



# Rethinking Mobile Interaction Design Within Service

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**Abstract.** Along with the explosion of mobile access across the globe, service experience has evolved. Now there is a myriad of service settings in which mobile interactive artifacts are used in providing service, ranging from express, shopping to healthcare, and more. Those interactive products in service consequently not only enable to interact with users but also aim to offer high-quality service. In this paper, we find mobile interaction design evolved by taking advantage of service design. To better understand the difference and competence of mobile applications within service, we compare the independence tool mobile applications and the service embedded mobile applications in four paradigms: communication actors, design objective, value, process. There is an obvious feature that from “linear analysis” to “open system analysis”. Then summarizing the benefits of rethinking from a service perspective: sequence thinking of content rhythm; a holistic lens in solving the problem; multi-role stakeholders’ co-creation. Based on service measuring methods, we deduce the evaluation dimensions content of service embedded mobile applications. Finally, To validate the evaluation scheme, we conducted a pilot study in mobile courier applications by collecting and classifying service functions to propose mobile courier applications design constraints from service dimension view. In this way, we try to give a contribution to the development of service-embedded mobile interaction design.

**Keywords:** Interaction design · Mobile application · Service-embedded application

## 1 Introduction

With the advent of the mobile Internet, mobile applications are increasingly affecting the lives of people. Users can access the Internet via mobile devices anytime, anywhere to enjoy a variety of products and services. Because of the applications of mobile devices, a lot of traditional services have enabled consumers to enjoy split-new service experiences, which refers to unlimited infinite channels of information exchanging flow, more efficient dissemination of information as well as reconstruction of the way of disseminating service information. So the widespread use of mobile devices - particularly smartphones - accelerates the transformation of the traditional service to a new model - “software integrate hardware plus APP” [1].

In this particular situation, mobile internet acts as both an interactive platform and a service-enabling infrastructure, whilst the mobile platform is raised to be an important medium constructing the whole service system. Owing to its mobile features, it plays an indispensable role in information flow and financial flow and connecting users (service receivers), managers (service providers), and other products no matter when and where among this new model service system to deliver a higher quality service. Under such a background, the mobile application has been embodied both interaction and service characters.

Yet the service features of mobile applications have not been given enough attention and the adoption of service design concepts and methods in HCI has been sporadic over the past decade [2]. When it comes to mobile interaction, it is generally designed from the interface details or human-machine interactions perspective, therefore lacking comprehensive concern about following the overall service objectives and values, making the mobile application aligned and assimilated into the service system.

This paper has focused on the interaction design of mobile applications in a service system that may include physical hardware and digital software services, as a subject for which the implementation and outcome would depend significantly on what kind of quality of service the managers and users desire. This article starts from the evolution of mobile interaction design, following the comparison between an independent tool and a service embedded mobile application, with paradigmatic concerns on the subjects such as communicating actors, design objective, value and process are brought into the system. Then choosing the mobile courier applications as a pilot to explore the mobile interaction design constraints from a service evaluation perspective, which considering the mobile application as one of the touchpoints in the express service system, shedding the light on the detailed interaction design suggestions from the holistic service quality requirements in the system.

## **2 Mobile Interaction Design Within Service**

### **2.1 Mobile Interaction Design**

In recent years mobiles became an integrated part of life for billions of users. It is vastly believed that wireless devices will help us to communicate and relate in better ways, be more creative, more informed, and more efficient and effective in our working lives. Under this circumstance, we have to cater to the everyday needs people have, shifting the design perspective away from technology and concentrating on usability; in other words, developing interfaces and devices with a great deal of sensitivity to human needs, desires, and capabilities [3]. Designers attach more importance to user aspects.

Most modern, mobile devices employ touch screens, which provide their own set of opportunities and constraints. We use them not only to view content but also to interact with that content. These forces designers to consider ergonomics, gestures, transitions, and finally, mobile-specific interaction patterns (Main navigation, Selecting content, Signing in, Using forms) [4]. When it comes to the concrete mobile interaction design, those implementation points are generally oriented by some specific interface features.

## 2.2 Mobile Interaction Design Within Service

Interactive artifacts are being introduced into service settings to a larger degree than before. We tend to rely on these artifacts as one, or sometimes the sole, possibility to do banking, to declare our taxes, etc. [5]. This interaction paradigm uses a mobile device to extract information and use it to more intuitively and easily invoke the associated service. A common approach to mobile and service interaction is primarily through smartphones, where applications act as intermediaries between interactive agents and different physical objects [6]. Not only can we treat the application as an interactive product, but also consider it as a digital touchpoint among the service system. UX work is changing, and understanding this change is important to maintain the relevance of UX research [7].

Jodi Forlizzi and John Zimmerman, two professors from Carnegie Mellon's HCI Institute and School of Design, state a pioneer exploration to promote service design as a core practice in interaction design. They point out that interaction designers who employ user experience and user-centered design practices most often work to specify the behavior of a single computer system, whereas service designers work to envision a multi-stakeholders service system, starting with an explorative phase that includes fieldwork, competitive analysis, log analysis, etc. They give examples of interaction design that benefit from a service perspective. One mobile application, called Flip-board, creating a magazine-like reading experience was instanced. With Flipboard, end-users co-produce value with the social networks, and service design thinking helps interaction designers to understand the exchanged role and value amongst the stakeholders (content providers, advertisers) to drive co-production [8]. Daisy et al. [9] address that in a shift to the service-centric design paradigm, it is important to recognize design researchers as distinct stakeholders, who actively interact with systems and services intending to fulfill their values and achieve desired outcomes. By a case study of new digital services for public libraries, they provide an extended value co-creation model that clarifies the position of design researchers within the sociocultural context in which they practice design and visualize how their positions impact the value co-creation, and in turn, the design outcome.

## 3 Comparison Between an Independent Tool and a Service Embedded Mobile Application

To differentiate and understand the characters and competence of service-embedded mobile applications from the independent tool type, we compared the two kinds of mobile applications in four paradigms: communication actors, design objective, design value as well as design process (Table 1).

**Table 1.** Four subjects as compared

Subjects	The independent tool app	The service embedded app
Communication actors	Target users	Target users (service receivers), managers, staff (service providers), hardware products, software platforms
Design objective	To achieve specific functions for meeting target needs	To provide quality services for collaborative services with other touchpoints in a system)
Design value	User-centered	User-centered, social value
Design process	Linear	Multi-factors

- Communication Actors

When designing the app as a mini tool in our smartphone, we tend to concentrate or immerse in our target users. Because the app mainly communicates with the target users who have the dominant access and right to experience and evaluate.

While considering the app in a service system, this app is in touch with multi-stakeholder, which relate to target users (service receivers), managers (back-stage), staff (service providers) as well as other service modes which contain physical hardware products and digital software platforms.

- Design Objective

In terms to design an independent tool type application, designers are prone to implement specific functions by acquiring and researching the needs of target users. For example, the weather application is for offering information on the weather forecast during the day or the week.

On the other hand, the service embedded application is for providing quality services - collaborative services - that design specialists for helping develop and deliver great services, regarding coordinate with another physical or digital touchpoint in a system, which forms a harmonious convergence of services. The courier application is a typical example to provide an express service. In the whole express service, the courier application plays a continuous role in supporting express service with the self-service terminal machine in front-stage and the express management system back-stage.. It is not only used by consumers but rather acting as an information posting platform serving for couriers and managers. It is also an interactive platform between the consumers and couriers, and communicating with other terminal machines by information timely sharing.

- Design value

In designing an independent tool type application, user-centered design thinking leads the design orientation and value-creating by observing, interviewing, and responding to the users in their subtle using behaviors and desires. Like using the calendar applications, the user habits - when most users use it? What do users want and do when using it? Why do they use it? etc. - all oriented by target users.

Nevertheless, the service-embedded application design needs to take consideration of use, satisfaction, loyalty about users and sustainability, transformation, profit about a society that is a perspective from service design [10]. For instance, the banking services applications, a time-saving way to transfer, check or record for users with transparent and timely information service, at the same time, also an effective approach to improving capital circulation, labor savings, or cutting costs for society and companies. It helps promote the upgrade of the traditional banking service model.

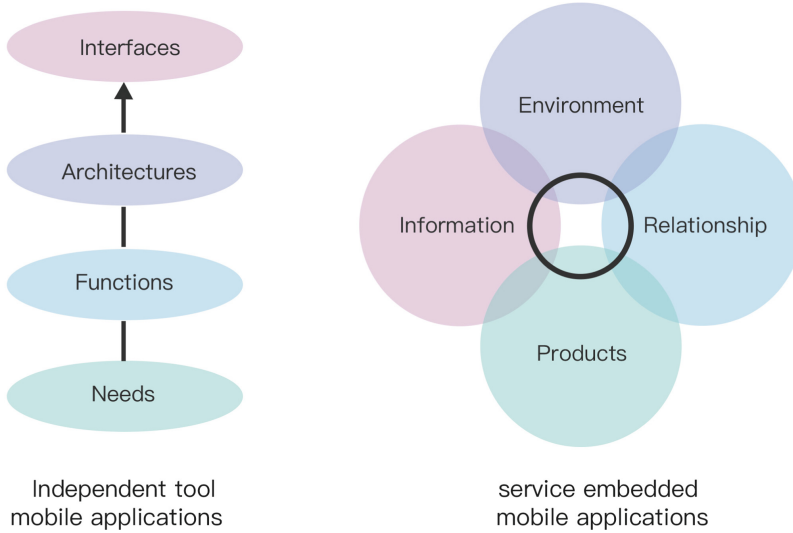
- Design process

The design process of independent tool mobile applications is linear, starting from finding users' needs then defining mobile application functions, after that setting the application architecture, and finally drawing the interface. It is quite a tool target-oriented with focusing on the target users.

For example, mobile dictionary applications are focusing on those who want to know, learn or use foreign languages. Designers have to know the various subtle needs when users consult the mobile dictionary application, such as looking for words, phrases, or sentences. Moving to the defining functions section and keeping going to set the architectures until the final drawing of the hi-fi interfaces, there is an obvious logical deducing process. The next step development mainly depends on the step before, and the first stage, finding users' needs, is the significant ground of the whole design line.

On the contrary, service embedded mobile applications' design process does not rigidly follow an order. The ubiquitous it is formed by multiple factors simultaneously, mainly from the environment, information, relationship, and products aspects. The four factors are not fixed and separate alone, rather they affect and penetrate each other, which leads to some more complex factors existing - those involve or combine two or more elements. In the meantime, the factors have a flexible effect on design, which means sometimes not every factor contributes to it, and not every factor has the same amount of impact.

The environment is an extrinsic element. It refers to the potential scenarios where we might use the mobile application for any service. For instance, healthcare applications can be used in a hospital, a home, a pharmacy, and so on. In those different circumstances, different demands may be stimulated. The relationship factor is about the connection amongst almost all stakeholders. It is a critical role, not simply unidirectional relation from users to managers. Like the nurses as service providers role to patients, whereas facing the doctors they act as information service receivers. The information is an internal factor, that about it is self-ability scope - what source, information, service that can afford, like providing online hospital registration channels, expertise information of various sections, etc. The products as peer parts in the system, which means the corporation



**Fig. 1.** A design process comparison between independent tool APP and service-embedded APP

between the other products and the mobile application. Like the self-service ticket terminal and display of calling all coordinate with a mobile application to provide service in a hospital (Fig. 1).

## 4 The Benefits of Rethinking from Service Perspective

Service design is an emerging field that focuses on creating good ideas by using a combination of intangible and tangible mediums. While applied to industries such as retail, banking, transportation, and healthcare, it offers many benefits for the end-user experience [10], and the holistic approach of setting other design disciplines into a wider social and active context. An integrated aspect is IxD’s focus on the design of interactive artifacts, while service design focuses on the design of services, and interactive artifacts are part of it [8]. In this way, designing service-embedded mobile applications can take advantage of service perspective in sequence thinking of content rhythm.

### 4.1 Sequence Thinking of Content Rhythm

The service needs to be displayed in a logical, rhythmic manner, which is the same in a mobile application that the service is a dynamic process over some time, with consecutive leveraging or chiming in with other service instruments and interacting with service receivers or providers. Therefore timeline is very important to the users, which means service rhythm is also pretty significant that will affect the user’s emotions.

No longer just considering a few physical contacts between mobile applications and users, even more, take consideration into the whole service process that includes tangible and intangible service to explore the participation possibilities of mobile applications. From interaction to trajectories for designing coherent journeys through user experiences [11]. For instance, when using a courier application to send express, users have the chance to access the application during the three service processes: before sending, sending, after sending. Designers ought to think from the integral three service process, regardless of whether interact with the app or not. Then choreographing the process in a brand new and desiring way, such as outputting the electronic order at mobile application, a convenient and time-saving mode to prevent anxiety and time consumption from a brick and mortar express shop. So design ought to link users and services with sequence rhythm in every interaction content to express a nice story together.

## 4.2 Holistic Lens in Solving Problem

Service provides a holistic, systemic, or integrated lens that lets designers envision problems solving solutions that are larger than a single computer part, that means satisfying the needs of a great number of stakeholders linked together in complex relationships for better adapting to the challenges of social computing and innovation [8, 10]. For service designers, the service design is not user research plus service blueprint, more importantly, from the perspective of holistic thinking, attempting to guide rather than follow, to create a more integral and valuable experience, reflecting through the service process in a variety of touchpoints.

This view helps designers design every touchpoint problem-solving solution under a holistic lens of the whole system pursuit. For example, the alphabetical arrangement of the typing keyboard in the bank app is disordered. Compared to the ordinary keyboard, the input experience is not friendly, because the user needs to spend the time to determine the location of each letter, but the security is higher than the general keyboard. When the user was accidentally seen by a stranger typing the password, the stranger can not know the user's password number only judging by is the place user's finger clicked. This is a design from the holistic, systematic lens, in financial applications, the importance of security is far higher than ease of use.

## 4.3 Multi-role Stakeholders' Co-creation

Service connotation and environment have endowed mobile application touching numerous stakeholders in different roles and identities. In the meanwhile, the ubiquitous mobile network enables stakeholders to co-create anytime and anywhere, it also provides a new creation mode because people are involved in activities with strong motivations to change the process and experience of interaction in collaborative services [12]. One stakeholder's character differs on facing or interacting with different participants due to the mazy mobile platform. The diversified role of stakeholders means a stakeholder can be both a service provider and a service receiver. In other words, the user's role has evolved from consumers to prosumers. And the completion of service is the result of multiple stakeholders involved.

## 5 The Evaluation of Mobile Applications Within Service

The evaluation of research artifacts is an important step to validate research contributions [13]. Service evaluation as a measuring standard of service, starting from the desired design results, which can improve service quality with clear directions. Design evaluation guide to design. As service-embedded mobile applications possess obvious service characters and competence, we can see them as an interactive product or a service touchpoint. When we consider it as a service, how can we assess it and what is the norm?

Cross-fertilization between marketing/management-centric and design-centric service designs is mutually beneficial [14]. In 1988 A. Parasurman, Valarie Zeithaml, and Leonard L. Berry represented a breakthrough in the measurement methods used for service quality research by capturing respondents' expectations and perceptions along the five dimensions. Reliability: the ability to perform the promised service dependably and accurately. Assurance: the ability to perform the promised service dependably and accurately. Tangibles: the appearance of physical facilities, equipment, personnel, and communication materials. Empathy: the provision of caring, individualized attention to customers. Responsiveness: the willingness to help customers and to provide prompt service [15]. Their measurement tools have been used by many researchers in a wide range of service industries and environments such as healthcare, banking, financial services, and education.

Given the widespread use of mobile internet and e-service, we sought to explore the measure dimensions of service embedded mobile applications' quality based on PZB research.

- Reliability is the ability of the service provider to fulfill the service commitment accurately and reliably. Reliable mobile applications are in line with user needs and expectations and mean that the service is in the same way with the promise to complete on time.
- Assurance namely the customer's trust in the brand, the application, and the service. The service-embedded mobile applications convey a high-quality brand image to stimulate user reliance. Brand image consistency promotes the formation and accumulation of consumer brand experience and eventually has become the primary factor in developing user loyalty.
- Tangibles in mobile applications reflect on information communication. In the knowledge paradigm, users are never lacking information, instead of how to get valuable information more conveniently. Mobile application tangibles focus on how to accurately and quickly transform the information into "visual".
- Empathy emphasizes inspiring and activating from the experience of others by observing people's real reactions, seeking user participation. Investigating the needs under specific different scenarios combined with digging potential emotional demands.
- Responsiveness in the service embedded mobile application reflects in quickly responding to user actions and feedback to problems, while in invisible service refers to the desire to help customers and provide services quickly.

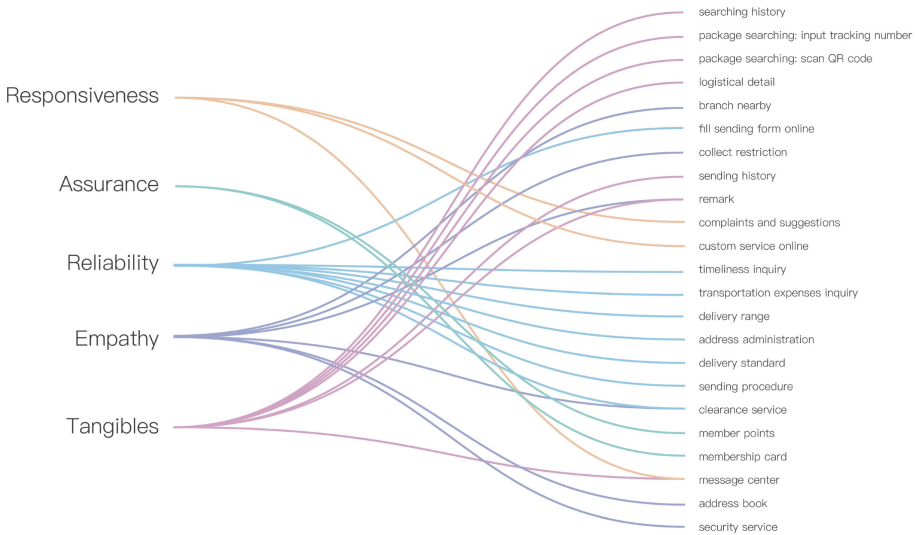


## 6 Pilot Study in Mobile Courier Applications

With the rising of online shopping in the mobile internet environment, an express service model combined with mobile applications has become one of the most popular, labor-saving, and cost-cutting service models. Mobile platform plays an important intermediary role in the whole express service system in information service and logistics flow, which means the mobile platform is a key online service touchpoint. Chinese express companies have launched mobile applications, scrambling to seize the online market. First, collecting service function points of 6 popular domestic mobile courier applications in China (Table 2). Considering that PZB divides the evaluation dimension according to the characteristics of intangible services, we project this thinking into tangible mobile applications. The service feature of mobile applications mainly performs in the service function points. Second, analyze the relationship between the service dimensions and the mobile application service functions, and find the corresponding link (Fig. 2). Third, proposing interaction design constraints of mobile courier applications from service dimensions.

**Table 2.** Service functions collection of mobile courier applications

Service functions points	Shunfeng	Shengtong	Yuantong	Zhongtong	Yunda	Cainiao Guoguo
searching history	✓	✓	✓	✓	✓	✓
package searching: input tracking	✓	✓	✓	✓	✓	✓
package searching: scan QD code	✓	✓	✓	✓	✓	✓
logistical detail	✓	✓	✓	✓	✓	✓
branch nearby	✓	✓		✓	✓	
fill sending form online	✓	✓	✓	✓	✓	✓
collect restriction	✓	✓			✓	
sending history	✓	✓	✓	✓	✓	
remark	✓			✓		
complaints and suggestions	✓	✓	✓		✓	✓
custom service online	✓	✓	✓	✓	✓	
timeline inquiry	✓	✓	✓	✓		✓
transportation expenses inquiry	✓	✓	✓		✓	✓
delivery range	✓		✓			
address administration	✓	✓	✓	✓	✓	✓
delivery standard	✓			✓		
sending procedure						
clearance service	✓					
member points	✓				✓	✓
membership card	✓			✓	✓	
message center	✓	✓		✓	✓	✓
address book				✓		
security service	✓			✓	✓	



**Fig. 2.** Classification of service functions points into dimensions

- Delivering accurate and timely information is particularly valuable when using mobile devices.

Transparent express tracking and visual package delivery path can give users a sense of security and help users access the distribution process and result more straightforward.

First, the logical classification makes the target information easier to be positioned and understood. Second, various information display forms such as graphical forms improve the efficiency of communication and reduce the user’s cognitive burden.

- Fit currently users’ behavioral needs; dig potential emotional value of products.

In the context of the experience economy, using scenario and emotional design methods become key factors in enhancing the user experience. First, analyze the operation scenario of users so that the service steps of an application can be closer to the current user behavior. Second, based on the current need, giving users an emotional experience that is beyond expectation can make the service impressive.

- Predictable results of the service and implementing functions effectively.

The more clear blueprint the users have for the upcoming service, the faster speed the decisions been made, and also users will more confide to the service providers. For example, calculating the aging freight before making the order and providing the information of the courier in detail, etc., all these things can help users make better decisions through constructing psychological expectations.

- Unify interactive actions logic and visual perception feelings.

In the process of establishing the brand image of mobile application services, the unity of interactive logic and visual experience plays an important role. Maintain the navigation between pages, icon features, and interactive efficiency of the same, so that user’s operation phases can be similar when using different pages of the application.

The visual effect is reflected in the unity of interface form (font size, element size), color (hue, purity, brightness), and texture (muscle, shadow thickness).

- Response to users' actions quickly

The response to users' behavior can help succeed sending promptly, which results in the positive effect of service. In the process of filling the cumbersome sending information tablets, the rational use of the response function can reduce the text inputting burden.

## 7 Conclusion

Mobile interaction design within service is something holistically more than mobile digital interface design, encompassing human interaction with objects, people, environments, and systems. It is a more holistic, multi-dimension, integrative field in mobile interaction design by embedding service as a critical new lens, that is essential in a knowledge-driven economy.

By analyzing the difference and competence of service embedded mobile applications from independent tool mobile applications. We found that this service-embedded mobile application has the advantages and characteristics of the service paradigm in the aspect of communication actors, design objective, design value as well as the design process. There is an obvious feature that from "linear analysis" to "open system analysis".

When we rethink mobile interaction design, we can gain benefits from the three aspects: sequence thinking of content rhythm; a holistic lens in solving the problem; multi-role stakeholders' co-creation. And while we describe the evaluation content from service quality dimensions, the thinking clue, and attention points are obtained in a different but integrated way.

Finally, we attempt to do a pilot study in mobile courier applications, a kind of typical service-embedded mobile application. Through collecting and classifying their service functions points into service dimensions, we put forward design constraints from the evaluation paradigm.

## References

1. Luo, S.-J., Hu, Y.: Model innovation driven by service design. *Pack. Eng.* **36**(12), 1–4 (2015)
2. Yap, C.E.L., Lee, J.-J., Roto, V.: How HCI interprets service design: a systematic literature review. In: Ardito, C., et al. (eds.) *INTERACT 2021*. LNCS, vol. 12933, pp. 259–280. Springer, Cham (2021). [https://doi.org/10.1007/978-3-030-85616-8\\_16](https://doi.org/10.1007/978-3-030-85616-8_16)
3. Matt, J., Gary, M.: *Mobile Interaction Design*, 1st edn. Wiley, New York (2006)
4. Elaine, M.: *Designing for Mobile, Part 2: Interaction Design*. <http://www.uxbooth.com/articles/designing-for-mobile-part-2-interaction-design/>. Accessed 20 Jan 2022
5. Stefan, H.: Interaction design and service design: expanding a comparison of design disciplines. *Des. Inq.* **2**, 1–8 (2007)
6. Gregor, B., et al.: Supporting mobile service usage through physical mobile interaction. In: *Fifth Annual IEEE International Conference on Pervasive Computing and Communications*. IEEE Press (2007)

7. Virpi, R., Jung, J.-L., Lai, C., John, Z.: The overlaps and boundaries between service design and user experience design. In: *Proceeding of DIS 2021*, pp. 1915–1926. ACM, New York (2021)
8. Jodi, F., John, Z.: Promoting service design as a core practice in interaction design. In: *The 5th IASDR World Conference on Design Research*, pp. 1–13. Springer (2013)
9. Daisy, Y., Anya, E., Sofia, S., Eva, E., Peter, D.: Service design in HCI research: the extended value co-creation model. In: *Proceeding of the Halfway to the Future Symposium 2019*, pp. 1–8. ACM, New York (2019)
10. Marc, S., Jakob, S.: *This is Service Design Thinking: Basics, Tools, Cases*, 1st edn. BIS Publishers, Amsterdam (2012)
11. Steve, B., Gabriella, G., Borianna, K., Tom, R.: From interaction to trajectories: designing coherent journeys through user experiences. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 709–718. ACM, New York (2009)
12. Gong, M., Manzini, E., Casalegno, F.: Mobilized collaborative services in ubiquitous network. In: Rau, P.L.P. (ed.) *IDGD 2011. LNCS*, vol. 6775, pp. 504–513. Springer, Heidelberg (2011). [https://doi.org/10.1007/978-3-642-21660-2\\_57](https://doi.org/10.1007/978-3-642-21660-2_57)
13. Remy, C., et al: Evaluation beyond usability: validating sustainable HCI research. In: *Proceedings of CHI 2018*, p. 216. ACM, New York (2018)
14. Yu, E.: Toward an integrative service design framework and future agendas. *Des. Issues* **36**(2), 41–57 (2020)
15. Parasuraman, A., Ziethaml, V., Berry, L.L.: SERVQUAL: a multiple- item scale for measuring consumer perceptions of service quality. *J. Retail.* **62**(1), 12–40 (1988)