Service Design for mediating technology and experience in Augmented Reality: A case study of a holistic AR travel service

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Abstract

Augmented Reality (AR) is a technology that brings new possibilities to service design and delivery by projecting a digital layer of information directly on top of one’s physical surroundings. However, there is tension between its technology-centric applications and its use as a holistic service. To bridge this gap, we examined the representative functions of AR applications from a service design perspective, with a focus on travel service as a case study. We built a taxonomy of existing AR functions and conducted interviews to understand user needs and patterns of travel experience as parts of a larger story. Based on this research, we then created a storyboard and user interface (UI) prototype for a holistic travel service supported by AR.

Keywords: service design, augmented reality, travel, service storytelling

Introduction

Augmented Reality (AR) is generally defined as the enhancement of a real-world environment using layers of computer-generated images
AR differs from Virtual Reality (VR) in that AR enables the user to experience interactive information layered on top of their physical reality, while VR creates its own interactive world. Over the last five years, we have observed an explosive increase in AR applications, giving rise to a variety of industries, including retail, advertising, manufacturing, health care, media, entertainment, sports, and education. Statistics show that the global AR market is expected to grow significantly in the coming decade, reaching about 198 billion dollars by 2025 (Liu, 2019).

However, all this excitement surrounding AR must be accompanied by an understanding that there is still tension in the balance between technology and the ideal customer experience. Many current AR applications are often developed around technological capabilities rather than user needs; therefore, the customer experience tends to be moment-based and fragmented. For example, Pokémon Go positions AR as its figurehead technology, but this feature is only applied to one moment—when a user throws a ball to catch a virtual monster—which is not quite connected to other parts of the virtual or physical experience (Rauschnabel et al., 2017). Pokémon Go started as a worldwide phenomenon, but after a couple of months, fascination decreased and usage dropped. To maximize the value of this technology, there is a need to research and explore AR from the perspective of human experience.

In this study, a team of design and marketing researchers explored a service design approach to AR technology using travel as an example, which aided in the design of a more comprehensive and human-centred AR experience to bridge the gap between technology and customer needs. We first analysed the existing functions and usage of AR applications by building a taxonomy of 110 examples. Next, we interviewed eight people to understand the general customer journey and their specific needs when travelling. Based on this research, we created a storyboard and UI prototype for a travel service that integrates AR technology.
Background

Augmented reality

AR is characterized by its ability to merge the virtual and the real—primarily through multi-dimensional sensory stimulation and immersive interaction—without changing the user’s physical surroundings. Azuma (1997) summarized three characteristics of AR technology: virtual real-time fusion, real-time interaction, and 3D positioning. Recently a new generation of AR platforms, such as Apple’s ARKit and Google ARCore, added environmental recognition capabilities, which led to the integration of AR into key social networks and operating systems. Currently, the majority of AR experiences are mediated by smart phones, but there is increasing adoption to other wearable visual or auditory devices, such as 0glasses or Boss AR. These advancements open up new possibilities for AR usage in diverse service contexts.

However, successful consumer use cases are still limited (Han et al., 2017), and an AR experience which enjoys ubiquitous consumer use is yet to be developed (Azuma, 2019). Scholars point to a set of challenges that AR technology and its applications need to overcome from a design perspective. AR must be integrated into workflows, tasks, and experiences more seamlessly (Tristan et al., 2017); be designed to provide practical benefits (Olsson et al., 2012); and supply quality information (Jung et al., 2015). The design of AR experiences presents several intrinsic challenges and thus should be approached holistically (Kourouthanassis, Boletsis, & Lekakos, 2015). Although AR applications offer much potential, existing guidelines or principles for their effective design is scarce (de Sá & Churchill, 2012).

AR and travel

Due to its ability to digitally overlay information onto users’ immediate surroundings (Rauschnabel, Brem, & Ivens, 2015), AR has received much attention as a way to enhance tourist experiences (tom Dieck & Jung, 2017). An increasing number of scholars have explored its potential in areas such as user requirements (tom Dieck, Jung, & Han, 2016) and behavioural studies (Rauschnabel & Ro, 2016). For example, Martínez-Graña et al. (2013) suggest that AR applications are especially relevant to

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the tourism industry since they improve tourists’ social awareness of an unknown territory.

Research shows that AR applications offer an efficient way to deepen understanding of the natural environment (Martínez-Graña et al., 2013), educate museum visitors (Casella & Coelho, 2013), and present historical events at tourism destinations (Benyon et al., 2014) by providing users with context-sensitive information (Yovcheva, Buhalis, & Gatzidis, 2012). Visitors particularly praise AR for its educational abilities, proposing it as a key focus in the design of experiences which incorporate entertainment as peripheral elements (tom Dieck, Jung, & Rauschnabel, 2018). Tourism is a service industry in which experience is the core value. Therefore, it is important to consider end-to-end experiences from a holistic perspective as the dominant offering.

AR and service design

Service design is a holistic approach with a structural arrangement of information which engages, informs, guides, and supports the customer experience, featuring touchpoints over time and across multiple channels (Parker & Heapy, 2006). As a new channel that provides a combination of physical and virtual information, AR offers great potential in supporting service experiences and participant interactions. Researchers propose that AR can be useful in the design of a service by providing backstage information to enhance location-based adaptation (Kansa & Wilde, 2008) or allowing travellers to personalize their services with multi-language functionality (Han, Jung, & Gibson, 2013).

Although little research has explored the application of AR from a service design perspective, Kim and Lee (2018) proposed that the technological capabilities of AR and VR can be used to enhance the autonomy of the customer through “service storytelling.” Service storytelling refers to an ongoing, collaborative, and interactive dialogue between the service system and the audience, which customers can actively participate in to create their own experiences. To create a holistic service experience that integrates AR technology with different phases of travel, we base the present study on this approach.

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Method

Taxonomy of existing AR applications

We began our research by analysing the key functions and usages of current AR applications, including 110 applications collected from the Apple Store, Google Play, and the representative AR industry review websites on May, 2019, using the keyword “AR”. Next, we determined their main use value in order to classify them (Figure 1), with a focus on psychological and behavioural perspectives rather than their technological specifications (Carlos Flavián et al., 2019). We found that the majority of these applications focus on entertainment, followed by education, action support, and spatial exploration (Figure 2). Details on their objectives are as follows:

- Catch attention (e.g., creating wonder via a surprise factor, such as iButterfly)
- Promote (e.g., informing customers about a product/service, such as Coke AR Cans)
- Call to action (e.g., persuading customers to make purchases by offering a virtual try-on experience, such as the Converse Shoe Sampler)
- Educate (e.g., supporting students in mathematics and science, such as GeoGebra AR)
- Support action (e.g., providing guidance, such as Find Your Car with AR)
- Utilize space (e.g., enriching interactions in the physical world to organize digital content, such as Amazon Products in Place)
- Immerse (e.g., transforming the environment into another space, such as Volcan de Fuego by The New York Times)
- Entertain (e.g., displaying an interactive game character, such as Flippy Friends Fruit Crush AR)
- Coproduction (e.g., supporting collaboration between customers or the personalization of a service, such as Minecraft AR)
- Retain customers (e.g., incentivizing customers to return and use the service by providing special offers, such as ROAR Shopping Advisor)

Figure 1: Taxonomy of AR applications

Figure 2: Usage of AR applications
User research

In the next stage of our study, we conducted interviews with eight participants about the general steps and flow of travel (Figure 3), including the decision-making process, pain points, and their perceptions of AR. We found that travel planning is the most time-consuming phase. The interviewees tended to travel together with family or friends, and typically one person leads the planning and collects agreements. They were all concerned about how their accommodations would match their expectations, as well as how to navigate in an unfamiliar environment. The interviewees were also concerned whether they would miss locations they planned to visit, information they needed during their visit, or opportunities to attend nearby events.

Another finding was that the interviewees did not yet view AR as a useful “service.” Many of them perceived AR as a technology that provides an exotic yet temporary, impractical, and unessential experience; therefore, the general image must be improved by a new approach. The role of design will be to weave AR touchpoints into the service flow based on user needs, ensuring they maintain a seamless connection to their respective services.

Figure 3: The general process of travel

AR travel experience design

Customer journey map

In the first phase of our design, we created a customer journey map to arrange the key AR functions in our taxonomy. The purpose was to tell a story from an individual traveller’s perspective about their overall experience over time and across channels before incorporating AR.
support. The customer journey is divided into three phases: preparation before travel (e.g., dreading, planning, and booking), experience during travel (e.g., getting there and being there), and activities after travel (e.g., going back home, sharing, and remembering).

![Customer journey map of a travel experience](image)

In the preparation phase, advertisements incorporating the AR functions of informing, promoting, and calling to action can initiate the travel experience. Other AR functions, such as education, coproduction, and immersion in a virtual reconstruction of the destination can also be helpful for pre-travel planning. For example, experiencing the destination in advance and learning useful information, such as history, safety, and transportation, can significantly enhance the travel-planning experience. Additionally, AR can support collaboration with travel companions in co-planning and documenting the agreed itinerary, especially for those who are collaborating from a distance.

During travel, AR applications can be integrated into a system to support a traveller’s actions. For example, users can see information and receive guidance on navigating the city according to their itinerary. Meals, accommodations, shopping places, scenic spots, or pre-booked places can be easily found based on the user’s geographical location. Virtual signs, guide arrows, and descriptions can be superimposed onto attractions, thereby allowing the user’s experience to be less impacted by the presence of other tourists. AR can also provide personalized and improvised guidance in real time, such as in unexpected situations (e.g., bad weather or festivals) or based on other user comments and reviews.

After travel, AR can be used for organizing, sharing, and revisiting travel experiences. For example, drawing upon the functions of utilizing space.
and immersion, AR can efficiently capture a travel experience in the physical space by archiving it virtually and providing a museum-like setting to view archived experiences with multimedia information. Users can also share these augmented travel experiences with their friends and families. As for the AR function of entertainment, virtual characters or scenes can add a more personalized voice to the experience, especially when shared on social media. On social media, AR can be used to inform, promote, and call others to action, thereby initiating new travel experiences while retaining the original customer.

**Storyboard and UI development**

Based on insights gained from our taxonomy and the interviews, we developed a storyboard (Figure 5) and UI prototype (Figure 6) for a travel experience with AR technology seamlessly embedded at each critical touchpoint throughout the customer journey. In this scenario, we explored the case of an inclusive Travel AR app available on a mobile phone, but the scenario can be applicable to other wearable devices that mediate AR.

The story begins with efficient AR support in collaborative planning before travel by projecting a virtual city over the users' physical surroundings and providing them with a preview of the experience. Once the travellers reach their destination, AR can help them seamlessly connect to their itinerary and turn unfamiliar surroundings into a navigable environment, for example, by allowing them to view the destination city from their hotel room and projecting the best routes for navigation.

During travel, AR serves as an efficient virtual guide who introduces information about tourist attractions, translates and recommends menu items in restaurants, and supports opportunistic exploration, such as shopping in a local market. It can also project how historical sites appeared in different time periods, enable interactions with characters from related history or folklore, and help travellers learn more about objects or events that they encounter in the street. After travel, AR supports the traveller in organizing and sharing their travel experiences as digital vignettes.
Figure 5: Storyboard of a holistic travel experience with AR technology

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Conclusion

In this paper, we explored how service design as a holistic approach can enhance the AR experience via a case study of a travel service. We first analysed representative AR applications to distil their key functions, then arranged these functions according to a customer journey map based on interviews. Finally, we developed a storyboard and UI prototype to support a seamless AR service. Future study will be focused on the evaluation of the proposed solution. We argue that a holistic service design approach is vital for the future of AR development and its more diversified usage in design and marketing. Although we focused on travel experience as a core example, the key functions of AR identified in our research can be used to innovate various service industries. Service design offers to unlock the infinite possibilities of AR technology in supporting user needs and creating new business opportunities.

Acknowledgements

This paper with funded by the China Scholarship Council to support Heng Zhang, School of Art and Design, Zhejiang Sci-Tech University.
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