to touch-not cool to touch, warm-cold, heavy-light, wet-dry, hard-soft, and elastic-not elastic.

During conditions 1 and 2, the distance between the participant and the iPad air was approximately 50 cm. During condition 2, the participant used their finger motion touching the image of the sweater. During condition 3, participants observed the stimulus from the same position as the camera when it captured the images (Figure 3). The order that the stimuli were presented in was randomised.

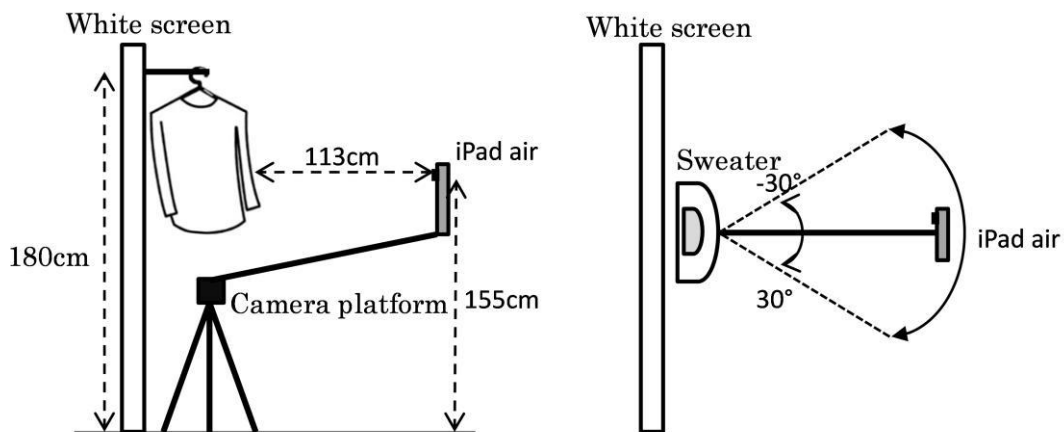


Figure 2: Environment used to capture the images using Fyuse

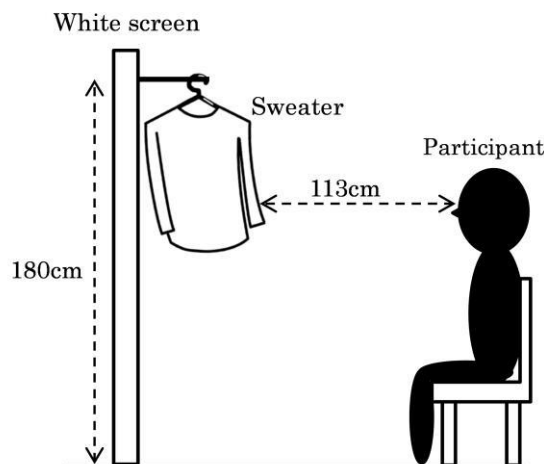


Figure 3: Experimental condition 3

3. RESULT

Figure 4 shows the semantic differential profiles during conditions 1 (seeing a still image), 2 (seeing images with motion parallax), 3 (seeing a real sweater), and 4 (touching a sweater). A two-factor analysis of variance (1st: tactile sensation word pairs, 2nd: presentation conditions) was conducted for each sweater (Figure 1, a total of nine sweaters).

For all sweaters, the interaction between two factors were significant. A-1: $F(30, 450)=4.738$, $MSe=1.566$, $p<.001$. A-2: $F(30, 450)=3.836$, $MSe=1.513$, $p<.001$. A-3: $F(10, 150)=33.132$, $MSe=3.898$, $p<.001$. B-1: $F(30, 450)=4.823$, $MSe=1.292$, $p<.001$. B-2: $F(30, 450)=1.862$, $MSe=1.165$, $p=.004$. B-3: $F(30, 450)=2.883$, $MSe=1.590$, $p<.001$. C-1: $F(30, 450)=2.719$, $MSe=1.193$, $p<.001$. C-2: $F(30, 450)=2.609$, $MSe=1.264$, $p<.001$. C-3: $F(30, 450)=3.930$, $MSe=1.333$, $p<.001$.

The analysis of the simple main effect demonstrated significant effects of the following items during the presentation conditions: smooth–rough (A-1,2,3, B-1,3, C-2,3), uneven–even (A-1, B-1,3, C-3), coarse–fine grained (A-1,3, B-1,3), itchy–not itchy (A-1,2,3, B-1,3, C-1,2,3), slick–not slick (B-1,3, C-3), cool to touch–not cool to touch (A-1, C-1,3), warm–cold (A-1, C-3), heavy–light (A-1, B-1,2,3, C-1,2,3), hard–soft (A-2, B-1,2, C-2,3), and elastic–not elastic (A-2).

The results of a multiple comparison using the Bonferroni method (with a significance level of $p<.05$), demonstrated significant differences between conditions 1 and 3 for the following: A-1: smooth–rough, uneven–even, coarse–fine grained, itchy–not itchy, cool to touch–not cool to touch, warm–cold, heavy–light; A-2: smooth–rough, uneven–even; A-3: smooth–rough; B-3: uneven–even, slick–not slick, heavy–light; C-1: itchy–not itchy, C-2: smooth–rough, itchy–not itchy; and C-3: hard–soft. This result indicated that visually-induced tactile sensations during condition 1 was significantly different from those induced during condition 3.

Further, the following items did not show any significant differences between conditions 2 and 3: A-1: uneven–even, itchy–not itchy, cool to touch–not cool to touch, heavy–light; A-2: nothing; A-3: smooth–rough; B-3: uneven–even, coarse–fine grained, slick–not slick, heavy–light; C-1: itchy–not itchy; C-2: smooth–rough, itchy–not itchy; and C-3: nothing. This result indicated that the tactile sensations that were visually induced during condition 2 that was close to those induced during condition 3.

Conversely, the results of the multiple comparison showed significant difference between conditions 3 and 4 as follows: A-1: coarse–fine grained, itchy–not itchy; B-1: hard–soft; B-2: heavy–light; B-3: uneven–even, itchy–not itchy, heavy–light; C-2: heavy–light; and C-3: cool to touch–not cool to touch. The following items did not show any significant differences between conditions 2 and 4: A-1: coarse–fine grained, itchy–not itchy; B-1: hard–soft; B-2: nothing; B-3: uneven–even, itchy–not itchy, heavy–light; C-2: nothing; and C-3: cool to touch–not cool to touch. This result indicated that the tactile sensations that were visually induced during condition 2 were closer to those elicited during condition 4.

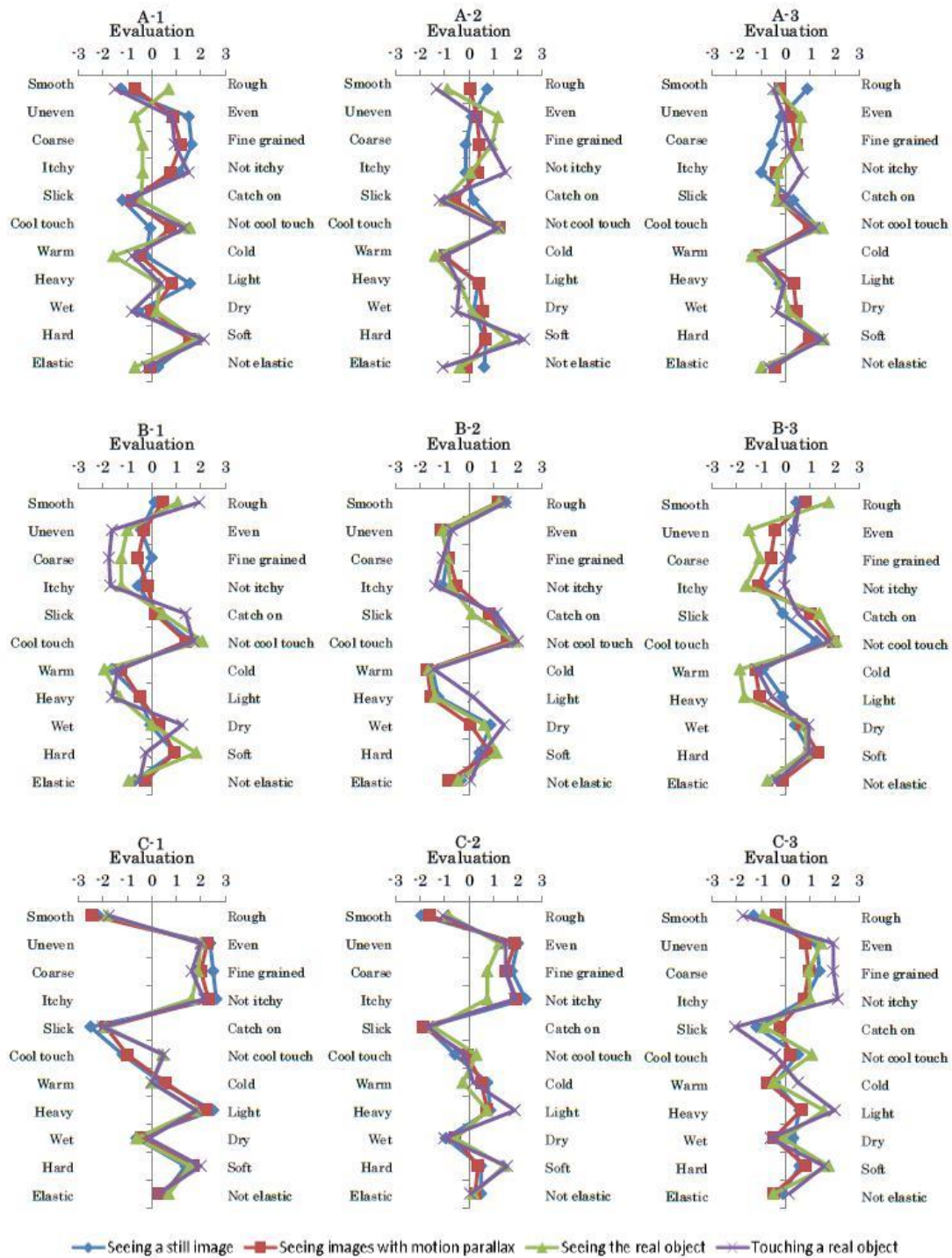


Figure 4: Semantic differential profile for each sweater

4. DISCUSSION

The data suggested that the tactile sensation that were visually induced with images with motion parallax were closer to those induced by real sweaters, instead of still images. In particular, the tactile sensations of fluffiness, irregularity, and roughness were very close. Since motion parallax increases depth sensation, sensations of toughness and irregularity during the condition with motion parallax is similar to those elicited in real life.

The data also suggested several differences in the tactile sensations that were visually induced when the sweater was seen, compared to when it was touched. The tactile sensations elicited by wool was especially hard to elicit using visual stimuli alone. However, images with motion parallax accurately improved these visually-induced tactile sensations. Participants are seen to observe images with motion parallax more carefully than the real sweater.

From the above discussion, techniques for displaying images with motion parallax to reduce differences in the tactile sensations that are elicited is proposed.

5. CONCLUSIONS

The differences in the visually-induced tactile sensations between when participants saw real clothes, compared to when they saw images of the clothes alone were analysed. The findings revealed that the presentation of images with motion parallax evoked tactile sensations, which were like those that were visually induced when they saw a real sweater. The perception of fluffiness, irregularity, and roughness was better in the motion parallax condition.

The use of Fyuse limited the resolution and photography conditions in the current study. Moreover, some noise and flicker were included in the experimental stimuli. Thus, further study is needed to evaluate the efficiency of image resolution.

Acknowledgments

Part of this work was supported by JSPS KAKENHI Grant Numbers 15K12132.

REFERENCES

Matsuda, K., Morimoto, K., Osa, A., & Kinoshita, T. (2014). *Transactions of Japan Society of Kansei Engineering*, 13(1), 91-98.

Morimoto, K., Matsuda, K., Osa, A. (2014). Effects of manipulations of spatial frequency and lightness and noise addition on tactual sensation for the fabrics pictures. *The 31st Annual Meeting of the Japanese Cognitive Science Society*, 364-369.

Kobayashi Y. (2010). Image Processing Method which enhances the subjective impression on surface thickness for Fur and Cloth. *Institute of Electronics, Information and Communication Engineers Technical Report*, 109(466), 147-152.