Using Passenger Personas to Design Technological Innovation for the Rail Industry

Luis Oliveira [1], Callum Bradley, Stewart Birrell, Neil Tinworth, Andy Davies, Rebecca Cain

Warwick Manufacturing Group (WMG), Warwick University, Coventry, CV4 7AL, UK
{L.Oliveira,C.C.C.Bradley,S.Birrell,R.Cain.1}@warwick.ac.uk
Unipart Rail Ltd, Jupiter Building, First Point, Balby Carr Bank, Doncaster, DN4 5JQ, UK
{andrew.davies,neil.tinworth}@unipartrail.com

Abstract. Research with end users can contribute to the design of technologies such as intelligent transport systems. However, it is important to use methods that can facilitate the uptake of research outcomes by the industry. This paper presents the use of passenger personas as part of the process of developing new technologies for the rail industry in the UK. Personas represent archetypal users and can facilitate the understanding of user behaviours, needs, motivations, characteristics and limitations. We aggregated existing knowledge and complemented it with bespoke data collection to understand passengers' perceptions about the rail system. The study design focused on current user experiences and also where technology can improve these experiences. A set of four personas was produced in order to illustrate who the users of the train systems are as well as their characteristics. This knowledge informed the requirements of innovative technologies that can enhance user experiences during rail travel.

Keywords: Personas; user experience; user centred design; rail passengers

1 Introduction and background

The combination of technological developments in transport, data provision, widespread availability of communication networks and increasing ownership of smartphones present remarkable opportunities to improve services related to rail transport systems and consequently enhance the customer experience. Passengers frequently use smartphones to pass the time on board [1], given that technology can make idle time more pleasurable [2]. There are several other areas in which technology is being used at the moment and can be introduced in the future, with the view to produce an improved service overall and better user experience. Examples include pre-trip, on-board and post-trip information via smartphones and passenger information screen [3]. One recent review presents diverse options of current and potential wayfinding and navigation information [4]. There are also possible

[1] Corresponding author

advancements in fare collection and management of tickets, including social media integration [5]. Focus groups and interviews with passengers indicate that there is an appetite for the use of more technology and provision of sophisticated information, "especially given the growing use of apps on smart phones" [6].

The process of designing technological innovations has to consider users' opinions of how they experience interactions with these technologies, in different phases of the development process [7]. The design and introduction of a new technology should be based on thorough user research to increase its chance of acceptance, to understand potential challenges and address those that could prevent smooth adoption of such systems. It is possible to find a few examples of attempts to learn about user needs prior to the introduction of new communication technologies. These include computer simulations of interactions [8], user observation and retrospective interviews after the interaction with prototypes [9], and analysis of real interactions with automatic ticket machines at stations [10], all with the potential to improve rail experiences.

The research presented in this paper is part of a multidisciplinary project that proposes the introduction of integrated technological systems to give personalised information, improve seat reservations and ticket validation, and reward and engage rail customers individually. Since this proposal is a notable advancement from the arrangements currently in place in the UK, a number of issues need to be assessed. This paper intends to demonstrate how train passengers evaluate current systems and how they perceive the introduction of new technologies in terms of the user experience. The main goal is to understand how a proposed integrated system would affect train travel, and this knowledge ultimately informed the design of the requirements of a new system.

The rail industry in the UK commonly segments the travelling public into three groups: commuters, business and leisure [1, 6, 11]. Commuters are those who travel by train very regularly, almost daily and probably for work reasons. Leisure passengers travel for social reasons, usually at off-peat times and during the weekends. Business passengers are those travelling for professional reasons, generally on open return tickets paid by their employers. These definitions work as market segmentations with demographic attributes and levels of familiarity with their travels. However, these segments are restrictive and may not provide enough information on user behaviours or needs [7]. Furthermore, the same user may navigate between two or all of these segments.

One common design tool to understand users and improve the development of products and services is *personas,* which precisely describe users and define what they wish to accomplish [12]. Personas can represent archetypal users and facilitate the understanding of user behaviours, needs, motivations, characteristics and limitations [8, 13, 14]. Having a small set of personas makes real users more tangible, especially for large organisations or multi-partner projects with a diverse group of stakeholders where some of them may not be familiar or involved with the user research. The real users are presented to the team via these personas, described with a realistic name, a photo, some demographic information and a textual description to make them credible representations of the user population [8]. For example, Burrows et al. [15] represented smart home users via a set of personas to offer a richer picture of their experiences of technology in real-life contexts. Marshall et al. [8] demonstrated how personas were used to evaluate the accessibility of rail transport.

Their results indicate failure points involving ticket machines and navigation at stations, which informed recommendations for design. This paper presents a research conducted to develop four main personas for train passengers. It describes how these personas would interact with the proposed innovations, and provides guidelines in the form of key requirements for a system that can improve passenger's experiences.

3 Methods

Two methods of data collection were used to generate the personas: face-to-face semi-structured interviews and paper questionnaires handed to passengers. The recruitment of passengers for interviews was conducted through emails sent to employees of the Warwick Manufacturing Group. Those who had taken trains recently were invited to take part in an interview containing a variety of open-ended questions to describe their train journeys and express their opinions. Face-to-face semi-structured interviews with 20 passengers were performed to understand their expression of attitudes, feelings, preferences, needs, behaviours etc. in relation to rail travel. Participants were asked to describe their recent travels in relation to seven common touchpoints with the rail system, namely to plan and buy tickets, navigate stations, board trains, locate their seats, validate their tickets, and alight. They were prompted to develop their descriptions explaining what works well and not, and how would they improve that touchpoint. In order to motivate participants to recall their train journeys and to foster discussions, they were asked to rate their experience on a 5-point 'smiley scale' from very happy to very sad, for the seven stages (Figure 1).

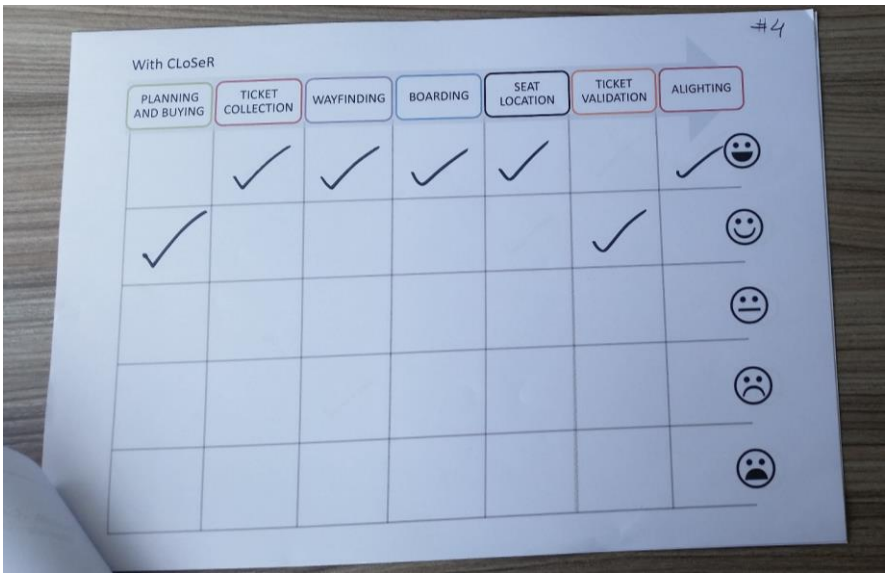


Figure 1 – Touchpoint experience rating exercise

The interviewer then disclosed the nature of the technological innovations proposed via printed images and diagrams. The features presented to participants included:

1. A diagram of free and reserved seats on your phone or on screens on the train and platform
2. Ability to search for, reserve and/or change your seat before and during your journey
3. Access to live information showing the occupancy levels of current and future trains
4. Directions displayed on your phone to help you find your platform and your seat on the train
5. Access to live journey information (e.g. the estimated time of arrival, alternative travel routes in the event of disruptions)
6. Ability to validate your ticket electronically at your seat, so you don't need to present your ticket for inspection
7. Information on facilities at your destination station (e.g. details of bus connections, phone number of taxis)
8. Ability to earn rewards through a loyalty scheme and redeem points for rail or non-rail purchases
9. Ability to pre-order special services (e.g. refreshments, train manager assistance)
10. Automatic compensation for late or cancelled trains

Participants were asked to rate their experiences again, but now as if the proposed system was implemented. Finally, a set of questions, similar to the first part of the interview, were placed in order to obtain participants' impressions related to these innovative systems. A total of 8 hours and 47 minutes were spent interviewing the 20 participants, equating to an average of 27 minutes per interviewee. Transcriptions were subject to customary thematic analysis [16] to facilitate the process of creating meaning from the qualitative data.

A further data collection method constituted of printed questionnaires handed to passengers on board of trains, in order to increase the reliability of the results and to validate the information obtained from the interviews. Passengers travelling on weekday, off-peak Great Western Railways services were randomly approached and invited to fill in printed questionnaires and to agree to participate via a consent form. Passengers' responses were transcribed into the same NVivo file used for the interviews to complement the existing thematic analysis.

In order to create personas, the qualitative data was organised to show the common threads, and what the relevant user characteristics are in relation to the product in question [7]. After mapping the most important ways in which people vary, the next step was to convert these characteristics into ranges or variables. Each participant was then classified according to his or her position on this range. After some iterations, patterns of characteristics and clusters of users emerged, indicating where some participants could be grouped as one of the user personas [13].

4 Results and discussion

The information obtained from the interviews and questionnaires were combined to provide a better understanding of passenger characteristics. By doing so, it was possible to aggregate their opinions and feelings in relation to the current activities using a set of variables. This knowledge indicated clusters of behaviours, needs, motivations, characteristics and limitations of passengers, and ultimately was compiled into four main personas presented in **Table 1** below: Tina, Lin, Harry and Joseph. We present below how these personas would interact with the rail system at specific touchpoints, and illustrate with a persona card (Figure 2).

The process of '**planning journeys and buying tickets'** is usually positive for passengers. That is because there are diverse alternatives to suit individual preferences. Some, like **Joseph**, do it on the web on their preferred vendor, some using their favourite apps on smartphones, and some still prefer to buy at the station from the ticket office. It was observed also that some passengers showed resistance to use other methods. **Harry** especially notes his preference for online split ticketing and using multiple vendors. Most of the concerns from users such as **Lin** are that she prefers the assistance of a staff member.

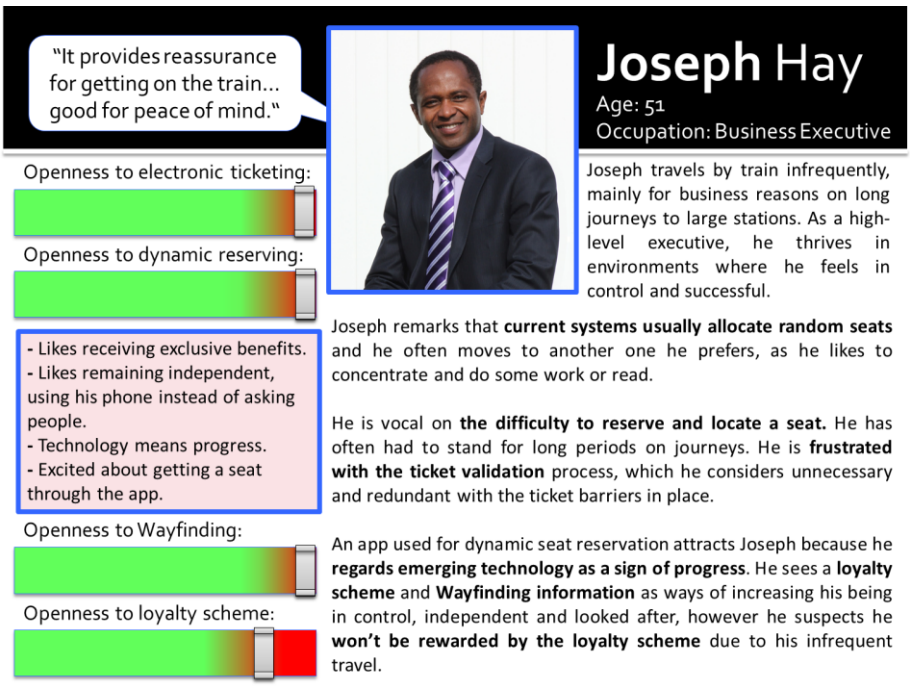
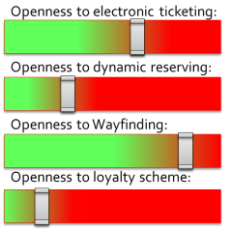
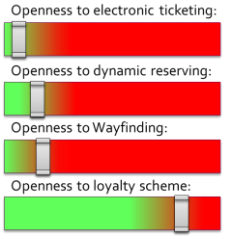
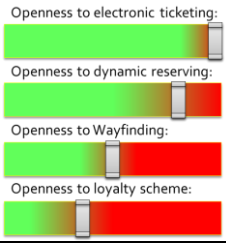
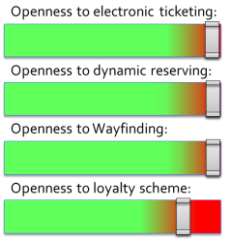


Figure 2 - Example of persona card

Table 1. Summary of personas.

Name	Variables	Description
Tina		Tina is experienced and proficient with technology, but she is slightly sceptical of some practicalities: how will the seat reservation and ticket validation system work if she pays for her 3 children? She has some loyalty programs, but rarely see the benefits. She worries that, with a rail reservation system linked to a loyalty plan, she will receive many spam emails and push notifications on her phone, which annoy her. She is also concerned about data privacy, especially regarding her young children.
Lin		Lin does not have a smart phone, nor will she be comfortable with major changes to the reservation or ticketing process. She is not opposed to others utilizing new systems and technologies, but just needs assurance that with any changes she will still be catered. She buys tickets at the station at the counter, and likes the presence of a real person on board of trains for reassurance or maybe for just a chat.
Harry		Harry is excited and positive about new technology, and is always with his phone. Given the variety of stations he travels to, he is unsure whether wayfinding information would cover his travels or will always be correct. He is unconvinced that a loyalty scheme would be beneficial, he just wants the cheapest fare. His ability to find cheap tickets may be limited by the need to use one specific vendor's application.
Joseph		Joseph complains about the difficulty to prove his right to travel, and the redundancies of barriers and inspections on board of the train. He needs a seat to work or read, and is vocal on the difficulty to reserve and locate a seat, especially due to the flexibility that he needs and the expensive open return tickets he has to buy. He likes to be looked after, but suspects he will not be rewarded by loyalty due to infrequent travel.

In the process of **'ticket collection'**, **Lin** does not use ticket machines and will not use electronic ticketing, but she has no qualms with it as long as she is not forced to do otherwise. **Joseph** would adopt electronic tickets straight away if it is convenient and gives him control, and so would **Harry**, as long as it gives him the cheapest ticket.

The process of **'Wayfinding'** (i.e. navigating the station up to the platform and to the train) provoked the second most negative mood responses from passengers. Being unclear on directions or your journey route is a problem that affects people diversely. **Tina** and **Lin** acknowledge they have to learn routes by repetition or simply ask for

assistance. **Joseph** and **Harry** would embrace wayfinding information if relevant and trustworthy.

The process of **'boarding'** is another aspect of people's journeys that prompts many negative mood responses. There is often the concern of 'is this the right train?' **Lin** voiced concerns for safety and reduced ability to board and cope in physically demanding situations. Boarding seems to provoke a 'keep calm and carry on' nature in the face of stress for many passengers, especially commuters and business archetypes like **Tina** and **Joseph**.

The process of **'Seat Location'** is the most unpleasant for people's mood experiences. This is generally because people want seats, and they sometimes are not available. Almost all users feel they have an especial claim to a seat, whether it be **Joseph** needing room to work, **Tina** needing space for her children or **Lin** who is unable to stand for long periods.

The **'ticket validation'** provoked some of the most diverse responses, with **Lin** enjoying the human contact, **Tina** enjoying the assured safety of an on board authority, **Harry** wanting to make sure other travellers are also paying, and **Joseph** wishing to be left alone.

Generally positive responses at the point of **'Alighting'** is indicative of user's improved overall experiences as a result of the CLoSeR project. Remaining issues with alighting, like **Lin's** need for assistance or **Joseph's** concern for finding his next train are attended to by the changes that CLoSeR bring to other earlier touchpoints as well.

5 Conclusion

This research suggests that there are four main types of rail passengers in the UK, when taking in consideration their relation to the introduction to new technologies: Tina, Lin, Harry and Joseph. These users informed how a system should be designed and behave, and facilitated the definitions of technical requirements of the proposed technology. The main points are summarised below:

- Users are concerned about how changes will affect themselves and other people in diverse touchpoints with the system [17]. They do not want to be discriminated and do not want others to be excluded either.
- Paperless ticketing is considered positive by most users, but should be easy to use. It is important to remember that some users will be unable to use electronic tickets, and others will still want to buy them at the ticket office.
- Users want to know more about departure times and platforms, as a reassurance to reduce the stress of boarding, at large stations, or when changing services. However, unreliable or irrelevant information may become annoying.
- Users believe that more information can improve the boarding process and make it safer, for example to avoid the concentrated boarding [18]. They also want to find free seats. This information could be on their smartphones or updated on the seat displays [19]. However, it should be well integrated and fed in real time with information about location of occupied and reserved seats.

- A dynamic seat reservation system should provide more than an individual seat, but ensure a more functional overall system, in which there will be less standing, queuing, conflicts and delays. If passengers are informed of the location of free seats and where to stand at the platform [4], there is potential for an optimised boarding process [20], which could also improve comfort and the overall passengers' experience.
- Crew should still be visible on board of trains for a number of reasons: to guarantee passengers' safety, train punctuality, solve conflicts, ensure all passengers had paid for their journeys, give information and provide customer care for passengers.

The knowledge provided by the use of personas was combined with information from stakeholder interviews [21] and helped inform the requirements for the technology that is being designed during the course of this project. The final study will be the integration and simulation of the hardware and software necessary to deliver the proposed features. A prototype section of a train coach is being built to be used for user testing and for technical and commercial demonstration. A smartphone application will also be evaluated and go through an iterative development process. Further tests, in the context of real trains in service, will be conducted prior to a possible deployment.

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References

1. Lyons, Glenn, Juliet Jain, Yusak Susilo, and Stephen Atkins. 2013. Comparing Rail Passengers' Travel Time Use in Great Britain Between 2004 and 2010. *Mobilities* 8: 560–579. doi:10.1080/17450101.2012.743221.
2. Oliveira, Luis, Val Mitchell, and Andrew May. 2016. Reducing temporal tensions as a strategy to promote sustainable behaviours. *Computers in Human Behavior* 62: 303–315. doi:10.1016/j.chb.2016.04.004.
3. Camacho, Tiago Dias, Marcus Foth, and Andry Rakotonirainy. 2013. Pervasive Technology and Public Transport: Opportunities Beyond Telematics. *IEEE Pervasive Computing* 12: 18–25. doi:10.1109/MPRV.2012.61.
4. Miñano, Sergio Peña, L Kirkwood, S Court, M Farnsworth, E Shehab, and N Tinworth. 2017. A review of digital wayfinding technologies in the transportation industry. In *15th International Conference on Manufacturing Research - ICMR*. Greenwich, London, UK: IOS Press. doi:10.3233/978-1-61499-792-4-207.
5. Foth, Marcus, and Ronald Schroeter. 2010. Enhancing the experience of public transport users with urban screens and mobile applications. *Proceedings of the 14th International Academic MindTrek Conference on Envisioning Future Media*

Environments - MindTrek '10: 33. doi:10.1145/1930488.1930496.
6. Transport Focus. 2014. The passenger experience - the full research report. London, UK.
7. Goodman, Elizabeth, Mike Kuniavsky, and Andrea Moed. 2012. *Observing the User Experience: A Practitioner's Guide to User Research*. 2nded. Morgan Kaufmann.
8. Marshall, Russell, Sharon Cook, Val Mitchell, Steve Summerskill, Victoria Haines, Martin Maguire, Ruth Sims, Diane Gyi, and Keith Case. 2015. Design and evaluation: End users, user datasets and personas. *Applied Ergonomics* 46: 311–317. doi:10.1016/j.apergo.2013.03.008.
9. Wirtz, Simone, and Eva Maria Jakobs. 2013. Improving user experience for passenger information systems. Prototypes and reference objects. *IEEE Transactions on Professional Communication* 56: 120–137. doi:10.1109/TPC.2013.2257211.
10. Transport Focus. 2010. Ticket Vending Machine Usability – Qualitative Research. London, UK.
11. Wardman, Mark, and Paul Murphy. 2015. Passengers' valuations of train seating layout, position and occupancy. *Transportation Research Part A: Policy and Practice* 74: 222–238. doi:10.1016/j.tra.2015.01.007.
12. Cooper, Alan. 1999. *The inmates are running the asylum*. Edited by Bradley L. Jones. 1sted. Indianapolis, IN: Sams.
13. Goodwin, Kim. 2009. *Designing for the Digital Age: How to Create Human-Centered Products and Services*. John Wiley & Sons.
14. Haines, Victoria, and Val Mitchell. 2014. A persona-based approach to domestic energy retrofit. *Building Research & Information* 42: 462–476. doi:10.1080/09613218.2014.893161.
15. Burrows, Alison, Rachael Gooberman-Hill, and David Coyle. 2015. Empirically derived user attributes for the design of home healthcare technologies. *Personal and Ubiquitous Computing* 19: 1233–1245. doi:10.1007/s00779-015-0889-1.
16. Braun, Virginia, and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3: 77–101. doi:10.1191/1478088706qp063oa.
17. Oliveira, Luis, Callum Bradley, Stewart Birrell, Andrew Davies, Neil Tinworth, and Rebecca Cain. 2017. Understanding passengers' experiences of train journeys to inform the design of technological innovations. In *Re: Research - the 2017 International Association of Societies of Design Research (IASDR) Conference*, 838–853. Cincinnati, Ohio, USA.
18. Fox, Catherine, Luis Oliveira, L Kirkwood, and Rebecca Cain. 2017. Understanding users' behaviours in relation to concentrated boarding: implications for rail infrastructure and technology. In *15th International Conference on Manufacturing Research - ICMR*. Greenwich, London, UK: IOS Press. doi:10.3233/978-1-61499-792-4-120.
19. Babu, Vivek Suresh, Luis Oliveira, Stewart Birrell, Andy Taylor, and Rebecca Cain. 2017. Comparison of E-ink and OLED screens as train seat displays: a user study. In *INTSYS - Intelligent Transport Systems – From research and development to the market uptake*, (in press). Helsinki, Finland: Springer.
20. Farnsworth, M, L Kirkwood, S Court, E Shebab, and N Tinworth. 2017. Optimisation strategy for efficient platform train interface activity. In *15th International Conference on Manufacturing Research - ICMR*. Greenwich, London, UK: IOS Press. doi:10.3233/978-1-61499-792-4-233.
21. Court, S, L Kirkwood, M Farnsworth, I Orlovs, E Shehab, and N Tinworth. 2017. Requirements analysis of digital technology for the rail industry. In *15th International Conference on Manufacturing Research - ICMR*. Greenwich, London, UK: IOS Press. doi:10.3233/978-1-61499-792-4-201.