

# **REMODEL THE PUBLIC SERVICE BASED ON BEHAVIORAL MAPS AND SERVICE DESIGN IN CASE OF TAIPEI MRT EXIT**

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## **ABSTRACT**

The main purpose of this study is to remodel the public service based on behavioral maps and service design in public space. Modeling human spatial behavior in public space is an area of great interest to public service provider and users. Adequate observations will reveal significant information about users' spatial preferences, which are essential considerations in public service designer. This study used behavioral maps and service design in public space with considering the five human factors that include physical, cognitive, social, cultural, and emotional. Researchers recorded the map of users' activity diversity, map of users' experience and emotional, and map of key issues and users' type for analyzed and proposed new service prototype. Experiments are then designed and implemented for evaluating the proposed smart bench and green trellis service prototype in the case study area. The results of this study show that the integration of behavioral maps and service design in public space allow researchers to investigate and deeper understanding the users' emotion, experiences and preferences. So that to increase the design of public service in public space.

*Keywords: service design, behavioral maps, public service, user experience, public space*

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## **1 INTRODUCTION**

The main purpose of this study is to remodel the public service based on the users' behavior. Current research on service design for public services indicates the importance of co-production: where the consumers—who in the case of a public service are both consumers and owners—materially participate in the production of the services they consume (Yoo et al., 2010). Modeling human spatial behavior in built environments is an area of great interest to public service provider and their clients. Adequate observations will reveal significant information about people's spatial preferences, which are essential considerations in public service designer. As point out by Yan and Forsyth (2005), the observation results of spatial behavior is an indicator of successful public service design, whereas they also can lead to an indicator of wasted resources and the cause for users' dissatisfaction. However, without a better understanding of human spatial behavior, appropriate design norms are difficult to set up. Behavioral mapping (Cosco et al., 2010), which is a procedure of recording detailed observations of who does what where for a specified time interval, has been used to derive data from the field. Then using the results to remodel the public service. This study describes a method that integrates behavioral mapping used to analyze behavioral data collected in the public space of the MRT exit 4 of Zhongxiao-Xinsheng station in Taipei. The results of the analysis can be used for learning and modeling users' behavior in public spaces and further been used to remodel the public service in the public space. This study demonstrates the application of service design to collect and analyze mass data of human behavior in a public space.

This paper begins with the literature review on service design, public service and how these two can be integrated to provide a better service in urban space. Using observation framework as a methodology to break down user experience through its behavior. Later, the acquired findings gave understanding to user's overall public space experience. Service design in its application can influence the user's behavior and also can improve the quality of the public space. In line with that, researchers aim to study further about what can be improved from public services in terms of implementing service design (Felix, 2011). This study will focus on observing user behavior in as a public space and how user interacts with this place. The purpose of this study is to provide the solution with the implementation of service design in MRT exit 4 Zhongxiao-Xnsheng. User scenario that emerge out when using service in the target area will be an insight for us to propose the idea on what service does user need. At the end of the process, researchers proposed early prototypes as a suggestion for each of user types.

## **2 LITERATURE REVIEW**

Moritz (2005) defines services as intangible, can't be stored, can't be owned, and not separable from consumption. Along with consumption, there will be services applied on it. Service thinking is different, in an important way, with product thinking. In product thinking, after the product takes place in the market, the product provider's job is done. It is then the customer's responsibility to use that product to reach the desired end. But in a service thinking, the services provider's task is not finished until the customer's need is fulfilled (Chesbrough, 2010). User satisfaction is the main consideration to reach the final purpose of providing service and customers often desire to have their needs fulfilled not only initially but over a series of interactions with their provider, it is why service design is important to deliver user satisfaction, creates user experiences. Services are different from physical products because they tend to be intangible, heterogeneous, simultaneously produced and consumed, but perishable (Avlonitis et al., 2001). Service can be related to changes in various dimensions. Some examples include innovation in the service concept, the client interface, the delivery system and technological options Service design is commonly defined as 'the initiation, adoption and implementation of ideas or activity that are new to the adopting organization and entails identifying and using opportunities to create new products, services, or work practices (Gadrey et al., 1995). Hence, Quin et al. (1987) also define service as include all economic activities whose output is not a physical product or construction, is generally consumed at the time is produces, and provides added value in forms (such as convenience, amusement, timeliness, comfort or health) that are essentially intangible concerns of its first purchaser.

Service design is defined as the activity of planning and organizing people, infrastructure, communication and material components of a service in order to improve its quality and the interaction between service provider and customers. Within service development, it processes service design

contributes with a set of modeling techniques for service experience. Among these techniques, can be mentioned servicescape, customer journeys, service interface, etc. (Moritz, 2005). One of the main concepts in service design is interaction. The servicescape or environmental image of the service is the result of a two-way process between the observer and his physical surroundings. Environments can help to create a pattern and place identity in which users can easily recognize and make sense of the environment (Viña, 2009).

Therefore, service design is not just designed for beautiful outfit but can make the user satisfied through observation the user imagination and the users experiences with involved various field of expertise in the design process. And also makes users as a part of the design project through the user imagined. User represented, and user experiences to fulfill the users need and also make public space a better environment for users.

Public space as a crucial type of urban formations started appearing at least 6000 years ago. Within urban areas, public space always existed and served a very important purpose. With the development of cities, the squares acquired more and more functions (Dyer and Ngui, 2010). As point out by Kevin Lynch in his book "The Image of the City", that users understood their surroundings in consistent and predictable ways with five elements: paths, edges, districts, nodes, landmarks (Lynch, 1960). The nodes in a city described by Lynch represent the focal points, intersections or loci (Lynch, 1960). In modern urban development, nodes in a city are described as the public space that have compact, mix-used development that serve the surrounding areas and are often accessible by high order transit and good road networks. However, in the term of modern city development, the public space become hubs, sensors that semantically be tagged as things from physical world items (Lombardi et al., 2012). The public space are also places or installations for cyber flow (Nakanishi, 2010, Kohno et al., 2011). They are carriers for public service, such as broadcasting messages but also the way of conveying urban meanings and identity for people and places (Memarovic et al., 2011).

Applying service design to public space turned out to be in some way different from its application to single products or services. It is because in the public space is an absence of a structured sequence of actions and interactions, this multiplicity of actions makes the user's perception of the city "not sustained, but partial, fragmentary, mixed with other concerns" (Lynch, 1960). Actually, sometimes it is even hard to define what exactly the service is, because activities arise and conclude unexpectedly and users can also perform several actions at the same time. Meanwhile, some public spaces have a very deep cultural background, a strong local identity that represents the spirit of the city and its inhabitants, a valuable asset that Alexander (1979) calls a "quality without a name". Thus, conclude from the literature review, this study advances the previous work by integrating behavioral maps and service design in public space for remodeling the public service in the public space. In addition, this study looks at the needs of the users as a key stakeholder in co-design that improves the public service by improving the perception of fairness in the services provided.

### **3 RESEARCH METHODOLOGY**

Observing users' activity and their behavior, including their emotions, in the target areas that will be the basic foundation to analyze user experiences. The main issues and severe user problem found in the observation will become the key for researcher to purpose the solution for the user. User journey while using the public space, user behavior as a respond for service provided is the main consideration for the improvement of public service in terms of service design.

The five human factors is a method for supporting observation in the field, prompting researcher to look for physical, cognitive, social, cultural and emotional elements present in the situation to understand how the environment affect people's overall experience. Understanding five factors of a person in a structured way and thinking about these factors together will give us a deeper understanding of the experience of that person (Kumar, 2013).

This study made an observation plan based on the five human factor criteria as shown in Table 1. These factors (physical, cognitive, social, cultural and emotional) shares in common are the power to affect people's behavior in, and experience of the public realm. The study of the emotional relationship between people and the material environment, especially in the observations of users, bring crucial notions to increase Design capacity to give existence of positive feelings to a more responsible society. Therefore, understanding how and why things evoke emotions is crucial to understand society and imperative to design the environment (Damazio et al., 2009).

Table 1. Five Human Factor Criteria

Five Human Factor Criteria	How do user engaged with that criteria
<b>Physical</b>	How do people experience their physical interaction with service facility? What do they do, open, carry and touch all facility?
<b>Cognitive</b>	How does user associate meanings to environment they interact with? What are the various interactions that require people to think?
<b>Social</b>	How do people behave, formally and informally interact among others?
<b>Cultural</b>	How do MRT user experience shared habits?
<b>Emotional</b>	How do people experience their feelings while interact in target area? What in the environment is triggering user emotion and feeling? Are people sad, aggravated, bothered, frustrated or happy?

#### 4 CASE STUDY AND RESULTS

This study will observing people activity and behavior based on five human factor observation framework in the target area, at public squares in the MRT Exit 4 of Zhongxiao-Xinsheng station, which is along the NTUT ecological ponds through the green gate and inside the MRT. Narrowing down the observation finding by analyzing several key issues and main problem that triggers user emotion, as a strategy to develop the service idea. Developing the service idea becomes the first step for this study to build early prototypes as a solution. In observation findings, researchers were able to see the pattern of user activity and movement in several spot that creates mapping for user activities.

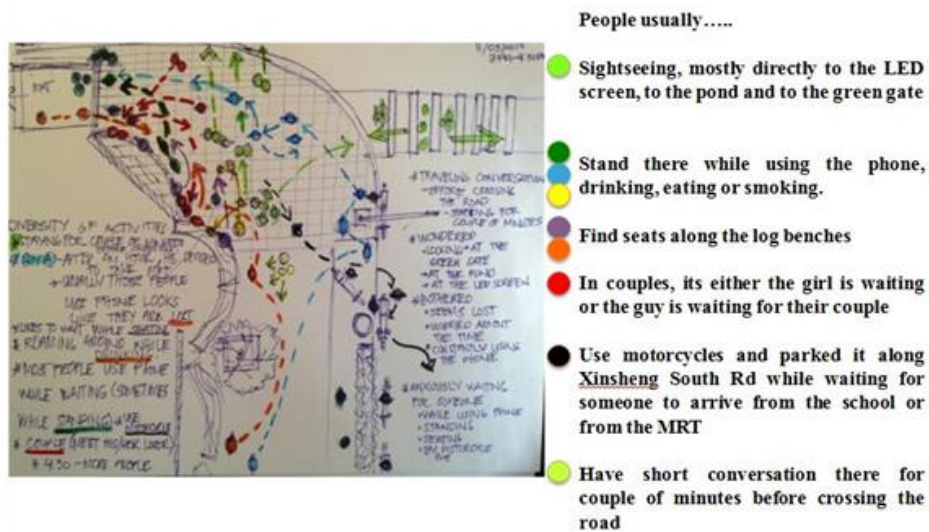


Figure 1. Mapping of users' activity diversity

Based on mapping of users' diversity of activities outside MRT exit 4 (shown in figure 1), there are three activities stand out. Those users who are usually sightseeing at NTUT's ecological corridor, using their mobile phones that seems lost and standing or seating while waiting for someone.

Researcher noticed that several user experience have a strong connection with their behavior shown in their activity when interact with all facilities and service in target areas. In line with that, this study also tries to define several activities in relation with their emotion.



Figure 2. Mapping of users' experience and emotion

In the observation result, this study found that: a) some of the user usually get confused when they lost direction; b) user seems bored while they are waiting for someone; c) people looks happy while chit-chatting with friends; d) user looks wondered when they see the ecological corridor and e) some users are bothered about carrying big luggage and finding easy cards. The mapping of users' experience and emotion is shown in figure 2.

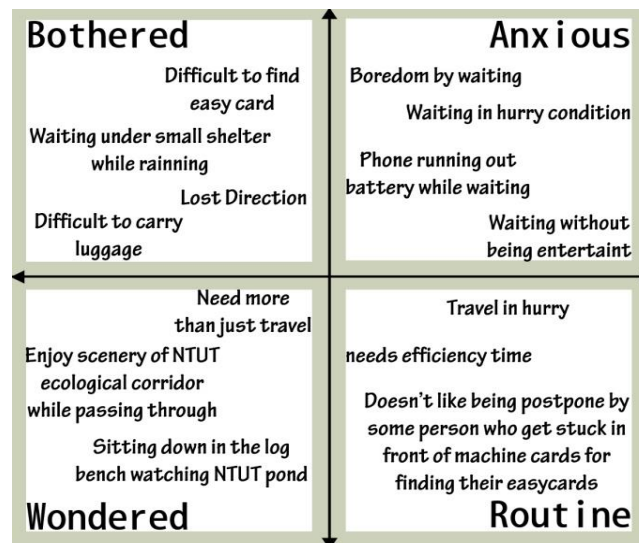


Figure 4. Analysis map of key issues and user types

Reviewing the user experience and emotion is guiding researcher to several key issues and problem found in the site. This key issues and user emotion helps researchers to determine the common characteristic and mapping it down to defining the different kinds of users as shown in figure 3.

Based on the aspect above, researcher were able to identify 4 types of user regard to their emotional feeling when interact with the NTUT exit 4 environments:

1. **Bothered user** (user with several problem using MRT facility)
2. **Anxious user** (user with anxious feeling while waiting for their friends)
3. **Wondered user** (user with extra time while they're travelling and can be easily distract by other triangulation aspect like enjoy the NTUT Ecological corridor)
4. **Routine user** (user with only travel purpose and needs time efficiency).

By analyzing 4 types of user with their problem leads researchers through the idea of service and build the early concepts of prototype. Researchers are trying to proposed solutions for every type of user to satisfy them. There are 4 prototypes, which represent each of user types. The prototypes are Green



Trellis and Smart Bench for wondered user, Informative Panel and Newspaper kiosk for anxious user, Luggy Mover (Luggage Mover) for Bothered User and Easy Bags for Routine User.

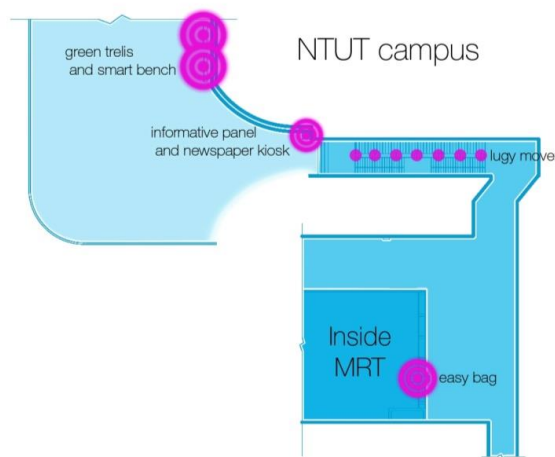


Figure 4. Map of allocated prototypes

The first three prototypes will take place in public space outside the MRT Exit 4. The Easy bags will operate inside the MRT exit 4. The prototype, Green Trellis and Smart Bench, will place in the NTUT log benches, Informative Panel and Newspaper kiosk will take place near the NTUT LCD screen, Luggy Mover (Luggage Mover) takes place in the stairs going down in MRT exit 4 and Easy Bags is in the card machine, inside MRT parameter (Figure 4).



Figure 5. Green trellis and smart bench prototype

The first prototype is the Green Trellis and Smart Bench. Based on observation, researchers found that a lot of MRT users using the NTUT current facility around the green gate area as one of the activities shown in mapping user activities (figure 1), so green trellis and smart bench are being proposed to improve the current facility and solve the MRT users problem based on their behavior and emotion (figure 3). After getting out from the MRT exit 4, there is a high number of user always stay in a place that has a shadow, the place where gives them a shade while waiting for someone or for a particular reason, and also have a problem with MRT small shelter in rainy day. This study proposed make green trellis as a shelter above existing log benches around MRT exit 4 and make some additional features to become smart benches. This prototype, as shown in figure 5, designed to put a phone charging inside the benches, natural relaxing music, Wi-Fi radar around the green gate area, to create more enjoyable area and friendly-user facility. Users may also read newspaper, listening music while sitting down along smart benches or while waiting for someone and they may stand under green trellis to avoid sunlight and can serve as a shelter from raining.

The prototype of informative Panel and Newspaper Kiosk will provide information that enable visitors to conveniently access information especially for new MRT User, people can get information before they enter MRT or after going out from the MRT exit 4. User will get inform about basic MRT guide, schedule and MRT alignment map and information about MRT exit 4's neighborhood area via QR Code for user who tend to lost direction. Newspaper kiosk is determined for reading newspaper while their sitting down in NTUT ecological corridor or takes away the newspapers while they travelling to the MRT. People can buy newspaper with their easy card by tapping the easy card into the sensor machines and newspaper payment deducted.

Another prototype is luggage mover that should help users with heavy bag or travelers with suitcase. They suggesting that prototype because elevator or escalator is not provided for passengers who enter MRT exit 4 and this prototype can help that kind of users.

Based on observation near ticketing area, approximately 5% of MRT users are in rush hours, some of the users cannot find their Easy Card and continuously blocking people flow. So this study proposed an easy bag prototype. Easy bags device based on communication via near field communication (NFC) technology, what can recognize signal from sensor card even over long distances. Through these improvements, users are not only helping themselves but also others by making efficiency of time especially for Routine user who is rushing to work.

## 5 EVALUATING THE PROTOTYPE

### 5.1 Smart Bench Prototype

A concept prototype is being proposed to assess the user problems. Through observation of user behaviors, this paper is able to build ideas for the early prototypes. The early prototypes are evaluated using Behavioral Prototype framework. This method is used to simulating situations of user activity while using the prototype (Kumar, 2013). This behavioral prototype is another step to explore user experiences based on the five human factors framework, the observation approach earlier. The researcher used five human factor criteria to evaluate the prototype. Researchers chose one prototype to become a test pilot prototype and the prototype being tested is the green trellis and smart bench prototype.



Figure 6. Smart Bench Prototype for phone charging



Figure 7. Smart Bench Prototype signage

The prototype is installed in the side of the log benches as shown in figure 6 and figure 7. It provides different USB cords depending of what type of phone. Based on the findings on smart benches experiments, researchers found that some users are curious about the prototype. They tend to come closer near the prototype, just find out how it works and where do the power source come from. Another type of users was observed is just to have a glimpsed of it while their passing by along NTUT green gate. Lastly, the user who took time to really used it. For further improvement of smart benches, the finding suggests to have clearer and bigger signage and to put information on how to use the prototype. Observation result of user interaction with the smart bench prototype is shown in figure 8.



Figure 8. User interaction with smart bench prototype

This study chose 9am-2pm and 4pm-7pm two period of time schedule for observation since at those times are both the peak time and busy time for users walking along place for smart bench prototype. There are a large number of people had glimpse of it. However, they are not considered as the main users. For those people who are under the “notice it” category, researchers consider that kind of user who had stayed around the area and really notice the prototype for at least 5 seconds. The second category of user is those people who took time to look closer of the prototype. The third category users are those people who took picture of it. The fourth category of user is those people who touched the prototype. The last category of user is those people took time to use it. However, some of them were wondering if the prototype really works or not.

Table 2. Number of users for smart bench prototype based on experiment

	Notice it	Look closer to it	Take picture	Touch it	Use it
<b>9am-2pm</b>	14 (32.5%)	15(34.8%)	3(7%)	5(11.6%)	6(14%)
<b>4pm-7pm</b>	11(22%)	10(20%)	4(8%)	18(36%)	7(14%)

Table 2 shows the statistics we gathered from the experiment. The experiment results show that the smart bench prototype is quite effective. Though it is just a simple model of prototype, the user can use the service easily. Some of the users touched it because they are curious on what kind of material the prototype made of, what’s inside the prototype and where the power source come from.

In the experiment those users who just to notice it and look closer, probably their phones are still have a full battery or with enough battery that they don’t bother to use the prototype. This study assumes that this prototype will be more efficient between 4pm-7pm than 9am-2pm since the cell phone of a lot of people are running out of battery by that time. The results show that the assumption is correct and the smart bench prototype can provide a better service to the public space.

## 5.2 Green Trellis Prototype

Another prototype experiment is the green trellis. The prototype is to putting the tent as substitute for the green trellis as shown in figure 9. The purpose of using this tent is to evaluate whether user may stand under green trellis to avoid sunlight in sunny or from pouring rain in raining season. Researchers observe how people use the tent depending on the weather.

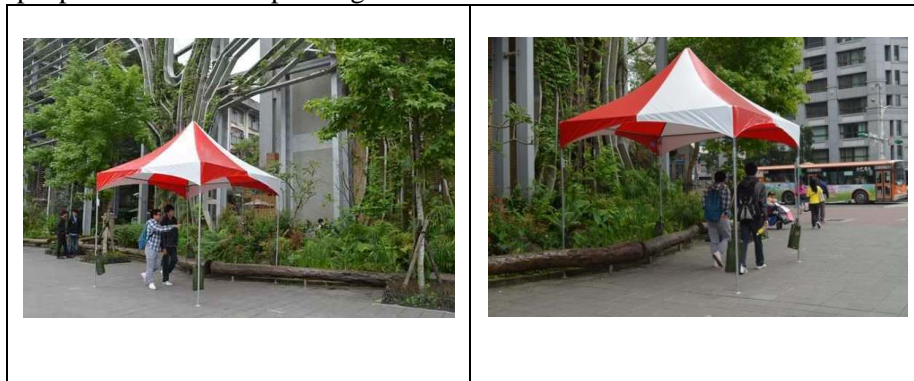


Figure 9. Installation of Green Trellis Prototype



Researchers observe how people use the tent (substitute for green trellis) depending on the weather. This study presumes that people are likely to use the tent in hot sunny or rainy day. But the weather of the day for the experiment is not really encouraging people for using the tent since it is neither sunny nor rainy day. However, researchers were still implementing the experiment in order to test the prototype and see whether people will still using the tent in that kind of situation. The results show that, even though it is a cloudy day some of the user still sitting or standing under the tent as shown in figure 10. Thus, this study concludes that the green trellis service is useful in this public space. Researchers assume that the green trellis prototype is likely to become more successful for providing shelter for protecting users from strong sunlight or rain.



Figure 10. Users' interaction with the green trellis prototype

## 6 CONCLUSIONS AND FUTURE WORKS

From this study, researchers try to put emphasize and approach all of the prototypes based on this flow shown in figure 11. At the end of the process, researchers try to classify what kind of prototype that is needed for every identified user and try to evaluate the benefit of the smart bench and green trellis prototype. The idea of the study is to provide the very basic thinking that offers some service to solve the problem of different user.

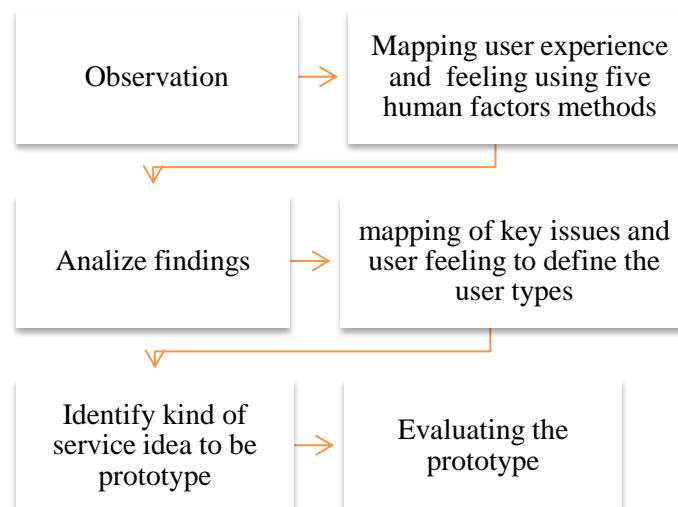


Figure 11. The Approach step flow chart

This study uses the integration of behavioral maps and service design to classify different kind of users and the service they need in the public space of case study area. According to the observation, researchers were able to recognize users' emotion that emerges out from several key issues and lead the study to define the anxious, bothered, wondered and routine as the 4 types of user. This 4 types of user are engaged with several problem found in public space. Since service design has an ability to create conducive environment, addressing the user specific needs of services and make a better service in public space. The results of this study shows that the service design method is appropriate to be used to remodel the public service in public space. Based on that, researcher investigated for deeper understanding on user emotion and their experience as an approach to increase the values of service. However, further investigating are needed for evaluate the other public service prototype proposed in this study in the future works.

## ACKNOWLEDGEMENTS

This study was supported by the National Science Council, Taiwan,(NSC 101-2410-H-027 -019 -). The authors are grateful to this support. The authors would also like thank for the help by Dr. Claire Tseng, Mr. Catur Hary and Mr. Wojciech Wilczek for their valuable opinions and suggestions.

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