An Investigation of Washing and Dressing Behaviors in Bathrooms in Taiwan

Ming-Shih Chen [1], Iu-Ru Lai [2]
[1] TUNGHAI UNIVERSITY, Taiwan, msc@go.thu.edu.tw
[2] TUNGHAI UNIVERSITY, Taiwan, lockin0804@gmail.com

Abstract: Bathrooms are generally shared among family members of different generations in Taiwanese households. According to statistics, 85.8% of bathrooms in Taiwan are shared among more than two people (Taiwan Design Center, 2006). However, the internal size of a bathroom in Taiwan is normally 5 square meters and contains general fixtures such as a washbasin, a toilet, and a bathtub. Considering that a washbasin, in which users can wash their faces or assorted items, might be the most frequently used fixture in a bathroom, this study chose it as the research target. As most bathrooms in typical households are considered communal spaces, the different habits of bathroom users and the similarities or variations in their physical conditions present a challenging issue for designers, who must consider individual user needs during design.

This study conducted on-site observations of the washing and dressing behaviors of bathroom users in different groups, and interviewed users concerning their bathroom usage experience. The specific morning bathroom usage procedures of 15 users were recorded. The users consisted of adults, children, and elderly people. The time allocated for each bathroom user was approximately 10 minutes, which began with observing the usage procedures and then subsequently transcribing these procedures into texts. After analyzing the same behaviors of different bathroom users, a conclusion was drawn about similar problems that occurred to general bathroom users. Finally, new indexes were designed to address those problems, as well as similar problems, were analyzed, consolidated, and summarized into four categories: water volume and temperature adjustment, face-washing and cleaning method, handrail setting and height, and storage space. Through the case study, this research aimed to define the problems encountered by users while washing and dressing in a bathroom, further discuss these problems, and seek for solutions.

Keywords: Bathroom Space; Washing and dressing behaviors; Observation method

1. INTRODUCTION

1.1. Research Motives and Purposes

Bathroom space is a household space shared by family members on a daily basis, regardless whether adults, children, the elderly, or those with poor mobility. The bathroom space in Taiwan is generally 5 square meters, and there is no dry-wet separation design between the washing area and toilet. Statistics show that 85.8% of bathroom space in Taiwan is shared by at least 2 persons (Taiwan Design Center, 2006); moreover, the elderly and children are likely to have accidents in bathrooms. This study aims to identify the usage habits and differences of Taiwanese users, in order to propose design references. Hence, this study discusses the design and configuration of washing and dressing spaces in a Taiwanese household environment, and improves such spaces in order to better cater to the use demands of different groups.

This study focuses on family bathroom space regarding the demands and attitudes of users toward washing, and understand how users of different generations or with physical disabilities use the basins for washing and dressing.

2. INTRODUCTION

2.1. Research Motives and Purposes

In the design of Taiwanese residences, bathroom spaces are narrow and without dry-wet separation. According to the Hondao Senior Citizen's Welfare Foundation, the bathroom is one of the three most dangerous places in the home. According to the Ministry of Health and Welfare, 44% of accidental falls of elderly people take place at home, mostly in bathrooms. Children are apt to slip and get injured, climbing and falling, be scalded by hot water, drown,ingest detergent by mistake, receive an electric shock, etc. It is hoped that the problems incurring in bathroom could be discovered, and future designs would improve bathroom environments, in order to mitigate the danger.

2.2. Development of bathroom and toilet utensil

The most commonly bathroom and toilet facilities in Taiwan include washbasin, bathtub, and toilet. However, according to Construction and Planning Agencystatistics, 87% of the Taiwanese are accustomed to showering while using the washbasin as support to enter and exit the bathtub, resulting in falling and breaking of washbasin due to poor weight endurance. Slippery floors also contribute to bathroom accidents, thus, for the sake of safety, there should be a dry-wet separation design for the toilet.

The Construction and Planning Agency, Ministry of the Interior (CPAMI), plans a book called Physical Manual of Residential Bathroom Space, which could help people learn about toilet facilities. In the Manual, the dimensions for commonly seen toilet facilities are stipulated. Commode includes table-board, scaffolding, and wall mounting types (Figure 1). In order to save space, residences in Taiwan tend to select wall mounting commodes, with a width of appropriately 60cm and height of 80-85cm (from table-board to the ground). However, in recent years, scaffolding and table-board types are increasingly advocated.

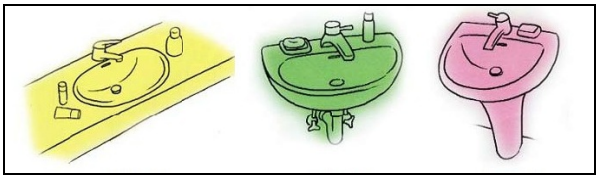

Figure 1: Basic patterns of commode (CPAMI, Physical Manual of Residential Bathroom Space)

2.3. Obstacle factors to use commode

The obstacle factors to use commode are ranked from top to bottom as: soreness of waist from long-time standing, no space available for storage, height is inconvenient for use, faucet is not easy to use, unclear marking of cold and hot water, and height of mirror.

Table 1: Obstacle factors to use washbasin by four groups of testes(A Study of Behavior in the ResidentialBathroom Environment,2006)

Obstacle factors	Aged group (%)	Ordinary group (%)
Soreness of waist from long-time standing	68.5	35.2
No space is available for storage	37.0	22.4
Height is inconvenient for use	16.3	26.4
Faucet is not easy to use	14.1	5.2
Unclear marking of cold and hot water	7.6	1.7
Height of mirror	4.3	6.6

The height of the commode is most inconvenient. The difference in the heights of users leads to differences in the use of commode. Usually, men believe that the commode is so short that they must bend over to use, which leads to soreness of the waist; moreover, they are apt to contact the commode while bending, crouching, or standing up. On the contrary, the commode seems too high for children to use, while the disabled deem it appropriate to have sufficient height and room under the commode for entrance and exit of wheelchair, otherwise those in a wheelchair could not use the commode, which means that the height of commode must match that of the wheelchair. The height of mirrors must also consider different users. Another problem in using the commode is storage. The table-board commode could provide flat space for temporary storage; however, when puddles occur due to splashing, it is likely to dabble, stain, or cause incrustation to the bath supplies. In terms of gender, females have more demand for the commode. Female respondents state that (Cheng, 2007) they will wash underclothes in the commode, and will consider the space and equipment to wash clothes (such as, washbasin, bucket, etc). In addition to washing and dressing in the bathroom, female respondents also tend to do their hair, shave eyebrows, use emulsions, etc; therefore, it is best to design bigger mirrors and larger tabletops to store articles.

2.4. Dimension for behavioral space

In bathroom and toilet use, people also need to put on and take off clothes, bend over for washing face, pick up articles beside the shower, and defecate. Therefore, movement space must be reserved in bathroom and toilet areas, which are necessary from the perspective of human engineering.

According to the Usability Research of the Space on Bathroom and Toilet, Ching-yi Lin proposed

relevant statements regarding the current bathroom and toilet use (Lin, 2002), as for the space for a commode, in order not to let the water flow from front side while washing the face, people mostly bend over. According to the standard height of people in Taiwan, the height of the commode is likely to be set around 75cm. Another concern about face-washing is that some people use this space for hair washing. Therefore, while planning the height of the commode, it is better to consider the habits of users. Human engineering references (Narasaki, 2002) also point out that, for the closestool and bathtub used by the elderly people, there must be necessary safety facilities and safety height (Figure 2).

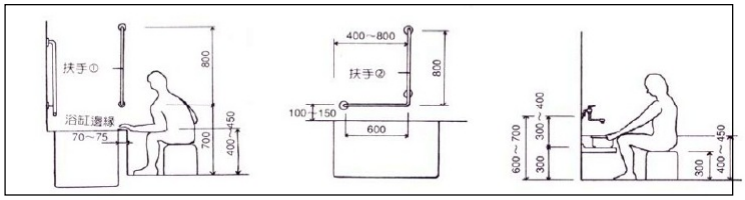

Figure 2: Comparison of auxiliary handrail of bathtub and table dimension (Narasaki, 2002, P116, 118)

Due to different personal heights, the height for a commode differs as well. Based on Figure 3, the best height of commode for ordinary users is 800±50mm, while that for wheelchairs is around 700mm (Figure 4).

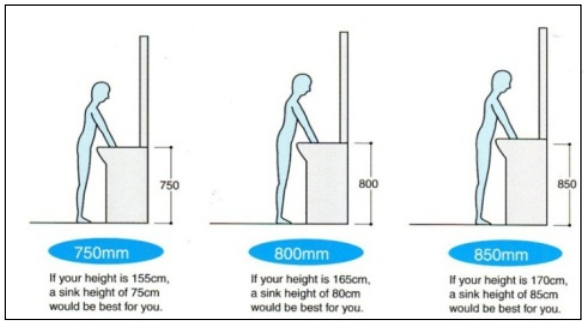

Figure 3: Most suitable heights of commode for people of differingheights

Source: The Concept of Universal Design, 2004, P25

Figure 4:Most suitable heights of commode for wheelchair users

Source: Toto Machine Co., LTD 2006, P74

In terms of residential patterns, open and independent residences in Taiwan tend to place the bathroom and toilet under the stairs, which limits building and surface spaces. Therefore, the bathroom and toilet space are usually squeezed in. Differences in residence patterns have minor

impact on bathroom and toilet spaces in Taiwan, while the major influential factors remain the limitations and obstacles to the elderly, due to their degrading physical abilities to use equipment and adapt to an environment. As a result, in order to consider the bathroom and toilet space for the elderly, consideration must be given to degrading physical abilities, the design of proper auxiliary tools to enhance the safety of elderly in mobility in bathroom and toilet, and avoid accidents. (Chen Ming-Shih, 2005)

It is important for the configuration of bathroom and toilet devices to consider the actions of users in order to maintain the fluency of action. The actions and scope of bathroom and toilet users shall be considered, and further plan a fluent device configuration. Many hidden accidents are likely to occur in bathroom and toilet spaces, thus, this study intends to learn the usage actions, trouble and inconvenience experienced in bathrooms and toilets, discover the problems and summarize reasonable advice in product design for bathroom and toilet spaces, as seen from the views of users, and provide reference for future research and design.

2.5. Study on relevant cases

Regarding studies on the use of washing and dressing spaces by different groups, Japanese scholars conducted relevant case studies regarding commodes in the homes of the elderly, which mainly focus on commode, as caretakers could take care of 2 elderly people at the same time. The commode applies asymmetric design, and considers that wheelchair users could use the commode by getting close, as well as more table space.

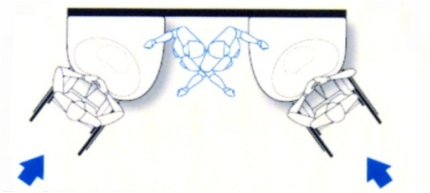

Figure5: Asymmetric commode (Source: Annual Design Review of JSSN Vol10. No.10,2004)

3. Research Method

This research in divided into 2 stages, preliminary research and field interview observations. It is intended that the research results of both present cases.

3.1. Preliminary research

In order to actually study the problems faced by different groups in bathrooms and toilets, preliminary research is conducted in the form of interviews, field survey, and observation. In terms of case selection, different patterns of residences are the main research target, including shared apartment, independent family home, and single-person suite for preliminary research. The users of each age group are selected as sampling survey (the elderly, middle-aged, and the young).

3.2. Field interview observation

The Post-Occupancy Evaluation method employed. The different family patterns found in preliminary research might derive different spatial configurations. Moreover, the different habits of use by respondents would affect use behavior. Therefore, in the case survey, it is more than interview and observation in many cases. Residence patterns and basic data are also the focus of the survey, which are then compared in an awareness survey.

3.3. Procedure and objective of interview and observation

This research is a relevant survey for use behavior, and its main difficulty lies in the implementation of behavior observation. As use of bathroom and toilet is private, actual behavior observation is impossible, thus, this study used behavior simulation observation and interviews to learn of bathroom and toilet habits in order to further understand their behavior model. The main content of observations and interviews include users, use behavior, use of space, etc. Use behavior is understood via interviews with respondents and observation of space. The procedures of observations and interviews are as shown in Figure 6.

Therefore, this study employs the non-participation observation approach to understand the washing and dressing conditions of respondents in bathroom and toilet to learn the mood response of users, while the products are used from the interview with the respondents. It is hoped that respondents can be interviewed face-to-face in natural and familiar environments, in order to understand the daily habitual washing and dressing behavior of users.

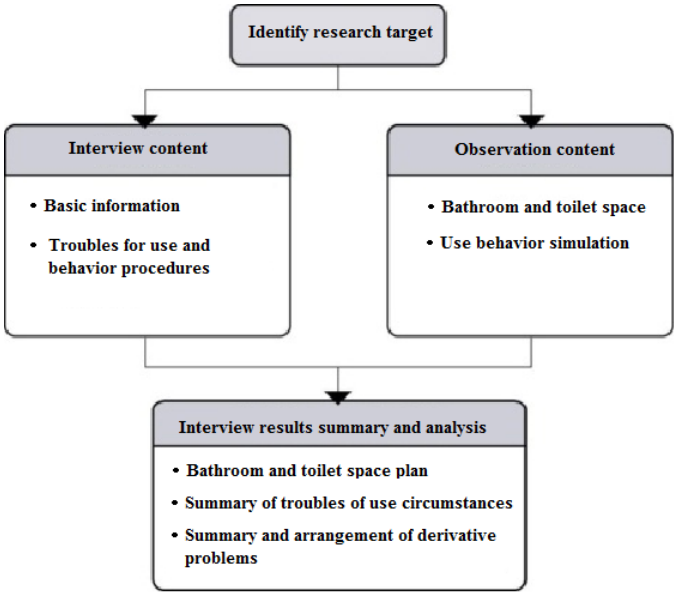

Figure 6: Procedures of Interview and Observation

3.4. Survey of users

3.4.1. Objective of survey

(1) Under different family patterns, the obstacles experienced by different groups in the use habits and behaviors of bathroom and toilet.

(2) Understand the expectations of different groups regarding bathroom and toilet space, and conduct a survey on improvement awareness.

3.4.1. Selection of respondents

As this research needs to learn the living behaviors of respondents, and conducts 30-40min interview and observation records, it conducts line and use behavior simulation in the form of purposive sampling (Wu, 2003, P.1-9), as well as multiple case studies of different residence patterns, including general users, children, and the elderly people, selects 3-5 samples from each

group. Their physical and psychological status must be apparently healthy, and mentality must be clear enough to interpret issues. Moreover, due to health status, apprehension, ability, and writing skills, the query mode of the questionnaire employs one-to-one Q & A interviews by the researcher with the respondents. As the respondents are limited by time, ability, and expense, this study only selects part of central Taiwan as the location of research respondents.

4. Research Results

4.1. Case interview and observation of washing and dressing behavior

This study has 15 respondents, 8 male and 7 female, which are averagely distributed among various age groups. This study mainly focuses on the morning washing and dressing behavior of respondents. As the respondents might not use the washing and dressing space freely at home, besides the videos recorded by respondents at home on the washing and dressing space in the morning, we also requested respondents complete a personal basic information form, and interviewed them on their usage obstacles. After analysis and summary, the types can be categorized into 3 orientations in order to discuss the behavior mode, product use methods, and storage items of each person.

Table 2: Basic information of respondents

Respondents / Project	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12	N13	N14	N15
Gender	M	M	M	M	M	M	M	M	F	F	F	F	F	F	F
Age	9	11	8	26	19	25	18	57	20	20	21	21	51	53	85
Height	135	130	125	180	177	173	176	168	150	165	154	152	152	163	145
Residence pattern	Independent suite	Independent suite	Independent suite	Independent suite	Single-person	Apartment	Apartment	Apartment	Apartment	Apartment	Apartment	Apartment	Apartment	Apartment	Apartment
Family members	5 F1*	5 F1	5 F1	4	1	4 F2	4 F2	4 F2	2 F3	2 F3	5	5	5 F4	4 F2	5 F4
Faucet pattern	Rotating	Rotating	Rotating	single handle	single handle	single handle	single handle	single handle	single handle	single handle	Rotating	single handle	single handle	single handle	single handle
Pattern of commode	Scaffolding	Scaffolding	Scaffolding	Table-board	wall mounting	wall mounting	wall mounting	wall mounting	wall mounting	wall mounting	Scaffolding	Table-board	Scaffolding	wall mounting	Scaffolding
Distance from ground	80cm	80cm	80cm	78cm	77cm	81cm	81cm	81cm	80cm	80cm	81cm	78cm	81cm	81cm	74cm

(* F refers to family members)

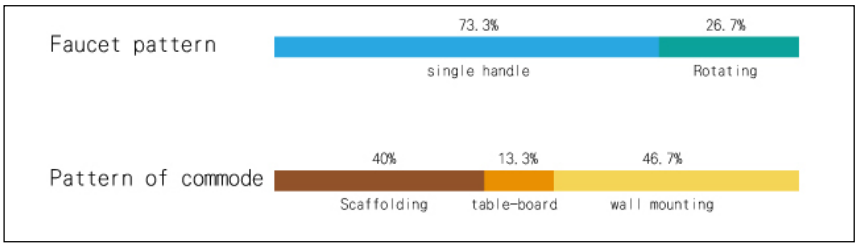

Figure 7: Shared space as the pattern for washing and dressing space in the same type of survey

In order to cover respondents of different groups, we select users of different age groups (the elderly, middle-aged, and the young). F indicates that users of different age groups use the same bathroom and toilet space. Some respondents have single-person suites. In order to discuss the most suitable height of commode for respondents, we measured the heights of the commodes, usually between 74~81cm. N1, N2, and N3 (children) believe that the height of commode is just right for use, while N15 (the elderly) deems that the height could be increased a little. The respondents in general accept the current height of the commode. As is seen in Figure 7, the single-handle faucet is mostly commonly used by families due to its convenience in operation, while the elderly-styled bathroom and toilet applies a rotating faucet due to simplicity in structure. The commode mostly uses the wall mounted type due to its safety and lower price. However, the table-board commode is preferred providing the toilet space is large enough.

4.2. Human behavior mode

According to the survey on the methods of face washing, most users prefer to wash the face by splashing with hands, while the elderly tend to wash face with water in washbasin. The difference might be attributable to users' habits or generations. A minority of respondents use a towel to wipe after washing the face. N1, N2, N3, N12, N13, and N15 respondents do not have the habit of washing the face in the morning, the majority of which are children. According to the survey, while the respondents hold water to splash the face, the water tends to be splashed around, which makes the commode wet. Although respondents that wash the face with reserved water take long time in cleaning the commode, thus, the waster splashed is greatly reduced. N4, N6, and N7 respondents do not use reserved water to wash face because they believe the commode is dirty. In terms of teeth brushing, users generally use a tooth glass, while the young group holds water with the hands for the sake of convenience; however, the commode might get wet; users in general bend over to spit, those users directly spitting would make the commode wet. Due to height difference with male users, female users tend to directly spit; children are taught by parents to get into the healthy habit of bending over for spitting. N13 and N15 respondents clean the toothbrush with water held in mouth during teeth brushing, in order to save water. As the case is the behavior mode of same family members, particular behavior mode is excluded due to personal habits.

Table 3: Human behavior mode

Type \ Respondents				N1	N2	N3	N4	N5	N6	N7	N8	N9	N 10	N 11	N 12	N 13	N 14	N 15
Human behavior mode	Face washing	Wash with reserved water									✓						✓	
		Hand splashing with water						✓	✓	✓		✓	✓	✓				
		Wipe with towel								✓	✓							
		Not wash		✓	✓	✓	✓								✓	✓		✓
	Teeth brushing	Brushing toothbrush	Direct wash	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
			Gargle and brush toothbrush													✓		✓
		Ways to get water	Use tooth glass	✓	✓	✓		✓			✓			✓	✓	✓	✓	✓
			Hold water with hands				✓		✓	✓		✓	✓					
		Spitting habit	Direct spitting	✓										✓	✓			✓
			Bending spitting		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	

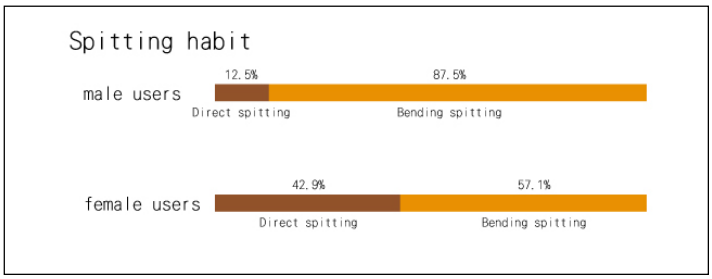

Figure 8: Difference of male and female in spitting habits

4.3. Product use method

To be discussed through faucet and commode. According to the survey, many respondents use the single-handle faucet because of the convenience for switching, and for this reason, the switch is more frequently used. Compared with a rotating faucet, those using a single-handle faucet tend to switch the water volume to the max, which makes the commode wet. However, most respondents could adjust the water volume to the appropriate state. Most respondents do not adjust the temperature, which might be attributed to the seasonal temperature during the survey. Male respondents are more frequent in opening of the faucet, as compared with female users; however, female users take a longer time. Most respondents are accustomed to hold up the commode with left palm while brushing teeth, and bend over to avoid foam falling in the mouth. Some users do not hold up the commode with hand, as in the case of a scaffolding commode, due

to incapability of such commode to support heavy weight, thus, users tend not to use support. Regarding the standing position, males are relatively taller, thus, almost all the respondents bend over to use the commode. Due to height, female users seem to deem it as easier to use. In order to particularly avoid water splash during use, N13 and N14 bend over to the utmost extent to use the commode.

Table 4: Product use method

Type \ Respondents				N1	N2	N3	N4	N5	N6	N7	N8	N9	N 10	N 11	N 12	N 13	N 14	N 15
Product use method	Faucet	Control of water volume	Large volume				✓					✓	✓					✓
			Intermediate volume	✓	✓			✓	✓	✓	✓			✓	✓	✓	✓	
			Small volume			✓												
		Temperature control	No control	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
			Control						✓	✓	✓							
		Times of opening		4	3	4	5	6	4	8	6	3	3	4	3	2	8	3
	Commode	Standing position	Up-right	✓								✓	✓	✓	✓			✓
			Slightly bending over		✓	✓	✓	✓	✓		✓							
			Utmost bending over							✓						✓	✓	
		Auxiliary support	Support with palm	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			
			Support with elbow										✓			✓	✓	
			Without support											✓				✓

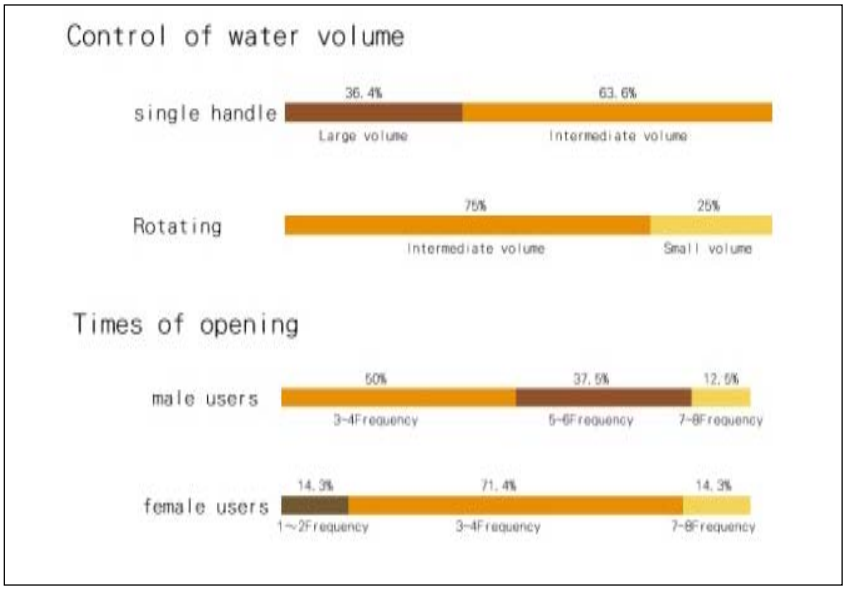

Figure 9: Control circumstances of faucet use

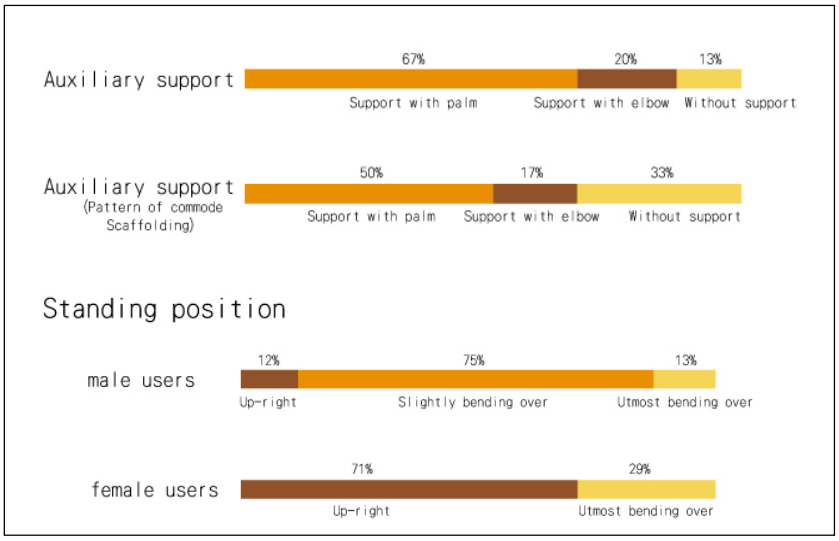

Figure 10: Commode use status by respondents

4.4. Environmental arrangement

According to the survey, most users tend to place the tooth glass alongside the commode, while the minority of users holds the tooth glass, which might be attributed to personal habits and the storage space of the commode. In terms of adjacent stored items, in addition to teeth brushing gear, cosmetics and other small articles are also placed in the washing and dressing space. The items for female users are more than those for male; therefore, they require proper storage space.

Table 5: Stored items

Type \ Respondents			N1	N2	N3	N4	N5	N6	N7	N8	N9	N 10	N 11	N 12	N 13	N 14	N 15
Stored items	Position placement of tooth glass while in use	Held by hand		✓											✓		✓
		Placed on the platform	✓		✓		✓						✓	✓		✓	
		Inner side of commode								✓							
		Without tooth glass				✓		✓	✓		✓	✓					
	Adjacent stored items *	Teeth brushing gear				✓	✓		✓		✓		✓	✓	✓	✓	✓
		Face washing gear				✓	✓		✓		✓		✓	✓	✓		✓
		Cosmetics				✓					✓		✓	✓	✓		✓
		Contact lenses and other gear				✓	✓		✓		✓		✓	✓	✓		✓

* Family members share the commode

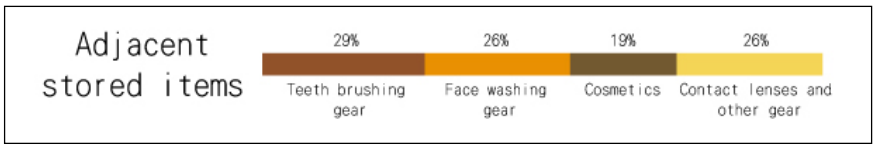

Figure 11: Conditions of adjacent stored items

5. Conclusions and Future Studies

The above four conclusions could be the basis to discuss the design of bathroom and toilet spaces, as well as the follow-up design orientation. The non-participation method and satisfaction survey are employed to verify whether newly designed commodes and faucets live up to the four indices and expectations of the public.

REFERENCES

- General Design Research Plan of Taiwan Design Center, 2006
- Construction Management Unit of Construction and Planning Agency, *Physical Manual of Residential Bathroom Space*, Construction and Planning Agency , Ministry of the Interior(CPAMI), 2003
- Cheng, K.H., 2007, A Study of Bathing Space Design from the Perspective of Universal Design, master's thesis, Tunghai University.
- Lin, C.Y. , 2002, Usability Research on Bathroom and Toilet: Take DapengHuacheng of Taipei County as Example, master's thesis, Chinese Culture University

- Narasaki, T., Tsui, C.K.(trans),2002, Illustration of Accessible Space Design for the elderly and Handicaped, Chan Shih Books
- The Concept of Universal Design,2004,P25
- Toto Machine Co., Ltd, Water Supply Facilities for the Elderly, 2006, p74
- Annual Design Review of JSSN, Design Research, 2004, Vol.10, NO.10, P3
- Wu, M.L., 2003, Application of Statistics and Analysis, P.1-9
- Chen Ming-Shih,2005,“Behavior and Consciousness of Bathroom Space Utilization of the Elderly in Taiwan”, Design Research of Japan, Japanese Society for the Science of Design, Vol.55, No5, p37~46

BIOGRAPHY

Ming-Shih Chen[1]

- March 1999, P.H.D., Design Science and Planning, Chiba University, Japan
- Affiliation / Department of Industrial Design,Tunghai University,Taiwan
- Position / Associate Professor
- Office Address / No.1727, Sec.4, Taiwan Boulevard, Xitun District, Taichung 40704, Taiwan
- Office Phone / +886- 4-2359-0492 #14
- E-mail / msc@thu.edu.tw
- Cell Phone / +886- 958-740741
- Specialty / Universal Design,Product-EnvironmentDesign,Surrounding and Acting Culture,Design for the Elderly

Iu-Ru Lai[2] , Department of Industrial Design, TungHai University, Grade II Institute