Lessons Learned from the Development of a Rural Real Time Passenger Information System

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Abstract. In recent years, the advances in real-time transport telematics systems that use computer, communication, navigation and information systems, make the dissemination of the passenger information more effective and efficient. This led to real time passenger information systems to become more and more common. This paper explores the aforementioned in a rural context and presents lessons learned during the development of a rural real time passenger information system.

Keywords: Real time passenger information systems · Co-design · Rural areas

1 Introduction

Rural communities face a range of challenges associated with accessibility and connectivity. Limitations in transport infrastructure and services can diminish travel possibilities and hinder access to opportunities relating to employment, education, and business (Chamberlain and Crabtree 2013).

Technology has long been heralded as offering the potential to mitigate some of these barriers by providing alternative means of access and connectivity (Chamberlain et al. 2013). Though such transport technologies have been widely deployed in urban and suburban areas in the developed world, their application in rural and remote rural areas has been very limited.

In this paper, based on findings we discuss briefly the design of a technology that provides real-time travel information to rural passengers, and discuss the lessons learned.

2 Co-designing a Rural Mobile Real Time Passenger Information System

To facilitate the design of the technology a series co-design sessions, expert panels, focus groups, and walkthroughs were conducted. The initial design process involved two co-design sessions in the Scottish Borders (SB) with rural public transport

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passengers that had previous experience with similar technologies and two sessions with participants in West Yorkshire (WY) that had no previous experience with similar technologies. The SB sessions involved six participants aged 19–21, and lasted approximately 150 min. The WY sessions involved 5 participants with an average age of 21 years old, and lasted approximately 180 min. In both the WY and SB sessions, we separated the participants into groups of two and showed them two videos. The first video illustrated the functions of the technology probe, while the second video showed the technology probe in action through various usage scenarios, as emerged from our previous studies[1]. The main purpose of the videos was to illustrate to both the WY and SB participants the technology we would like them to improve. After the videos, we gave the participants four scenarios illustrating real-world situations where RTPI would be needed for successful completion of the journey on time. The scenarios emerged from our ethnographic style study in the Scottish Borders, and the island of Tiree. The purpose of the scenarios was to blend a set of real, relatable, on-going activities in order to enable the participants in the co-design sessions to imagine a native futuristic look at how technologies could better support those activities.

After we gave some time for the participants to digest the scenarios, we gave them a set of functions and asked them to come up with their own functions, assign them to scenarios, and grade them as "must have" and "could be good to have". These were grouped as general functions, boarding-point functions, and on-trip functions. It should be noted that the functions we gave to the participants emerged during previous studies we conducted in various rural areas (see subsection X on page Y for more information).

Fig. 1. Various design screens as produced by the co-design sessions

[1] Video 1 can be found at https://www.youtube.com/watch?v=3bY2X_FObCI, while video 2 can be found at https://www.youtube.com/watch?v=1Wgn-pMJAHA

After the end of this exercise we asked the participants to utilise the functions and the scenarios to design a smartphone application to improve the rural passenger experience and support the user during disruptions by primarily utilising the "must have" functions and secondarily the "could be good to have" functions. Each group produced a design that had variable levels of depth in different aspects. For example, the design of one group of participants from the WY session focused mainly on the social interaction between the users during disruption.

Based on the outcomes of the sessions in WY and SB, we created a design with inputs from two human-computer interaction experts and two transport studies experts that merged the design aspects, elements, and addressed several of the issues that emerged from the co-design sessions. The final design mainly concentrated on providing information regarding pre-trip, on-trip, and on boarding point, journey planning, supporting the rural passenger experience through social media, and disruption. Figure 1 illustrates various elements of the design.

3 Lessons Learned and Recommendations for Co-desining Rural Real Time Passenger Information System

There are many continuing arguments in the human-computer interaction and transport studies over which methods are appropriate when developing RTPI systems. These can depend on (i) who the user groups are (age, gender, sensory or physical impairments, novice versus experts), (ii) the task or tasks to be performed, (iii) the physical environment, and (iv) the social context.

A variety of approaches and methodologies are emerging as particularly useful in the design or RTPI systems. These involve engaging users in co-design and interactive experiences in order to elicit and capture a rich texture of individuals' experiences. These methods allow researchers to gain insights into how people travel, what information is important to them, and what objects and activities are of direct relevance to the design exercise.

Our design approach heavily draws upon these methods, as we were interested in capturing and designing based on rich lived experiences. As such, our overall design is characterised by three interrelated dimensions: (i) a social dimension for designing new practices and processes, (ii) a cognitive dimension for understanding the interference between providing information and actively contributing to the development of the system, and (iii) a technical dimension for creating new technologies that allow the participants to contribute new information without acquiring extensive technical skills.

Our key recommendations for the design of a rural RTPI system, based on lessons learned, include:

- Establish a panel of expert users early in project.
- Get to really know your participants.
- Study usage in both a controlled environment and in the wild.
- User props to initiate and promote discussions, and make the user the expert
- Use co-design activities to increase empowerment and buy-in.

- Use low-fidelity prototypes to encourage creative thinking before creating high-fidelity prototypes.
- Use high-fidelity prototypes to increase engagement.
- Encourage coding and validation of results during design sessions with users present.
- Use ethnographic studies, observations, and ride-alongs to provide physical and social context insights.

There are a number of challenges in these steps, such as recruiting the correct participants, identifying the objectives and metrics to determine if the design is achieving those objectives, and designing an initial relatively complex technology (or set of technologies). Our work indicates that these can be partially mitigated by employing a cyclical approach that is based on a small core user base that actively contributes to the improvement of the solution throughout its lifecycle. Such a proposed approach can be actualised with the SER model, which aims to transition the users from consumers of information to providers and, ultimately, meta-designers of the medium that conveys the information (Fischer 2011). Figure 2 illustrates this model.

In addition, we have identified a number of issues that should be taken into account when evaluating such systems. These include:

- Correct selection of evaluation metrics that reflect the objectives.
- Testing of the design to ensure that the presentation will not distract the users.
- Ensuring that, if scenarios are used, they are realistic for the user population and make use of significant portions of the design.
- Making sure that the data collection is feasible for the users and reasonable for later analysis. This is particularly true if the users are asked to mark up something or write something out.
- Making sure data from all users can be accumulated and compared against each other for analysis of the evaluation.

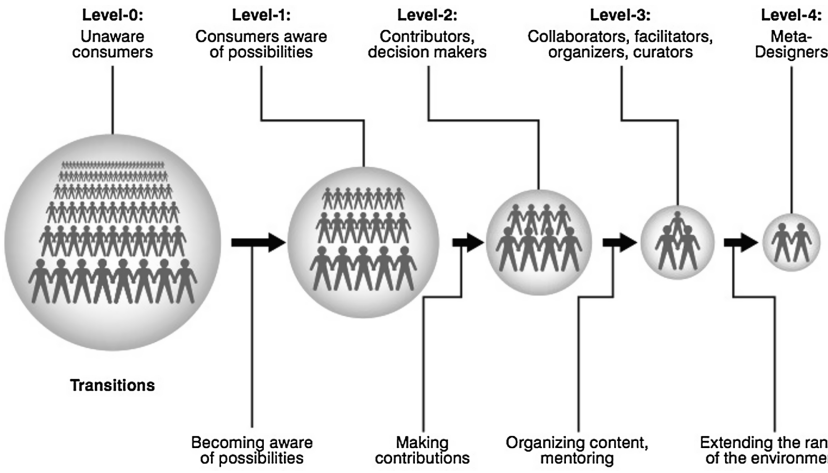

Fig. 2. The SER model (Fischer 2011)

Overall our lessons learned and subsequent recommendations fall under the concept of the "loose fit," and aim to balance the asymmetry of ignorance with the asymmetry of knowledge of the users when designing a rural RTPI system.

4 Discussion and Conclusion

In this brief paper we illustrated our co-design process and discussed lessons learned. The mobile RTPIS we co-designed focuses on capturing and sharing of both an individual's and a group's tacit knowledge, enabling the informed participation of people from all walks of life, and allowing the contributors to modify it according to their needs, leading to "living" information spaces. Our work indicates that, for the aforementioned reasons, a modular design approach that supports the users during various stages of their journey is needed, and that the design approach must include an initial key community of users that can provide an initial collection of domain knowledge in a setting that promotes continuous evolution of that knowledge.

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