The Complexities of Transport Service Design for Visually Impaired People: *Lessons from a Bus Commuting Service*

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The customer journey of a public transport service for visually impaired people has relatively few stages, but the transitions between different channels of the customer journey are complex. They are the result of multiple roles of service providers and users, the interplay between digital and physical environments, and the influences of decision makers in public service. There are only a limited number of case studies in service design that demonstrate methods to analyse the complexity of these problems and resolve the interlinked issues.

This case study analyses the design of EyeBus, which was commissioned by the Ministry of Science and Technology in Taiwan and implemented in Taipei City as a public service, to illustrate the complexity of service design at different stages, including 1) problem distillation from multiple stakeholders, 2) omni-channel system design, and 3) sustainable development with multiple separate public and private sector actors. Additionally, this paper discusses the potential complexity factors in public service design and suitable design methods at each stage for future service innovation.

***Keywords* –** Service Design, Case Study, Public Transport Service, Visually Impaired.

***Relevance to Design Practice* –** The levels of complexity of public transport reveal the inherent nature of public services. The different perspectives toward understanding service design can help government agencies and service providers allocate appropriate resources to alleviate service challenges. The design of the EyeBus service reveals best practices for establishing universal transport design.

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Introduction

In recent years, concerns about societal inequality have abounded, from youth unemployment and healthcare concerns for the aging population to community mobility, including transport for disadvantaged people. All these require smarter solutions and create pressure for the public sector to deliver innovative services (Bason, 2010). Among them, transport service is critical to everyday urban life, connecting various geographic locations. It is one of the most basic public services. However, the design of transport services is complex, with multiple interrelated issues being entangled together with no straightforward answers.

People with visual impairments constitute a significant percentage of commuters with disabilities who use public transport networks. Maintaining a high level of mobility for these citizens is a crucial challenge for societies because it promotes social integration and decreases dependency on social service organisations (Stanley, 1998).

For visually impaired people, public transport plays a key role by providing independent travel for daily life, which creates more opportunities for employment, education, leisure and social interaction. Visually impaired people often struggle to adapt to their living environments, and their range of activities is thus greatly limited. Creating a friendly public transport environment, so that means of mass transport can help visually impaired people travel independently and smoothly in cities, has attracted increasing attention in countries all over the world, and has become an urgent concern requiring comprehensive solutions. To date, using public transport services remains a significant challenge for those with visual impairments.

In the absence of visual cues, it is difficult to complete a journey by public transport. A previous study interviewed six blind adults about accessibility challenges using public transport (Azenkot et al., 2011). Scholars have also conducted large-scale questionnaire-based surveys on the difficulties encountered by visually impaired people when using public transport services (Marin-Lamellet et al., 2001). These inconveniences have serious potential consequences for visually impaired people, contributing to dangerous situations in dynamic environments and forcing many to give up using public transport for independent travel. In Taiwan, a survey showed that 54% of visually impaired people had not taken public transport within the previous year due to such concerns and could only use more expensive taxi services or rely on their families for assistance (MoHW, 2018).

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Relevant laws and regulations have promoted accessibility in travel, such as constructing facilities specifically for visually impaired people (such as dedicated walkways, voice prompts for crossing streets, etc.). Attempts to optimise public transport services for the visually impaired have become more common throughout the world. The application of smart technology has become the dominant design trend in developing systems to assist visually impaired people, including iBeacon or AI visual recognition technology (Lavanya et al., 2013). The design of products to assist visually impaired people when travelling has expanded significantly, including smart guide canes, guide glasses, and smartphone apps specifically intended for visually impaired people. It is easy to find service cases of visually impaired users utilising emerging technologies to solve longstanding challenges. However, due to insufficient system stability and the high cost of technology, most such solutions have not yet been implemented and adopted into the everyday lives of visually impaired people (Lu, 2018).

Previous research also suggests that improving the mobility of visually impaired people in public transport is not achieved by equipment optimisation or layout (Marin-Lamellet et al., 2001) of a single channel. The customer journey of public transport involves transitions between multiple settings and scenarios, which are influenced by many factors, such as people, tools, and environment. It needs to be examined and optimised from a systematic perspective. Therefore, when the services available to them are not comprehensive, visually impaired people still face many difficulties in using public transport (Azenkot & Fortuna, 2010; Marin-Lamellet et al., 2001).

Service design, as a human-centred, creative approach to service innovation (Meroni & Sangiorgi, 2011), has been investigated for its promising potential in public services reform, with a particular emphasis on the application of co-design and public engagement (Bate & Robert, 2007; Browne et al., 2011; Parker & Heapy, 2006). When engaging with a service system, it is necessary to establish a system ecosystem framework to help designers understand the interactive network of the service system more clearly. The design content moves from a single product to the synergy of channels, and the design object moves from users to stakeholders, thus solving complex social problems (Pirinen, 2016). For this reason, in recent years, service design has become a crucial part of design practice, an approach that has been applied in numerous cases in the public sector and is considered a means to change social for economic challenges (Meroni & Sangiorgi, 2011).

As mentioned in previous studies, public services are complex service systems involving a series of often iterative interactions between a range of human, organisational, and technical elements and processes (Radnor et al., 2014). They co-create value through the interaction of resource allocations. So, what are these complex factors in service design regarding transport services? When it comes to visually impaired service users, how should we consider and address these complex factors? What challenges will designers face when working with the public sector and participating in the design of public transport services for visually impaired people?

The objective of this case study is to address the complex network of stakeholders and resources in public transport services. By presenting the various layers and aspects of complexity from a service design perspective, it illustrates how service design thinking can offer collaborative solutions and thus serve as a reference for future work. This research aims to achieve the following objectives:

1. Identify and present the complex network in the public service system by conducting in-depth service research.
2. Discuss how service design helps connect multiple stakeholders, and propose solutions at different stages of the design.
3. Propose an implementation framework and methods, based on the results of the case study, for future public service designs.

The remainder of this paper is organised as follows. First, we summarise the differences between public services and general commercial services, discuss the complex aspects that should be considered in the design of travel services and the research status of travel-related design for visually impaired people, and illustrate the research methodology. In the fourth section, we report on the complex factors faced by designers in different stages of service design and propose possible solutions. In the fifth section we further discuss the complex levels of service design for the public sector and consider the possible processes and methods of service innovation. Finally, we conclude by pinpointing important research avenues and practical implications.

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Background and Related Works

The aim of this section revolves around the theory and practice of public transport services for visually impaired people: 1) differences between public services and general commercial services; 2) characteristics and complexity of public transport service design; and 3) difficulties faced by existing transport services for visually impaired people. On this basis, the background and value of this case are presented.

Public Service

Public services can be seen as complex service systems consisting of a series of often iterative interactions between a range of human, organisational, and technical elements and processes (Radnor et al., 2014). Using these essential factors as a lens, the differences between public services and common commercial services can be examined through past studies.

Firstly, in terms of internal structure, government agencies have traditionally had very rigid organisational structures. Different departments work independently without interfering with each other's operations (Hyvärinen et al., 2015). As a result, the public sector does not have practices for sharing information with end-users or other organisations. Hence, no one seems to have a holistic overview of social or specific user group needs. This fragmented and uncoordinated system may lead to ineffective service implementation. In stark contrast to the collaborative innovation of the private sector, the public sector is cumbersome and rigid in thinking, and is bound by various norms, so that its vitality and innovation are limited (Design Commission, 2013). Secondly, when it comes to external resources, while commercial sector organisations are mostly driven by profitability, the public sector is driven by a more complex concept of value, which is difficult to measure (Mulgan & Albury, 2003). Therefore, the promotion of public services is often limited in resources and lacks more capital investment in innovative policy planning and development of related technologies, equipment and facilities. Finally, public services involve a more comprehensive range of stakeholders. The service offering is not a simple dyadic one but is rather dependent upon relationships between the users, citizens, a network of public service organisations (PSOs) and other people in the service ecosystem (Osborne, 2017).

Osborne (2017) also analysed the specific context and nature of public (compared to private) services, and services from the perspective of management. It is precisely because of these differences between public services and general commercial services that more complex considerations are taken into account in public service innovation. At present, public service innovation is still regarded as the responsibility of specific departments, while citizens need only to receive, passively consume, and evaluate the services (Pestoff, 2006; Osborne et al., 2013). Such silo structures accompanied by closed, top-down processes have been frequently described as innovation barriers as they hinder collaboration with external sources such as employees, citizens, and other public and private partners (Bason, 2010; Eggers & Singh, 2009; Tett, 2015).

In recent years, there has been a growing interest in service design and its introduction to public sector innovation, focusing on responding to human needs and experience and creating a more equal interaction between the public and private sectors (Sangiorgi, 2015). Service design originates from the commercial field; its human-centred and collaborative methods have been recognised as a potential solution to the issues outlined above and are regarded as a strategic thinking tool to deal with issues of inequality (Prendeville & Bocken, 2017). Service design could also be a potential vehicle for generating and implementing internal changes within organisations (Junginger & Sangiorgi, 2009).

Design for Complex Public Service

As mentioned above, service systems are composed of complex products and services (Maglio et al., 2009), and create value through the integration of stakeholders, technology, and other resources (Maglio & Spohrer, 2008). Although different research paradigms exist, there is a consensus that services have become increasingly complex, and dealing with these complexities in service design is a key challenge (Briscoe et al., 2012; Walletzký et al., 2019).

Early service design research largely focuses on service providers, or a company perspective (Tronvoll et al., 2011), and restructures the service through a dyadic perspective between a company and its customer. With service environments becoming increasingly complex and stakeholders more diverse, a growing number of researchers have advocated value networks to reflect on service improvement (Pinho et al., 2014). Stakeholders in a service network play a collaborative role and integrate their resources to create value for themselves and others. A large number of conceptual developments of a service value network are based on a service-dominant logic (Akaka & Vargo, 2015; Vargo & Lusch, 2016). Numerous scholars suggest that a service system should focus on the overall environment of a complex world by analysing the relationships among multiple stakeholders (Gummesson, 2007).

Similarly, Segelström (2013) considered that for design practitioners, being user-centred did not mean that focus would be only on the end-user of a service. They stressed the importance of also understanding the client and its organisation in order to create impactful design solutions. In service design thinking, users are seen as resources and co-producers of value, along with the service providers (Kimbell, 2011). Bason (2010) also pointed out that involving end-users and other stakeholders in the entire design process is a critical driving force for innovation in the public sector because it can effectively respond to key social challenges.

As described in much of the literature, it is important to fully consider and utilise stakeholder viewpoints in service design. Service design should consider the experience of all service participants. Service design is interdisciplinary, combining various professional fields. Consequently, the mixed application of different research and design methods and service process changes within different contexts means that service design has no fixed boundaries (Jeon, 2019).

After years of development, the methodology and tools of service design have gradually taken shape. They are widely used in the industry for service improvement and are also beneficial for public services. For example, Denmark MindLab improved waste management in Copenhagen through service design (Bason, 2013). Also, the British Government, through its GOV.UK portal, issued and continues to update a service manual to help teams create and run high-quality public services that meet its Service Standard (GOV.UK, 2022). However, existing tools and design methods cannot solve all problems easily. Each service design includes multiple influencing factors that interact to create value (Frost & Lyons, 2017; Lim et al., 2019; Maglio & Spohrer, 2008). Furthermore, in different design contexts, the complex factors addressed by service design may contain different details. It is critical to analyse key factors affecting a service system and choose the appropriate methods to improve service design (Lim & Maglio, 2018).

Public Transport Services for Visually Impaired People

Past studies have highlighted the various difficulties faced by visually impaired people when travelling by public transport (Marin-Lamellet et al., 2001; Pan et al., 2013). For example, passengers have to rely on the visual display of information, such as bus routes and timetables (Marston & Golledge, 2003), and visual cues to determine bus stop locations, board the correct bus, and get off at the right stop (Azenkot et al., 2011; Yoo et al., 2010). This series of steps relies on visual observation and various on-the-spot situations. Consequently, visually impaired people face more challenges and difficulties in using public transport.

As stated in the introduction, public transport is one of those services that is key in enabling social integration, and therefore an improved quality of life, for visually impaired people (Stanley, 1998). For public transport services, in addition to the dispersal of management responsibilities across numerous government departments, resource constraints, and a host of stakeholders, more specific factors (including software programs, devices, facilities, and systems, etc.) are involved, such as the use of Wi-Fi/GPS-based networks for transport services, information exchange between different devices, and service continuity requirements introduced by field switching. All of the above will increase the complexity of a service system initially thought to be simple.

Current research and design cases on the travel experiences of visually impaired people focus on two issues: assisting visually impaired people in recognising the correct bus while at a bus stop (Banâtre et al., 2004; Noor et al., 2009) and reminding or notifying them of the next arriving bus (Flores & Manduchi, 2018). Researchers have proposed ways to provide visually impaired people with access to information (Hara et al., 2015), such as a smart bus stop that shares real-time updates on bus status via the mobile phone (Azenkot et al., 2011; Sayah et al., 2005). Pan et al. (2013) suggest installing a camera at the bus stop and using image recognition technology to inform visually impaired people waiting at the stop of the route numbers of buses as they arrive. However, this approach is effective only for a single incoming bus and not when multiple buses arrive at once. Moreover, even if visually impaired people are given information about an incoming bus, they may easily board the wrong one when there are multiple buses (Sáez et al., 2019). Brito et al. (2018) propose the use of GPS to inform visually impaired people of their real-time location while riding to prevent them from missing their stop.

It is clear that a majority of the design cases focus on optimising assistive approaches that help visually impaired people travel independently on the basis of various touchpoints, but rarely discuss the planning and achievement of service goals from an overall journey perspective. More transport services for the visually impaired are using digital technology as an innovative solution, resulting in the realisation of services that may be overly dependent on the stability of the technology.

Summary

Services are complex configurations of multiple elements including people, information, and technologies (Maglio et al., 2009). Complexities in a service system generally increase with scale and the number of components. Before proceeding to service design planning, it is imperative to understand the complexity of the system and design elements that form the cognitive foundation. Based on the literature review, we found that the existing research mostly uses the relatively macroscopic perspective of management and organisational change to describe and discuss the complexity of public services, such as internal structure or external resources. At the same time, there is a shortage of actual cases from which to systematically analyse the complex factors that need to be considered from the perspective of service design. As a result, it is difficult for designers to absorb knowledge from the literature as the theoretical basis for future design innovation.

Moreover, existing service research on the travel experiences of visually impaired people tends to focus on certain breakpoints. For visually impaired people, a complete journey includes planning a route, waiting for a bus, boarding the bus, tracking the bus's position, and getting off at the right stop. Thus, considering one or individual touchpoints is insufficient to design a comprehensive solution. Moreover, existing solutions involve the use of new technologies that are yet to be implemented at an urban scale or become a common public service, and also entail additional construction costs.

Public transport services for visually impaired people should take account of the overall layout as well as the needs of all stakeholders (i.e., visually impaired people, transport operators, service providers, and the public sector). The service system solution must be a combination of multiple factors to balance the complex relationships among stakeholders, organisations, information, and the environment (Marin-Lamellet et al., 2001). Thus, when a service solution expands from a single journey to a system on an urban scale, the service system will involve more stakeholders, organisations and departments, as well as multiple scenarios. The transitions between complex scenarios, the data links between auxiliary devices, and the integration of multi-party management resources are all key research topics for future service design.

Research Method

Case studies provide an opportunity to capture reality, so they are suitable for examining context-related, complex, unique, or ambiguous topics (Merrian & Tisdell, 2015). As mentioned above, the design of public transport services for visually impaired people has been tried in various locations, but it is mostly limited to solving the problem through a single channel based on technology. Although some studies discuss the complexity of the service system, they fail to focus on actual cases of public service. Thus most service design cases lack descriptions of complexity, and few studies systematically analyse and summarise complex problems and influencing factors (Pirinen, 2016).

This study explores the factors that influence service design and the interaction between these factors in the context of a real case. By retrospective analysis of the EyeBus case and interviews with participants, this paper presents and summarises the complexity of public service design activities and gives some useful guidance to designers. The background, participants, and initial outputs of the case examined in this study are described below.

Introduction to EyeBus

The case was based on one of the Breakout Experimental Projects introduced by Taiwan's Ministry of Science and Technology (MoST) in 2018, which received overwhelming support (MoST, 2018). The key objective of the project was to improve the most intensively used and yet the most inconvenient bus service network for visually impaired people.

The project involved cross-department cooperation, information transfer between different systems, and multiple stakeholders. The project team incorporated Taipei City Government resources, local associations for visually impaired people, bus industry operators, device vendors, and public works contractors to support technological considerations and execution.

The R&D team was divided into management, design, and development groups according to their primary roles. Among them, the design team was mainly responsible for field investigation, need research, design concept development and testing, etc., throughout the project implementation. This study focuses on the service design method, process, and results, so the case development is mainly reviewed from the design team's perspective. The follow-up interviews with participants were also conducted by core team members who participated throughout the process. The background of the team members is shown in Table 1.

The EyeBus public transport service system includes three design components for key touchpoints to build a convenient bus booking service for visually impaired people on the premise of minimal changes to social resources (Yu et al., 2020). The EyeBus project includes the redesign and verification of these three service elements: (a) the EyeBus app, (b) the bus telematics system, and (c) the waiting area at the bus stop. They are described in detail in the following section.

Figure 1 shows the user journey: the visually impaired passenger operates the Eyebus app to send a boarding reservation, and waits for the bus in a defined waiting area at the bus stop; the bus driver receives the reservation through the bus telematics system and aligns the front door of the bus with the waiting area when arriving at the bus stop to enable the visually impaired passenger to get straight onto the bus; finally the passenger gets off the bus when it arrives at their destination stop.

The service success rate during field tests in Taipei City was 93.6%. In other words, most of the visually impaired passengers successfully boarded the reserved bus and reached the correct destination at the first attempt using the EyeBus system. Moreover, the average satisfaction score was 4.58 (using a 5-point Likert scale) compared to 3.30 with the pre-existing service, showing a significant increase. Consistently, the net promoter score (NPS) was 70 compared to -69 for the pre-existing service. The interviews with the visually impaired participants reported

Table 1. The background of the team members.

Group	Code	Role	Experience (years)
Management group	M1*	Project management & design consultant	18
	M2	Design consultant	/
	M3	Design consultant	/
Design team	D1*	Project management & researcher	3
	D2*	Service designer & researcher	3
	D3*	Service designer & researcher	2
	D4	UX designer	/
	D5*	UI designer	1
Development team	E1*	UI designer & developer	5
	E2	Front-end developer	/
	E3	Back-end developer	/

Note: * indicates core members who participated throughout the project.

similar feedback. EyeBus could help them achieve independent commuting goals with a better user experience, one they were pleased to recommend to their friends and relatives.

> ... After I just experienced this for two hours, I found it very simple. … If this was a paid app, I would pay for it... (One of the visually impaired interviewees)

The system is presently being adopted by the public sector. In addition to service users and providers, the service design project has positively impacted service supervisors in relevant government agencies:

- The project was approved by the Taipei City Government. The EyeBus service was scheduled for trial on the Minquan Metro Bus route, and a soft launch is expected before the end of 2020.
- The visually impaired participants took the initiative to write about their expectations for the service launch.

The EyeBus case has three characteristics. First, it is a design process to deal with the complex series of relationships among multiple stakeholders, channels, and scenarios. Second, it solves a problem in public service transport through service design methods and processes. Finally, it is a project with a landing trial executed and tested in the field. In our retrospective analysis of cases, we try to answer the question why technology alone could not solve the travel problems of visually impaired people in past research, and explore the importance of optimising the travel experience of visually impaired people from the perspective of services and systems.

Case analysis

The case study is divided into two phases. First, we take a retrospective look at the three stages of the service development process, as shown in Figure 2. Through the analysis of text and video data in the design process and retrospective interviews with core participants (see Table 1), we provide an in-depth discussion of the complexity of a bus service system and the travel experiences of the visually impaired.

Second, in the implementation stage, we conducted stakeholder interviews to interpret the relationship between complex factors from different perspectives, showing how design iteration and verification can be used to redefine the service ecosystem. The interviewees are shown in Table 2.

Through data collection and analysis of the above two stages, the purpose is to obtain a more comprehensive and in-depth understanding of the case process and details and present an implementation framework and method that can serve as a reference for future public service design.

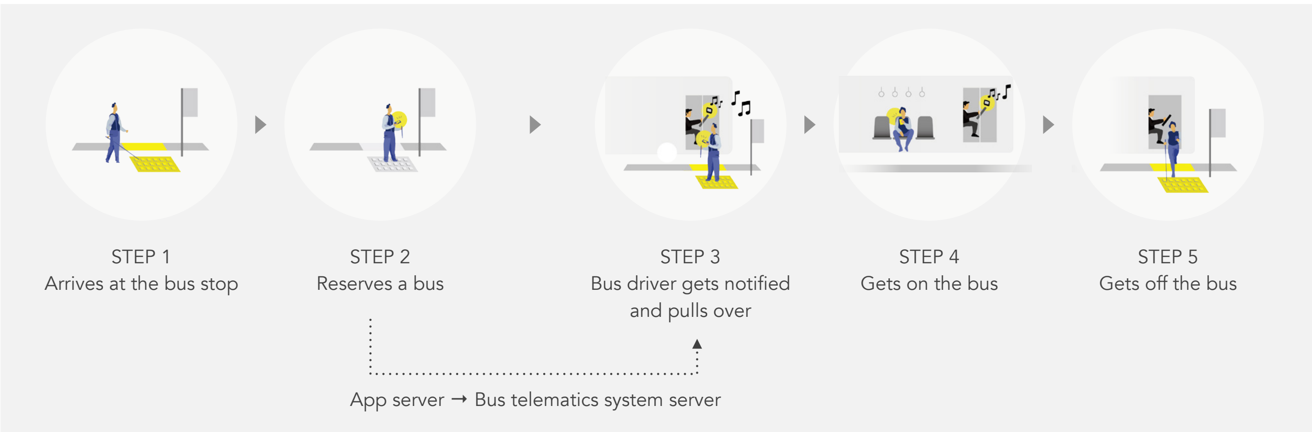


Figure 1. A bus journey using the EyeBus service system.

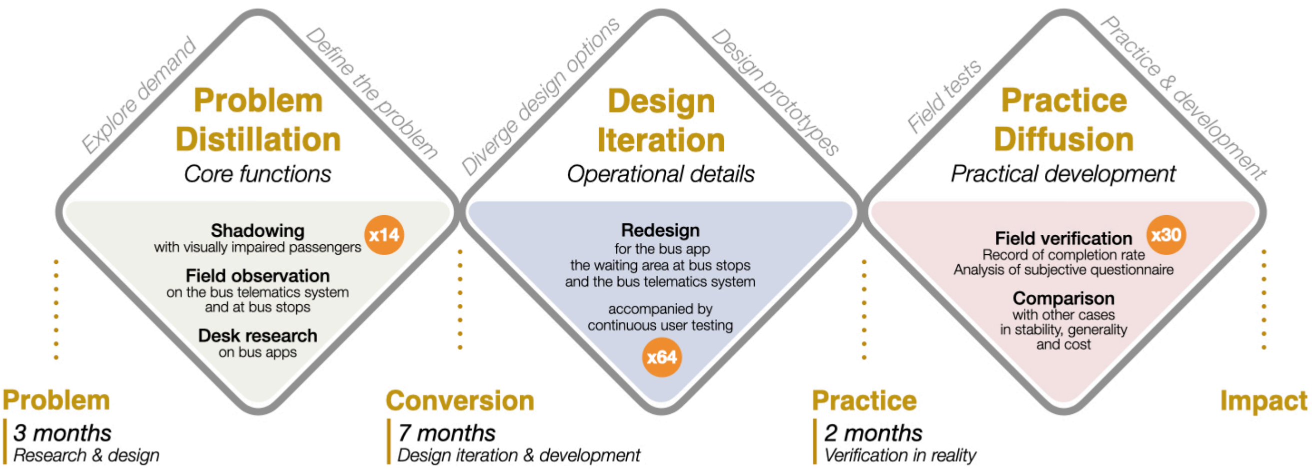


Figure 2. The three stages of the design process.

Table 2. Interviews with different stakeholders.

Category	Background of respondents	Number of respondents
Service supervisors	Ministry of Science and Technology	4
	Department of Transportation, Taipei City Government	4
	Industrial Technology Research Institute	1
	EyeBus screening committee	4
Service providers	Bus telematics system & app operator	4
Service recipients	Proposer of Breakout Experimental Projects	1
	Total	18

Findings: *The Complexity of Public Transport Service Design for Visually Impaired People*

The case analysis identified three key phases that help to explain the complexity of public transport service innovation: problem distillation from multiple stakeholders, system design across multiple channels, and sustainable development based on uniting the efforts of multiple public and private sector actors. It combines features from IDEO's 3I process (Brown & Wyatt, 2010) and the British Design Council's Double Diamond Process (Design Council, 2015). From the perspective of the three-stage process, it seems that all service designs contain similar structures, with few variations. However, case analysis reveals that in practice, all the stages are intricately intertwined. The following describes the complex aspects faced by the design team at each design stage and the solutions adopted.

Problem Distillation from Multiple Stakeholders

The bus riding experience of visually impaired people is different from that of sighted people. The team needed to gain a more comprehensive, in-depth understanding of how visually impaired passengers ride buses and to map out the key players, support systems, and resources involved.

Visually Impaired Passengers: People with Different Visual Abilities Have Different Needs

> … visually impaired people from different backgrounds have nothing in common except the fact that they are visually impaired. It's like a smaller version of the whole of society. (One of the blind interviewees)

Visually impaired people are often categorised as a single group for physiological reasons, and their pain points when riding a bus are similar, but they may have entirely different ways of daily interaction depending on the nature and severity of their visual impairments. Therefore, digital tools must include both audio and visual modes. There is no clear physiological demarcation between the two behavioural modes; for example, people with low vision may switch to a digital tool operation mode based on hearing due to poor visibility at night. There is a high degree of internal heterogeneity due to age, personality, educational background, and other factors. When faced with the same situation and difficulties, visually impaired people have varied attitudes and solutions. Therefore, to meet the seemingly simple need of riding the bus, designers should take compatibility with different types and situations of users into consideration.

General Passengers: Avoid Affecting Normal Travel

An accessible bus system may meet the target users' needs but may cause inconvenience to specific groups or even highlight target users' visually impaired status. Because the public bus system is for everyone, service designers must take impacts on both target users and other users into consideration. Service designers should set boarding points for visually impaired passengers with the minimum change to bus stops to ensure that normal public travel is not impeded.

Bus Drivers: Avoid Creating a Cognitive Burden

As frontline bus service providers, drivers must pay attention to both road safety and passenger needs. They are less willing to assume additional tasks due to short rest periods, noise and air pollution, and traffic congestion (Hsu & William, 1996). Therefore, it is crucial to avoid creating a cognitive burden on the driver's side of the contact point.

Figure 3. Partial view of a bus instrument panel.

Government Agencies Related to Bus Operation: Low Cost and Minimal Changes to Existing Urban Facilities

The public sector's role as the funder and key institution is to provide designers with the experimental field and resources. Accessible design often carries the stereotype that it is unprofitable and expensive, making service proposals often unlikely to be implemented and often unsustainable. Therefore, to avoid large-scale engineering interventions in public transport facilities and equipment, design changes must be made with the least cost and modification needed to achieve the maximum benefit. Furthermore, the public sector is concerned with the results of design practice, and in order to assess the feasibility of R&D they want to understand in advance what solutions will look like and how performance will be measured.

The Intertwined Needs of Multiple Stakeholders

Service designers specialise in proposing human-centred solutions. However, conflicts among stakeholders present significant challenges to public service innovation. For service users, although accessibility measures can serve designated groups, the needs of persons with different kinds of disabilities may also conflict with each other. From a private-sector vendor's perspective, investing in small-scale service experiments does not generate profit and may cause internal resource consumption, placing the company's operations under pressure. For the public sector, investing in R&D with outcomes that are difficult to evaluate is likely to be ineffective. They are reluctant to take risks to innovate under the pressure of public opinion.

> In recent years the government has invested in a lot in studies that do not show immediate benefits. But the legislators pay attention to what the tens of billions of dollars have been spent on. We must achieve something simple and visible to win the hearts of the public. (Interview with a service supervisor)

Based on the above, EyeBus must be based on the principles of low construction cost and minimal changes to existing processes, and must take into account the habits of visually impaired people. Next, the design needs to be based on the perspective of the service system, providing design content that applies to multiple scenarios and channels to ensure that the services can meet needs and run smoothly in changing situations.

Omni-channel System Design

Public transport for visually impaired people exists in an open environment, serving passengers with different physical impairments, involves numerous stakeholders enabling the service, and relies on physical and digital environments. A journey using EyeBus involves three key steps for the passenger: reserving a bus, getting on the right bus, and getting off at the right stop. This looks like a simple step-by-step process, but it spans both online and offline channels in different scenarios in which the underlying complexities are enormous. For example, planning the journey and arriving at the right stop may require route queries and navigation via mobile phone; finding the correct bus to board may require holding up a sign with the bus route number and asking for help from passers-by. All these steps are exposed to a complex, open environment with many influencing factors. In retrospect, previous projects that were technology-oriented or depended on vendors' expertise were often only designed for a single touchpoint and part of the customer journey. Even without discussing the technological stability and cost of such solutions, they may be unlikely to fundamentally improve the wellbeing of visually impaired users.

In the case described here, the EyeBus team conducted a naturalistic observation of 14 visually impaired people and monitored their interactions with people, technology, and the environment as they undertook their bus journeys. In order to enrich the data, travel in different scenarios was included, such as during peak and off-peak hours, under sunny and rainy conditions, and riding on their habitual commuting routes as well as on unfamiliar routes. Based on interviews, we divided the customer journey into seven stages. We identified several challenges that visually impaired people regularly face, as shown in Figure 4.

Clearly, most of the pain points in the journey are concentrated at the stages of waiting for the bus and boarding the bus, which reveals the biggest challenges for visually impaired passengers: standing in the right place, hailing the right bus, and boarding the right bus. EyeBus chose to focus on these three important challenges in the process to systematically sort out and rebuild the service, giving comprehensive consideration to physical and virtual devices, the stakeholders involved in the process, and even the assistance of facilities in the physical environment.

The Complexity of Single Channel Design Which Takes Vision, Hearing, and Tactility into Account

The multi-channel, multi-scenario, and multi-stakeholder characteristics of bus journeys increase the difficulty and complexity of the design process. The EyeBus team determined a fundamental design principle through in-depth research in the early stage: Innovation in public services lies not in proposing several new versions of artefacts but in proposing practical solutions that can be implemented within the constraints of existing technologies and costs. Based on this principle, the EyeBus team designed components for three key touchpoints, as shown in Figure 5, to build a convenient bus booking service for visually impaired passengers on the premise of minimal changes to social resources. The individual optimisation of the three components, which are based on existing products, appears simple and straightforward, but in line with the design requirements and implementation constraints mentioned above, the decisions as to what to modify and to what extent were complex, being founded in the elaboration of the system as a whole and the needs of the different stakeholders.

- **The EyeBus app**: The challenge for the user experience (UX) of the app is the diversity of the users. Most of the app's operation needs to focus on the auditory user interface (AUI) for blind users. Moreover, an improved graphical user interface (GUI) is needed for users with colour blindness or amblyopia. Both interfaces need to be designed according to UX design principles (Garrett, 2010).

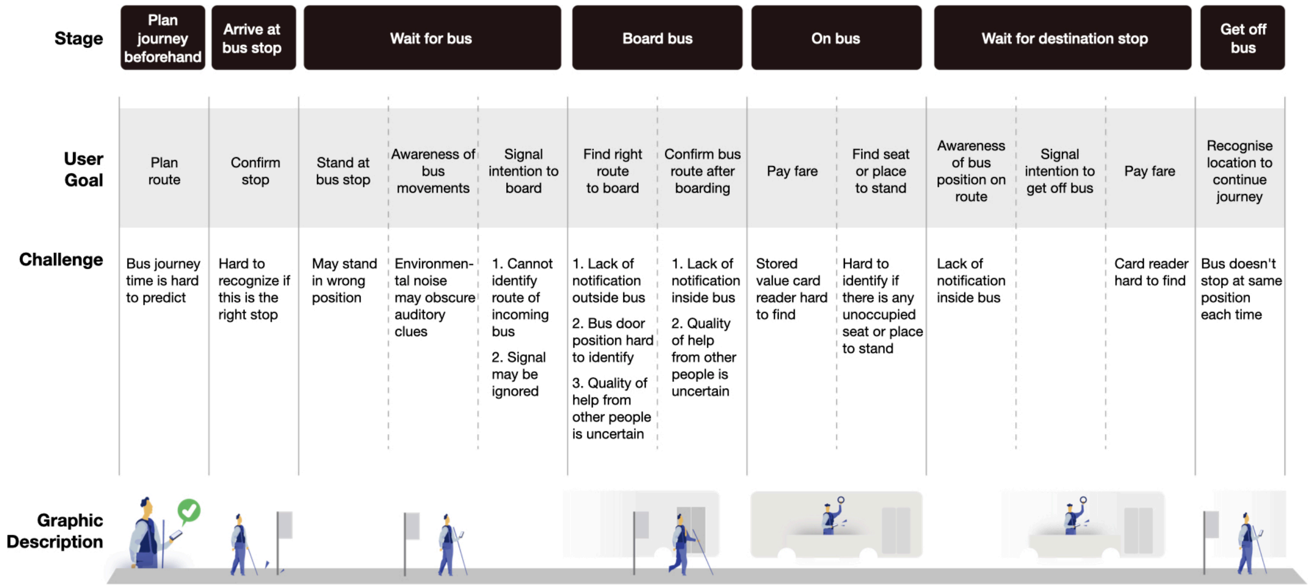


Figure 4. Customer journey and pain points for visually impaired passengers using public transport.

(a) (b) (c)

Figure 5. The three key components of the EyeBus service system:
(a) the EyeBus app, (b) the bus telematics system, and (c) the waiting area with tactile indicators.

- **The bus telematics system**: The challenge of its UX is how to distinctly notify bus drivers among all the messages the system receives. A combination of sound, visual signal, and text confirmation is the solution we proposed after a series of design iterations and tests. Consequently, the UX of this component needed elaboration. For example, how to alert the driver to a booking with a distinct yet comfortable sound, and how to remind the driver when approaching a bus stop where a visually impaired passenger is waiting.
- **The bus stop**: The UX problems are twofold. One is the ease for the visually impaired person of finding the bus stop without interfering with other passengers, and the other is the ease for the bus driver of noticing the visually impaired person among other passengers. The result is a combination of standard tactile paving, a yellow reflective strip along the kerb, and text on the ground indicating the priority for boarding the bus through the front door. Consequently, their UX needed to be designed. For example, whether the tactile paving tiles would cause inconvenience to wheelchair users.

Based on the above, it was evident that the design of the different channels would involve various complex factors due to their different needs for target users. Taking the app as a specific example, it is a complex issue to design apps for visually impaired users with proper functionality, accessible operation, and a good user experience. It is necessary to design with high empathy and polish the details through continual prototype testing. As development progressed, user testing was conducted in three stages: low-fidelity prototype testing, high-fidelity prototype testing, and field testing. Based on the feedback from user testing, the design team gradually tested and corrected different aspects, from core functions and information architecture to interface usability and operation flow, while also optimising system stability. The final version of the interface design is shown in Figure 6.

The visual interface should follow the specifications dictated in the Web Content Accessibility Guidelines (WCAG), with a colour contrast that reaches the WCAG's highest level: AAA. Therefore, EyeBus app uses white text against a dark background as the base colour scheme to minimise eye strain, with blue as the

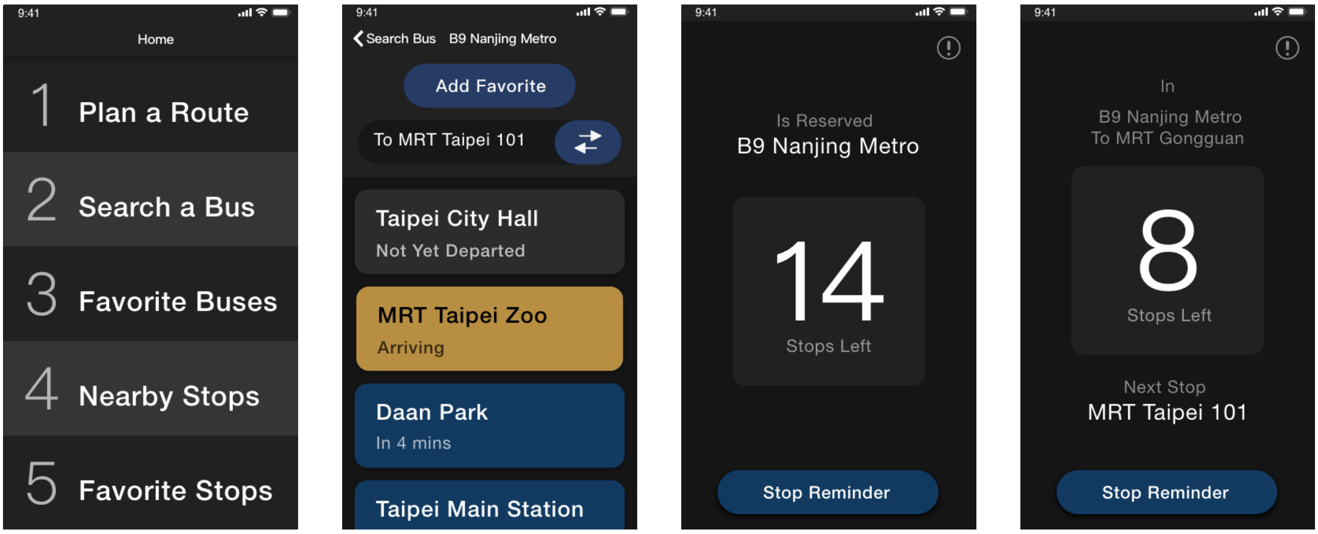


Figure 6. Examples of the app interface design.

colour for general buttons, and yellow for warning buttons to help colour-challenged people easily distinguish between the different buttons. For the auditory interface, the EyeBus app follows the principle of linear reading, with a built-in screen reader. The interface incorporates an alternative text design that converts sentence fragments into complete sentences using buttons, so that visually impaired users can effortlessly understand the meanings.

In addition, the EyeBus app is used at almost every touchpoint of a visually impaired passenger's journey, so it must respond to the usage habits of multiple users and meet the changing needs of service users across different scenarios. To this end, the EyeBus app designers developed a functional framework for various bus booking scenarios, taking into account the usage habits of blind users and of those with limited vision, and continually supplemented with perceptual prompts during the service journey.

The Complexity in Combining Different Channels into a Trustworthy Service System

In the design of the individual channels, the EyeBus team:

- Made bus reservation more accessible and more convenient through the app design for the visually impaired user;
- Optimised the existing bus telematics system and prompt method to improve the efficiency of notifications to the driver;
- Added a small area of tactile paving in the waiting space at bus stops to assist visually impaired passengers. While giving the driver a positioning guide, it also ensures the universality of the waiting area.

Although all three components performed well in their respective tests, the design of the bus booking service was made more difficult by its multi-channel, multi-scenario, and multi-stakeholder characteristics. The connection between online and offline touchpoints is prone to errors. If the service were planned according to a single linear process, users would encounter a lack of guidance and remedial measures, resulting in mistrust in the service.

After fully considering requirements and choosing design mediums in each channel, the smooth connection between touchpoints is the most crucial factor. Note that the connections between service contact points conform to the past behaviour patterns of visually impaired passengers, and also allow the mobile app to reflect the physical environment. This can establish a backup system for the service system: when any channel is interrupted, there is still another channel that operates smoothly to ensure the stability of the service process.

For example, when a visually impaired passenger is waiting to board a bus, the app's real-time bus tracking feature helps the passenger determine when the bus is arriving at the stop. However, GPS is inevitably inaccurate, meaning that the bus is often either faster or slower than what the tracking indicates. Therefore, the team included the question "Have you boarded the bus?" in the bus booking process, which pops up when the system detects that the bus has left the stop. If the visually impaired passenger has boarded the bus, a reminder can be set to prompt them when to get off the bus. On the other hand, if the passenger has missed the bus, or if the bus has not yet arrived, they can also be reminded to recheck the bus's location immediately using the app, to avoid waiting for the bus in a state of uncertainty.

One of the causes of failure of public transport provision for visually impaired people is underestimating the complexity of the service. Some developers focus on either user-centred or driver-centred solutions, and some focus on the service between them. However, the real complexity of the service system is unexpected. It contains three functional parts: the client mobile app, the bus telematics system, and the bus stops. We have service users, service providers, service supporters, and service supervisors as stakeholders. In terms of digital devices, the system has an app, bus telematics systems, and a service for processing buses' GPS data. There are 14 digital information exchanges and two visual cues among these stakeholders and digital devices, as shown in Figure 7.

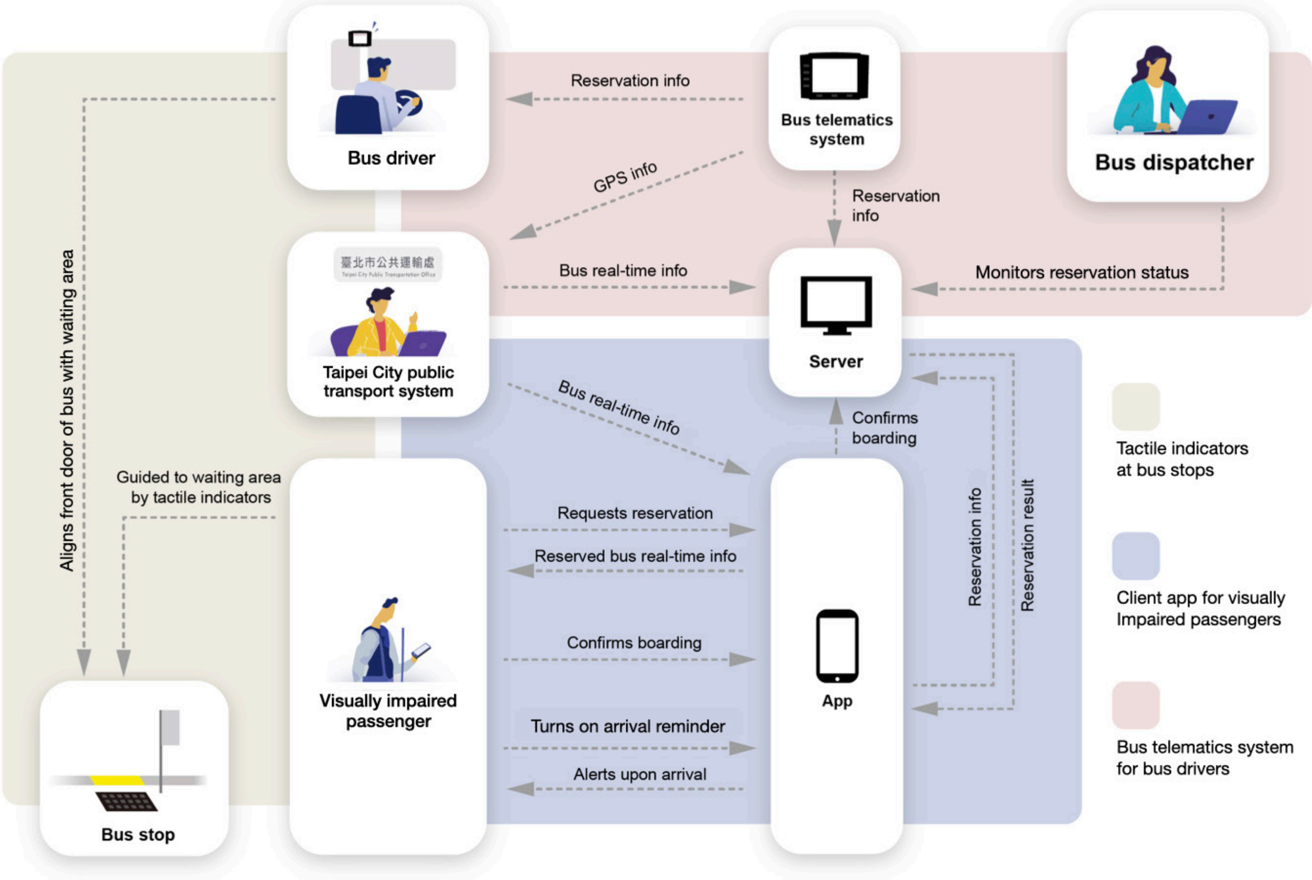


Figure 7. Information exchanges between different devices in the EyeBus ecosystem.

These devices connect stakeholders to enable the operation of the service. Thus, their user experience affects how smoothly the service is used and whether users even want to use it. A failure of these digital information exchanges will stop the service, so the stability and user experience of these devices are key to the service's operation. As a result, they increase the level of complexity of service design.

Sustainable Development by Uniting Partners Across the Public and Private Sectors

When the system design was completed and required actual implementation, the EyeBus team needed to work with different agencies within the public sector and with third-party device vendors, construction contractors and bus operating companies to build the system. The case presents the complexity of this stage to consider the following three aspects:

- Service design value by proof of service;
- Elimination of the silo effect from the public sector by coordinating different vendors and agencies;
- Refinement and promotion of the service model for sustainable development.

Necessity of Proof of Service: Present Design Value

Even if an accessible service system has been developed successfully, as an investor, the public sector should be able to foresee the difficulties of full implementation and witness the smooth operation of the service on-site before integrating it into policy decisions. Therefore, when the design team takes service realisation as its vision, concerns from the public sector must be considered, which may result in more challenges.

Relevant research studies (Brown & Wyatt, 2010) also pointed out that most stakeholders remain afraid of failure and change, and design methods cannot be put into practice in most real cases. Therefore, professional proof of service (PoS) is very important.

In the EyeBus case, the implementation details included recruiting visually impaired people with different levels of impairment who could ride on buses, had a certain level of technological literacy, and were able to provide sufficient service suggestions; documenting users' ideas, behaviour, and system transmission status through photographs, interviews, or background information during the trial process; and making the process and results of the study open for joint discussion of directions for improvement. PoS should be conducted by a third-party department, who will use a transparent, fair, and just assessment methodology to evaluate the outcomes of the vendor in question and control the quality before the service starts to operate. PoS can demonstrate the feasibility and value of the design concept for executive leadership and departments, enabling the system to be implemented successfully and developed sustainably in the future.

> … We have to do projects which can achieve benefits immediately… After watching your PoS video, we changed our minds and found that the answers we got from the perspective of real users and previous research were different. (Interview with service supervisor)

Eliminating the Silo Effect from the Public Sector: Introducing Resources and Promoting Cooperation

When a multi-channel public service design pursues trial operation, the implementation process must be authorised by individual departments of the local government. The silo effect amongst government agencies worsens complexities.

In the EyeBus case, if the app is to be released in the name of a public-sector actor rather than a private vendor, it must be approved by the Department of Information Technology of the Taipei City Government. When the bus telematics system of the bus needs to be updated, it must comply with the regulations of the Taiwan Telematics Industry Association (TTIA). When the construction of the waiting area has been completed at a bus stop, it must be approved by the Public Works Department of the Taipei City Government. However, there is a huge difference in service levels among government departments and a lack of interdepartmental communication, which leads to severe silo effects. Each department needs to be convinced from the beginning to keep the project progressing.

Difficulties in Diffusion and Sustainable Development: Continuous Adaptation

The EyeBus service system is designed for Taipei City. The design is compatible with the city's bus lines, information system, and bus stop waiting areas, and the specifications have been established so that multiple vendors and contractors can meet them. However, if the same design were to be extended to other cities, it would not be difficult for the app to be adapted because it is not site dependent, but the bus telematics systems of other bus service providers may not be compatible in the same way that they are throughout Taipei City. Furthermore, more variations of bus stop topography may need to be considered for waiting areas, or more bus travel characteristics may require consideration. When extrapolating the design experience outside of the project and seeking to implement it in other areas, it is necessary to reexamine the needs to tailor the service to local conditions.

The sustainability of the EyeBus service depends on active interdepartmental cooperation and continuous adjustment within the public sector. In addition, during the practice diffusion process, when new equipment vendors and supervisors join, experience may not be inherited completely. Therefore, continuous service validation and updates are essential for maintaining service quality.

> … but there are policy considerations; the minister is usually in power for no more than three years. It would be a pity if this case would be cancelled if the minister changed... Moreover, once the people involved moved on there would be nothing left but a report and the experience would not be able to be passed on... (Interview with a service supervisor)

Discussion: *Design for Public Service*

In order to gain more insight into the complexity of public transport service design for visually impaired people from a whole network perspective, in this study we take a retrospective look at the case of EyeBus to review the multiple elements in the service system. Based on the case, we discuss the possible complexity factors in different design stages, and practical details or methods that need to be considered in each stage, as shown in Figure 8. These discussions might inspire designers working in the public service system. When designing a touchpoint of public services, thinking about the solution from the perspective of the service ecosystem may result in a different solution.

Complexity Factors in Public Service Design

Complexity within service systems generally arises from their increasing scale and number of components (Briscoe et al., 2012). As described in the case presented here, public transport services involve many stakeholders, include a complex mix of scenarios, and are managed by multiple government agencies which coordinate the stakeholders' efforts. These characteristics lead to various complex factors that need to be considered in each phase of service design. Based on the case analysis results, this paper divides the complexity factors in public transport service design into three parts: stakeholders, channels, and PoS for practice diffusion, to illustrate them in detail.

Comprehensive Stakeholders Map

In the past, being user-centred was often emphasised in design theory and was regarded as primary among the five principles of service design summarised in the book *This Is Service Design Thinking* (Stickdorn et al., 2011). However, as mentioned in many studies (Osborne, 2017; Verleye et al., 2017; Yang & Sung, 2016), replacing the user with the stakeholder more accurately represents the process of service design, especially in public service design.

In the overall service design process for EyeBus, the team first observed bus journeys made by visually impaired passengers, interviewed bus drivers, who are service providers, and then constructed the customer journey map and extracted insights. These steps are essential for designers to understand unfamiliar service details. The involvement of users in the innovation and implementation of public services is currently a widely discussed topic in public management research (Osborne et al., 2016; Trischler & Charles, 2019). But in addition, as Trischler et al. (2019) have said, coordinating resources across multiple actors (including users and organisations) is also a basic consideration for public service design. Otherwise, while potentially effective

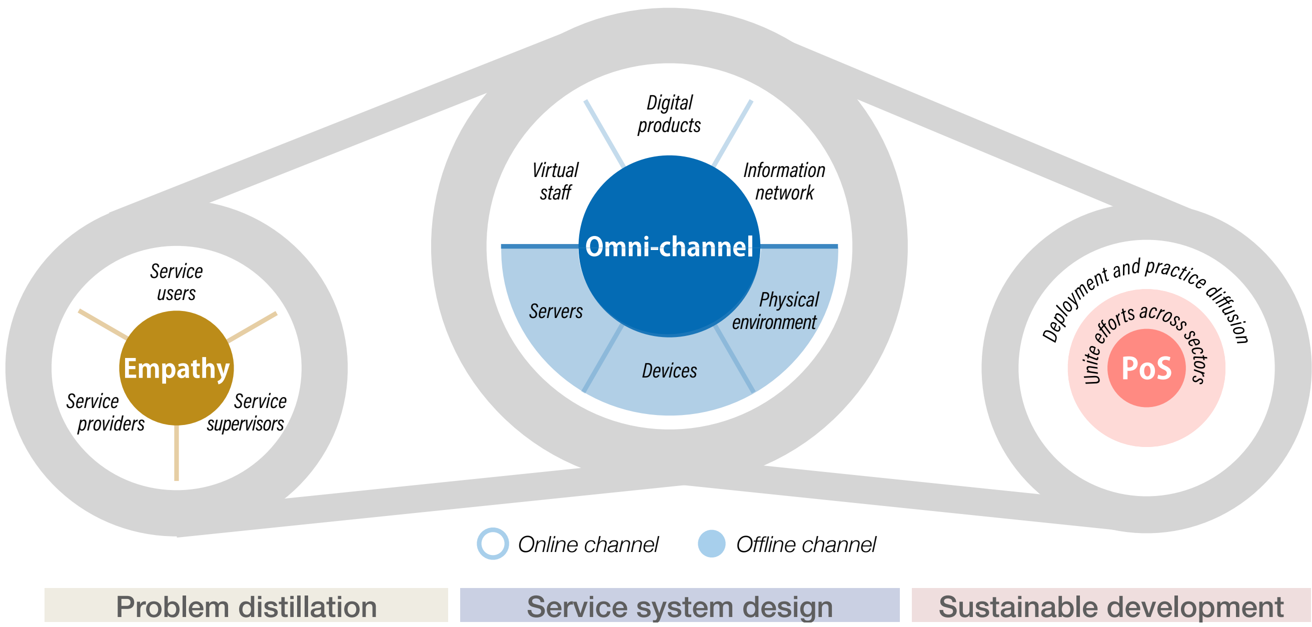


Figure 8. Possible complexity factors in public service at each design stage.

on the end-user level, innovations might not gain the approval or support of those responsible for implementation. The most easily overlooked issue at the problem distillation stage is to clarify the needs of service supervisors.

In summary, before establishing a service proposal and proceeding with development, it is necessary to obtain the assistance or cooperation of stakeholders. In order to implement EyeBus, in addition to clarifying user needs and designing opportunities in the preliminary research, the EyeBus team also broadened the research scope to include service stakeholders, such as the resource release of service supervisors and the workload status of service providers, hoping to complete the service and achieve the goal of safe rides for visually impaired people with minimal costs.

Therefore, after drawing up the service proposal, the EyeBus team combined the service process and corresponding resource units into a service relationship diagram, including:

- Visually impaired associations and orientation and mobility specialists that can inform designers about the experience of visually impaired people;
- The Taipei City New Construction Office and construction contractors that govern the construction of bus stops;
- Technology providers that cooperate with service innovation, such as vehicle manufacturers and driving route system vendors;
- Bus companies that cooperate with service evaluation.

Incorporating service stakeholders into the scope of collaboration as soon as possible can help the planning team negotiate and cooperate with specific public departments, vendors and contractors as soon as possible and accelerate development efficiency.

Multi-Channel Coordination

Marketing is the origin of the omni-channel concept. The focus of omni-channel research is on the retail domain and on coordinating the brand experience across multiple channels (Roto et al., 2016). With omni-channel experiences, the customer may access multiple channels simultaneously to achieve a seamless experience.

In the preliminary investigation and analysis of the case study, it can be seen that the customer journey of visually impaired bus passengers is short, but the touchpoints are dense. In a short customer journey, it may be necessary to coordinate multiple channel designs to assist continuous service, which involves the cooperation of service providers such as drivers and dispatchers. For example, in the process of waiting for and boarding the bus, for visually impaired passengers the steps include arriving at the waiting point, sending reservation information to the driver, and boarding the bus safely. The channel design involved includes the waiting area (physical environment), the app sending the reservation (device), app feedback notification (based on the information network), the driver's correct stop (service staff), and so on. The design team needs to consider different channels at the same time when designing services and provide a seamless service offering for passengers with visual impairments.

Accordingly, we propose that the second complexity factor is the channels of the service system design, including people, devices, and environments. These can be further divided into offline and online channels (physical and digital), resulting in a 3 × 2 service channel matrix, as shown in Table 3. The role of service designers is to manipulate these six channels to form a better service ecology.

Table 3. The six channels of service design.

	People	Equipment	Environment
Online channels	Virtual staff	Digital products	Information network
Offline channels	Servers or service staff	Devices	Physical location or setting

From PoS to Diffusion

Based on case analysis and stakeholder interviews, as mentioned above, PoS is the core and premise of a service design from concept to implementation and promotion. Because of the vast resources consumed in service design, the designed service system, like a minimum viable product, should be rigorously examined in real settings after its completion. Only when the service can sustain the field test, can it demonstrate real value in reality.

One of the EyeBus design principles is to leverage the current service ecology. The team only designed the app, the format of the alert messages for the bus telematics machine, and the bus stop adaptations. The remaining parts relied on companies that were already working with the city government for practice diffusion. Only when the service system design passes PoS and the actual value of the service is verified in reality, will the separate public and private sector actors subsequently be truly united to jointly promote the implementation of the service and promote it to other regions. These links together form the third complexity factor of practice diffusion.

The ultimate goal of public transport service design is to improve the transport experience in daily life nationwide. Hence, improving the core service ecology in context is the first step, followed by spreading best practice to other cities. However, when the intention is to disseminate current practice to different cities, the silo effects among government agencies worsen complexities. The establishment of EyeBus required at least the Department of Transportation and the Public Works Department in Taipei to work together closely.

The basic transport infrastructure might also give rise to complexities. Taipei is the capital city, with the best transport infrastructure in Taiwan. Differences in the quality and completeness of transport infrastructure in different cities might produce obstacles for the diffusion of EyeBus. The additional complexities may also be financial. The visually impaired passenger population in Tier 2 cities is smaller than in Tier 1 cities, while the level of financial difficulty is greater. How to balance these two factors introduces another level of complexity.

Methods and Process in Three-Stage Design

Compared to the numerous issues in this complex project, the design process was relatively simple. Several previous projects by the design team had gradually formed and applied the three-stage design process to achieve a better quality of design outcome (Shih et al., 2020; Yu et al., 2020). In different projects, facing different design goals, the design artefacts and the critical stages are different, and correspondingly the complexity of the design system also has its own emphasis, resulting in different coping strategies. For example, some projects emphasise the usability design of the app (Wang & Tang, 2021), while others emphasise co-creation by stakeholders to drive independent innovation within the organisation (Wang et al., 2020).

Thus the three-stage design process seems to combine the simple architectures of IDEO 3I and Double Diamond, but each stage contains complexity factors, so it is necessary to develop strategy details according to the fields and contexts of different projects. A good innovation project from initiation to implementation cannot do without the three stages of the pragmatic innovation process, which are problem distillation, service system design, and sustainable development. Similarly, the Design Council (2019) has also updated its classic Double Diamond process. In addition to the design process, principles, and tools, it includes cooperation between stakeholders and organisations to consider design innovation and highlights the importance of practical implementation.

Taking EyeBus as an example, each design stage contains detailed considerations and suitable design methods. Details will be addressed in the following section to provide guidance for designers.

Problem Distillation

Service designers should avoid being overly guided by personal experience, values, and interests in their solutions, consequently paying attention to the overall understanding of the target group to establish inclusive design details. The core task of this stage is to define the key performance index and key delivery (KPI&D) of the service problem and empathise with all the stakeholders.

Initially, most of the government agencies and user-related groups in the EyeBus project rejected the idea of thorough research. They regarded the problems as simple and straightforward. However, an incomplete understanding of the service problem may eventually lead to an unexpected failure caused by aiming in the wrong direction. Therefore, to explore ambiguous issues, the team first catalogued the stakeholders, support systems, and resources in the service system and acquired a clear understanding of their roles and responsibilities. They observed the whole service journey in fields from different stakeholders' viewpoints. Then the EyeBus team identified existing touchpoints between passengers and bus drivers and distilled the key elements of the service ecology and the peak touchpoints in the customer journeys of the service, and finally chose the design medium based on the six channels. These key elements were the apps, bus telematics systems, and bus stops.

The tasks in this stage included elucidating the pain points of existing visually impaired passengers, defining the planned service customer groups and goals, finding design opportunities, and deciding design mediums. Common tools used in the problem distillation stage included shadowing, contextual interviews, customer journey map, and persona matrices (see Figure 9).

Service System Design

The difficulties of public service design lie in the involvement of different channels. A good service is a synergy of each design element fulfilling its stakeholders throughout its service journey and touchpoints. The core task of this stage is to clarify the design elements and connect them to the service system, and to iteratively design and test the design elements until they are satisfactory and stable.

In the EyeBus project, the design team proposed a storyboard to describe the ideal experience when reserving a bus ride. They also introduced the service blueprint as a graphical tool presenting how the service would work frontstage and backstage to reach consensus among stakeholders (see Figure 10-a).

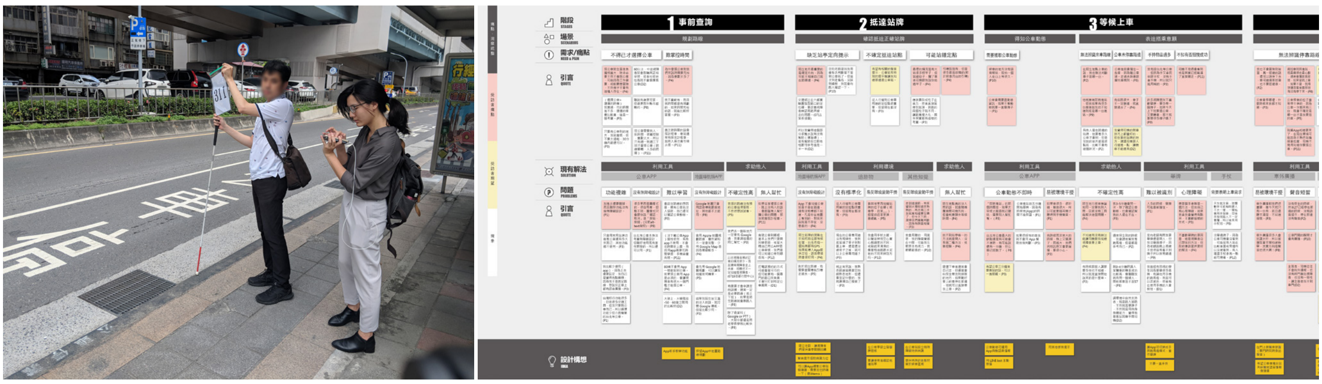
In terms of iteration, the EyeBus team invited visually impaired users to examine the app's usability, bus drivers to experience the degree of burden in serving passengers, and O&M instructors to evaluate the versatility of boarding points, to ensure that every iteration of the design was based on stakeholder feedback (see Figure 10-b).

Furthermore, considering that gaps in service touchpoints may cause poor experiences, especially in multi-channel and multi-scenario services, the EyeBus team sketched back-up user flows rather than just proposing an ideal user journey, in order to bridge the gaps between touchpoints.

Sustainable Development

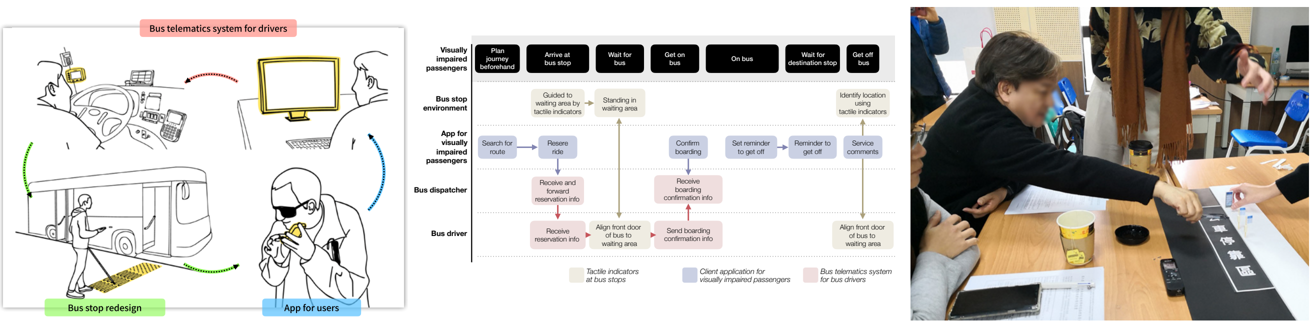
Diffusion is the most important and complex stage in the design process because it must be linked to feasibility, cost, and budget. As an accessible service embedded in the existing bus system, EyeBus must adapt to various situations, such as a majority of bus travellers not using the service and possible connection issues. In order to observe whether the service can operate under conditions of interference in the public field, the team undertook field testing to identify potentially overlooked practical factors that might not have been addressed in the design.

Upon the first launch of the service, the EyeBus team conducted a soft launch, and recorded every service gap with quantitative and qualitative research methods such as the G-S-M model (see Figure 11) to examine the service's stability. Further, after the first route launch, the team needs to continue weighing the possibility of establishing different routes in new contexts to make detailed adjustments and ensure successful diffusion.



(a) (b)

Figure 9. Common tools used in the problem distillation stage: (a) shadowing; (b) customer journey map.



(a) (b)

Figure 10. Common tools used in the system design: (a) storyboard and service blueprint; (b) stakeholder test.

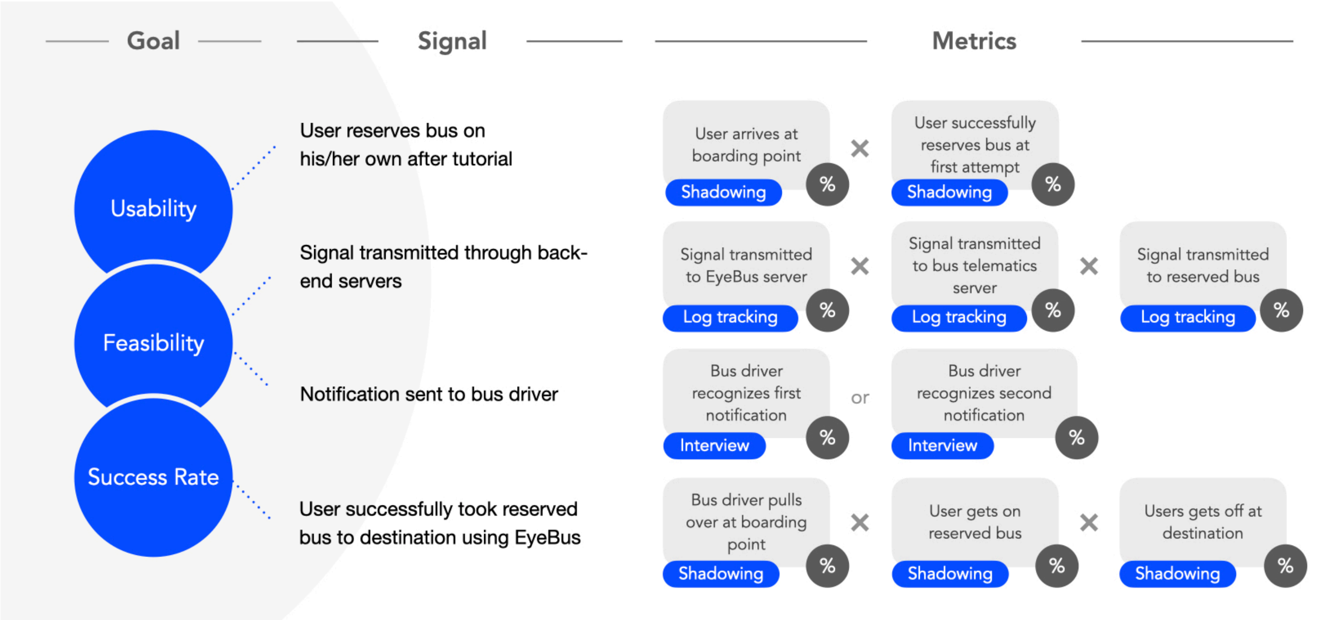


Figure 11. Using the G-S-M model to evaluate the usability and feasibility of EyeBus.

Conclusion and Future Work

Public service innovation, especially for a vulnerable minority, is a challenging issue. The customer journey in public transport service for the visually impaired has only a few stages, but the transitions between its different channels are complex. This results from the multiple roles of service providers and users, the interplay between digital and physical environments, and the influences of service supervisors in the service system. Also, the service suffers from limited resources under considerations of proportionality and efficiency of public welfare.

Overall, compared with the criteria for public service innovation proposed by Boyne (2003), EyeBus focuses on solving the problem of safe and convenient public travel for visually impaired people under the conditions of limited cost and minimal impact on other users. Therefore, the project achieved good results in efficiency and value, simultaneously winning the high satisfaction of the visually impaired passengers in the testing stage, and they expressed their expectations for the EyeBus service during the interviews.

Based on the analysis of EyeBus, this study illustrates the complexity of public transport service design from different design stages. First, stakeholders with different roles have different needs, and their needs may conflict. In the problem distillation stage, the team needed to gain a more comprehensive, in-depth understanding of how visually impaired people ride buses, and map out the key players, support systems, and resources involved. Second, previous solutions to transport service design for visually impaired people have mainly aimed to enhance or assist the senses based on a single channel. However, public transport involves a cross-scenario customer journey, and information exchange between different channels increases the complexity of service system design. Moreover, information exchange between different stakeholders and channels increases the complexity of the entire system exponentially (see Figure 7). Finally, during the sustainable development stage, the problem of how to unite the efforts of separate public and private sector actors brings extra complexity to the work of the design team, such as the need to make the foreseeable visible, eliminate the silo effect, and promote the service to other cities to make it sustainable.

This paper discusses the adaptability of the results from the case; the possible complexity factors in public service design, including stakeholders, channels, and practice; and the Triple Diamond process for future service innovation.

Design research is considered valuable because it is collaborative, oriented towards solutions and action, based on pragmatic experimentation, contextual, and systemic (Trullen & Bartunek, 2007). Analysis of complexity helps us target the orientation of service correctly, and distillation of the complexity of the service system helps us in designing the service. Research into this process could contribute to a better understanding of the nature of public services from the perspective of complexity. With the case study findings, this research also proposes five possible principles for developing service design for public services.

- Take a problem-oriented approach, not just user-oriented, with all stakeholders, including service users, providers, and supervisors.
- Co-create across the value network, not just between givers and receivers.
- Focus on the most critical touchpoints, not the whole customer journey.
- Enhance the user experience for each critical touchpoint, not simple justification of the service system.
- Dig into the ecology and layers, acknowledging it as holistic.

Finally, not only public services are getting more sophisticated, but also commercial services. The findings and discussion in this case study may contribute to our society's wellbeing and business value. Moreover, the research results may advance our understanding of service design and research.

For future research, we hope to see more case studies of service design in real contexts. That will help to establish a better relationship with mutual advantages. Moreover, from the perspective of the complexity of service design, we need more research to explore modification of current tools and shifts in service thinking for a more sophisticated ecology.

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