Creating Spatial-Interactive Service Experiences

A framework for designing interactive service spaces

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Abstract. Inspired by the emergence of interactive space design and service design, this paper explores the concept of interactive service space and proposes a framework for designing interactive service space experiences. The framework has been applied in two design projects of successful commercial setting, mojo iCuisine interactive restaurant and Yun-Ching Real Estate VIP Center, as validation of its feasibility and applicability. We believe that this framework is beneficial for designers who have interests in creating service experience with interactive space approach, and for further studies regarding the concept of interactive service space.

Keywords. Service design; interaction design; interactive space; interactive exhibit; user experience.

INTRODUCTION
Computational media brought into the realm of architectural design not only changes in design processes, methods, and techniques, but also a major reshaping of our physical environment in the form of a movement towards prospects known as Intelligent Environment (Droege 1997), Ubiquitous Computing (1) or Ambient Intelligence (Aarts and Marzano 2003). Sensors, interactive touch screens, and a variety of interface technologies have been blended into the fabric of everyday environments, redefining the way we interact with architectural space.

Within this trend, interactive spaces have emerged as a new typology in architectural design (Huang 2008), and have proven to be stimulating and beneficial in commercial application that makes an emotional journey of discovery (Lucas 2012). Interactive interfaces and installations also facilitate services inside many public or private service spaces such as train stations, hospitals, or consumer reception areas in stores, as the physical environment plays a critical role in the quality of service experiences (Bitner 1992).

Nevertheless, there seems not to be a framework for incorporating service thinking in interactive space context. Thus, in line with this physical-digitalization phenomenon, we are motivated to develop an interactive service space framework in the hope of helping designers better create spaces of spatial-interactive service experiences.

EXPLORATIONS
We are motivated to link interactive space to service design by exploring the concept of interactive service space to address the following questions: Is it possible to create service opportunities using an interactive space approach? What is the best approach to designing an interactive service space? How can one incorporate, design, and implement a spatial-interactive service experience?
To answer these questions, this paper proposes a framework for designing interactive service space, and discusses how this framework can assist designers in creating spatial-interactive service applications so as to create service model that works.

**RELATED WORKS**

This paper is situated in the intersection between *interactive spaces* and *service design*. Relevant works can be grouped into three categories, as elaborated in detail below.

**Application frameworks for interactive spaces**

“Interactive Space” is used as a general term to refer to the architectural spaces integrated with input/output devices that interact with people (Winograd 2001, Streitz et al. 2003). Jeng (2003; 2009) proposed a conceptual framework that integrates interaction interfaces, sensing technologies, application control, and human adaptation to provide a design and implementation strategy for interactive spaces. Huang and Waldvogel (2004; 2008) envisioned interactive architectural spaces as a novel type of “inhabitable media”, and identified key ideas that form the basis for an inhabitable media system. Furthermore, Achten and Kopriva (2010) proposed a methodological framework that uses analysis, concept generation, simulation, and assessment to help designers evaluate and design better interactive architectural spaces.

The interactive space frameworks mentioned above all centre on human experience, which orients a significant fundamental understanding for designing and implementing interactive architectural spaces.

**User interfaces for interactive spaces**

Spatial interface technologies relate to space design both in technical and spatial-ergonomic ways (Ting-Han et al. 2010; Miles 2008). The dimension of the device, environmental lighting, power cord routing, and heat problems could be serious issues when integrating a multi-touch screen module into a space. Additionally, this in turn provides spatial constraints and reshapes the form of the space being designed.

Streitz et al. (1998) and Huang and Waldvogel (2004) have built real interactive environments and discussed practical issues in integrating interactive spatial elements into architectural spaces, whilst Snibbe and Raffle (2009) summarize valuable design principles for integrating interactive camera/projector systems from their interactive exhibit practices experience.

Other spatial interactive interfaces applications and technical research can also be found in relevant conferences, such as ACM Interactive Tabletops and Surfaces [2], which provides practical methods and techniques in implementing and integrating spatial interactive interfaces into architectural spaces.

**Service Design**

Service Design investigates the interactive relationship between the service provider and the service users by planning people, infrastructure, communications, materials and objects (Marc and Jakob 2011). Service design has emerged as a branch of study in interaction design in recent years, both of which fields share a common interest in creating user-centred experiences (Holmlid 2007). Similarly, Simon (2011) sees service design as arranging a series of interaction points between customers and the service system through many different touch-points during the customer journey.

The “customer journey map” is a multi-channel and time-based method in designing immersive user-focused service experience (Zomerdijk and Voss 2010). Similarly, the “service experience blueprint” method, as proposed by Lia et al. (2008), is a user-centered approach that defines the relationship among products, services, people, and their environments and leads users move around different service interfaces.

Some service design case employs advanced interactive interface as a method to improve user experiences in a service space. In a project of redesigning ATM experience by BBVA and IDEO [3] demonstrates how banking service can be empowered via digital interactive interface in a self-serving banking space.
Summary
According to the reviews above, it is surprising that very little work discusses service design within interactive space design context, and the integration of interactive interfaces and service spaces. Hence, this paper differentiates itself by bringing service design into the interactive space context and fosters a new interactive space genre.

TOWARDS AN INTERACTIVE SERVICE SPACE FRAMEWORK

Methods and steps
This research started by studying relevant works in the context of interactive spaces and service design. Then, in order to further the understanding of the field, we also empirically studied our previous commercial works on interactive exhibit space in order to assess both the theoretical aspects and the practicability of designing interactive service spaces. Secondly, based on the analysis of previous studies, we propose a framework as a hypothesis of this research. Finally, we conduct two commercial interactive service space projects and use the framework to map and analyze them to verify and further refine the framework.

Interactive space compositions
By empirically assessing the design compositions of our previous interactive space projects [4], we found that interactive space composition contains 3 aspects: space, installation, and interface (as shown in Figure 1).

The three levels of the interactive space composition entail specific respective design considerations, but collectively they constitute a minimal basic model for an interactive space. Space-level design should involve integration issues of installations, and installation-level design should consider the affordance and representational issues of the user interface.

There are some similarities between planning a service and planning an exhibit, such as the focus on user experience, and the applicability and flexibility in integrating interactive media to shape better experiences. Also, both visiting experiences can be designed as a journey of a user experiencing different interaction touch-points.

The idea of customer journey map in service design resembles the route planning in designing an interactive exhibit. Therefore, to further refine the framework specifically for interactive service space, we employ an interaction design viewpoint for service design that sees service as a series of interactive experiences (Simon 2011) by adding a service level on top of the three levels of the interactive space composition. Thus, the composition becomes a 4-level structure: Service, Interface, Installation, and Space.

Figure 1
Basic composition of an interactive space.
THE FRAMEWORK
Based on the extraction and refinement of the 4 levels of interactive service space, we further extract the framework into a composition of 6 application levels. The Service level is extended and interpreted into Touch-points level, Interface level to the Interaction level and the Interface level, whilst the Installation level remains the same, and Space level to the Location level and the Interactive Service Space level. These 6 application levels constitute the body of the framework (Figure 2).

The framework can be applied by starting with an envisioned service scenario or a revision of a current service workflow, and dividing this into a few different service touch-points in Touch-point level. Service facilitation can then be followed by considering and specifying each correspondent level: Interaction, Interface, Installation, Location, and Interactive Service Space. The meaning of each level is explained as follows.

Touch-point is where and when a service can be offered, or a situation in which a user meets service. A touch-point can be a part of a series of services or an interaction opportunity that provides relevant information for the user.

Interaction here means the interactive opportunities that can be created in the context of a service touch-point. It should be defined and developed as specific and clear functions with which users can interact to obtain the service.
The touch-points are transformed into interactions, the interactions are realized with interfaces, the interfaces are implemented with installations, the installations are arranged and embedded into different locations within the interactive service space. Each level, except for the touch-point level and the interactive service space level, has a direct inheriting relationship with its previous level and integration issues with its next level. The framework should be seen from a user-centred viewpoint, designed from touch-point level downwards to each level, and result in the interactive service space level. It should be noted that the framework here only expresses the relationship between different levels within a single service touch-point context. In an application, it should be applied in a context of multiple touch-points that compose of a sensible spatial service experience journey.

Interface is the appropriate user interface technology or method that facilitates the interactions for users to obtain the service in an intuitive and comprehensive way. For example, employing multi-touch gestures may be more appropriate than using a computer mouse and keyboard (Ting-Han 2011).

Installation is the hardware or facility that complies with the interfaces, and offers a physical and spatial context for the interaction. Installations can be as large as a spatial element or as small as a personal mobile device.

Location is where the installations are placed within the space. By connecting different locations of installations with a planned route, the service experience journey can be created and allocated.

Interactive service space should be represented as a whole and enabling users to navigate within it correctly and effectively. This can sometimes be achieved by spatial implication design or guiding graphics.

Figure 3
The mojo iCuisine application example of Interactive Service Space framework.
In design applications, the designer defines the spatial interactive service journey compositions involving all levels. The framework serves as a design and analytical tool to help designers strategically deploy spatial and interactive resources to help achieve service goals at each touch-point along the service journey. Nevertheless, although this framework encourages designers to think in multi-level of design, this does not mean that every touch-point should be facilitated, specified or intervened with interactive interfaces or technologies in each corresponding level.

**TWO EXAMPLES**

In this section, we analyze two interactive service space design projects in a successful commercial setting with our framework as contextual demonstration. Two examples are *mojo iCuisine* and *Yun-Ching Real Estate VIP Center*.

**mojo iCuisine**

This example demonstrates how we develop an interactive restaurant by augmenting and expanding new digital interactive functions on a catering service experience. The framework analysis of mojo iCuisine is shown in Figure 3.

The restaurant was opened in October 2009 in Taipei. A total of 22 dining tables in the restaurant are equipped with interactive interfaces via which restaurant consumers can browse menus, order dishes/drinks, play games while waiting for the meals, view advertisements, fill out customer opinion forms, and pay the bills, as all of the interactive dining tables are connected with a database and the accounting system in the restaurant. The colourful and flourishing landscape composed of these interactive dining tables is also a catalyst to empower a joyful experience in the restaurant. The overall design and implementation are detailed in Ting-Han et al. (2011).

Based on the framework of interactive service space of 6 application levels, the whole spatial service experience journey is defined and divided into 7 steps of touch-points, starting with the customer entering the space and ending with them leaving the restaurant. The whole journey is designed to occur only within mojo iCuisine, interactive service space, restaurant, which comprises the entrance, dining area, and the exit, as revealed in the location level. A projection wall projecting greeting images and touch dining tables with interactive menus (as indicated in the installation level and the interface level) are two installations that are realized the interactive functional components in the interaction level designed to meet the service touch-points in the touch-point level.

**Yun-Ching Real Estate VIP Center**

This example shows the framework analysis of Yun-Ching VIP Centre visiting experience extended from a 190” multi-touch real estate presentation experience (Lu et al. 2012). The initial idea for the establishment of this centre was to develop a presentation system for salespersons in Yun-Ching Real Estate Company to present company profiles, products, and relevant real estate information to VIP guests who visit the VIP Centre. However, to better craft the visiting experience, we further develop the system as part of a spatial interactive service experience and thus result in a design as shown in Figure 4.

In this case, the spatial interactive journey is defined in a 5-step touch-points scope, starting from the customer arriving at the VIP Centre and ending up with them making the buying decision. The key installation incorporated in this project is the 190” multi-touch screen, which achieves the functions of house information detail description and the house selection process in the interaction level by defined multi-touch gestures in an interface level including drag, zoom in/out, mark, delete, and pull.

Unlike the first example, in which the service interactions all take place within a single space, the second example involves two spaces, the VIP Centre and the residential house, which demonstrates a cross-space design application and planning possibility. The second example reserved a lot more rooms as unspecified, and it shows the opportunities for future facilitations in different levels of design.
DISCUSSIONS
The concept of interactive service space offers an option for designers to develop a service that incorporates spatial and interactive resources and features. This research proposed a framework and uses two examples of commercial design practice to validate its feasibility. The framework serves as a conceptual tool to help interactive service space designers think in a multi-level fashion when designing a spatial service experience. Nevertheless, the success of the service quality still relies on the insights and cleverness in deploying service touch-points in a sensible and appropriate context. Some design principle regarding user experience, user-centred design and service design thinking could be beneficial in planning the right spatial interactive service scenarios when applying this framework to design.

Some benefits of the framework
Our framework achieves certain benefits, as described below:

- The framework can be served as a design tool to help designers analyze, develop, or innovate their interactive service space under certain constraints in aspects of service touch-points planning, interaction design, interface design, installation design, and spatial design. Different levels of design constraints ensure the feasibility and applicability of their design.

- This framework also provides a practical structure for division of labour, as different levels can be assigned to different professionals. For example, the service journey can be planned by service designers. The following interactive functions can be developed by the interaction designers and software pro-
grammer, installations can be designed by hardware engineers, and the spaces can be designed by architectural interior designers. In a collaborative design context such as this, the framework serves as a collaborative framework that defines the relationships between different professions that have mutual influences and integrity issues between upper and lower levels of the profession.

The framework can also be used as a tool for current service renovation. By putting an existing service journey into the framework, this framework can help designers think about possibilities of integrating interactive and spatial resources to facilitate or enhance the existing service quality or further transform the service into a brand new spatial-interactive experience.

**Possible impact and implications**

In the last years, design has shifted from a form and function paradigm to a multifaceted and complex problem-solving task. A contemporary designer does not merely deal with form and functional issues in a design, but also digitality, interactions, and other design dimensions. The framework this research proposes suggests a design thinking that goes beyond simply form and function, towards the level of service and interaction that is usually beyond the scope of an architectural space design. In other words, this research tries to bridge service interaction design and architectural spatial design, and the proposed framework makes the service interaction and spatial design concurrent in design thinking possible, and this offers designers the possibility of dealing with design problems in more complex design dimensions. Designers can design not only the space but the service experience within the space or even create novel interactive service experience through different levels of interrelated and integrated thinking among services, interfaces, installations, and spaces in parallel.

**CONCLUSIONS**

We have proposed a framework of interactive service space that contains 6 application levels: Touch-points, Interaction, Interface, Installation, Location, and Interactive Service Space. We have also demonstrated the framework application examples on two interactive service space design practice, mojo iCuisine and Yun-Ching VIP Center. Though this framework is an approach rather than a formal and structured method, with application validation, we believe that this framework could potentially benefit designers in designing interactive service spaces.

This research is novel in the way that it bridges service design and interactive spaces. To an extent, this paper has approached a new strand of interactive service space research, but is limited in adopting the touch-point journey approach, whilst there are other service design approaches and interpretations of a service. Another limitation of this research is the lack of service quality evaluation, which may be an important factor for designing a successful service.

The next stage for this research is to further refine and detail the framework and incorporate service quality assessment and innovation mechanisms to make it a useful tool for creating innovative business by interactive service space design.

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[2] ACM Interactive Tabletops and Surfaces