RAIL PASSENGER KNOWLEDGE AND ITS IMPACT ON INFORMATION REQUIREMENTS

SHALAKA KURUP

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My heart is warm with the friends I make,

And better friends I'll not be knowing;

Yet there isn't a train I wouldn't take,

No matter where it's going.

Edna St. Vincent Millay

ABSTRACT

The rail industry in Great Britain aims to provide value for money by improving customer service and journey satisfaction for passengers, particularly given the rising cost of rail travel. There is increased innovation in several areas, including the personalisation of information, automatic delay repayment, the provision of on-board Wi-Fi, and importantly, the successful management of disruption. The enhancement of disruption information is a key area of investment and research within the industry. The aim of this project was to investigate the current landscape of information provision during rail travel with a focus on increasing its appeal to all passengers, principally during disruption. Specifically, the main objective was to understand how academic theories of expertise and passenger behaviour can aid in improving the design of the content and delivery of rail information to passengers.

Following the review of existing research around information provision and passenger experience, interviews were conducted with both rail passengers and service providers to discuss the main themes found in the literature. The aim was to gain an understanding of the main challenges surrounding information provision, particularly with regards to adapting to differing levels of customer knowledge. It was noted that there were key differences seen – both from the literature and the interviews – between frequent and infrequent travellers, which could be attributed to being a product of extensive travel experience, or expertise. At this point, the first step taken was to investigate these differences in a large-scale manner, with a specific focus on the way in

which knowledge and experience impacted information use. For this purpose, three different types of surveys were designed and administered.

The first, an online survey, was used to examine the information preferences of travellers, alongside their assessments of their own level of expertise regarding rail journeys, and their travel frequency. Results showed that expertise and travel frequency seemed to only account for some of the variance in the preferences for different types of rail information. However, rail information was grouped into six distinct categories according to participant ratings, with some types of information being rated significantly higher than others.

This was followed by a repertory grid study and an online survey. This study aimed to look at expertise and travel frequency as well, but with an examination of disruption support, as opposed to generalised rail information. Results confirmed the distinct differences between self-rated expertise and ratings of travel frequency – while most people seemed to consider themselves as being fairly knowledgeable regarding rail travel, there were clearer differences seen with regards to the more objective assessment of their travel frequency. Particularly, frequent travellers understand the nuances of disruption information better – identifying both “good” and “bad” features of disruption alerts – as opposed to less/infrequent travellers, who only focused on the uncertainty created by the disruption alerts. Additionally, four important characteristics of disruption information were identified.

The final survey – a vignette experiment – aimed to look at expertise and frequency, in addition to other aspects of rail travel. The aim was to identify the impact of other factors that could be contributing to information use and

disruption management. Two variables were selected: journey purpose and the level of familiarity that one has with their trip. Hypothetical disruption scenarios were presented to participants, with the variation of these factors. This was followed by the rating of the six main types of rail information gathered from the online survey, and the four key disruption characteristics obtained from the repertory grid survey. These were rated based on their "usefulness" within the hypothetical disruption situation. The findings were surprising. There was limited influence of the variables examined, with distinct preferences for specific types of information seen across all passengers, regardless of the factors presented, or their expertise or travel frequency. When it comes to disruption management, it seems to be that everyone's preferences for informational support are the same.

The main theoretical impact of this thesis was with regards to the study of expertise in itself. Expertise, simply put, is hard to study. Travel frequency, on the other hand, is not. This thesis contributes evidence towards the notion of expertise being a product of experience and practice, making frequency of travel an appropriate proxy for the study of expertise within dynamic travel environments.

From an industry perspective, these findings led to the development of an information provision template that outlines the basic areas to be covered when presenting information to rail passengers, within both general travel situations, as well as during the occurrence of a disruptive event. This template can be used as a guidance checklist for the development of all forms of information systems, from mobile applications to on-board information

screens to station displays. This thesis concludes with recommendations for the application of these findings, and for future research within this area.

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1. INTRODUCTION

1.1 RAIL TRAVEL IN GREAT BRITAIN

The oldest railway system in the world is undergoing rapid growth. Again.

The volume of rail journeys completed in Great Britain has now reached a record high of 1.74 billion for the year 2018, accompanied by a 5.9% rise in passenger revenue between 2018 and 2019 (Office of Rail and Road, 2019). However, with 29.4 complaints per 100,000 journeys (Office of Rail and Road, 2017), there is a required improvement in the customer experience of rail travel. Ensuring the successful delivery of information to passengers is a crucial aspect of providing good customer service, particularly considering the consistent rise of rail fares across the UK – at the time that this thesis was written, rail fares had further risen by 3.1%, following a 3.4% rise in the previous year (Gwyn Topham, 2018). Value for money is particularly important, considering that rail customers currently pay about 70% of the running costs of the railways. The cost of travel has been highlighted as being one of the significant barriers to the adoption of rail as the dominant mode of transport in GB vs. car travel (Stanton et al., 2013). Not only have some passengers found the fare structure to be complicated and confusing (Transportfocus, 2017d), they consider rail as being poor value for money (MVA Consultancy, 2010). Industry research, however, has shown that passengers are prepared to accept the cost, if the service meets the

requirements of their travel: punctuality, comfort and reliability (Smith, 2018). Journey satisfaction is, thus, a key player here.

The industry regularly conducts customer surveys in order to better understand passenger satisfaction (the National Rail Passenger Survey, for example), and independent organisations (such as Transportfocus) analyse those in conjunction with other forms of research, in order to best appreciate the priorities of rail passengers. In response to this, one of the top priorities for improvement for customers is the availability of timely and accurate information and service updates (Transportfocus, 2017b). Currently, rail-related information from the perspective of passenger journeys relies on three systems: Darwin (the data feed for real-time information and updates), Knowledgebase (the backend engine containing all the supplementary information to the Darwin feed) and the Online Journey Planner (the front-end software used by customers). This information is collected from, and distributed to, train operating companies (TOCs), who provide updates and knowledge to customers through their own station, on-train, website and mobile application-based feeds. This process faces a series of challenges, from the management of various and diverse sources of data to the maintenance of accuracy and speed.

Within the rail industry, specific organisations (Transportfocus, Passengerfocus, the Office of Rail and Road, to name a few) investigate the extent to which various factors influence customer experience on the railways, which includes everything from delays and disruption to information provision to the features of the rolling stock. For example, Rail Delivery Group (the organisation that brings together all the passenger and freight rail companies in GB) focuses on

better understanding the main reasons for discontent with regards to information provision during disruption, which is a major area of research within the rail industry (Accent & Rail Delivery Group, 2017). In the Passenger Information During Disruption-29 report commissioned by Rail Delivery Group (Accent & Rail Delivery Group, 2017), the main focus was rail disruption and passenger experience, with an aim to understand the key areas requiring improvement for rail travellers. The findings showed that overall ratings of the management of delays and disruption were quite low, with information provision being seen as a significant issue, particularly at stations. While there is data available regarding the perspectives of rail passengers on the areas that require improvement (Passengerfocus, 2014; Transportfocus, 2017a, among many other reports), there is still a significant gap in the research into the improvement of information provision to support passengers during the process of disruption management.

Disruption management and information provision are areas that are very closely linked. Intuitively, one can easily make the claim that passengers require more information during disruption, due to the sudden occurrence of uncertainty and confusion. Information helps manage this uncertainty - and the ensuing stress – by providing passengers with a sense of control. Psychological research states that the absence of this level of control leads to the opposite: increased stress and reduced satisfaction (Cox, Houdmont, & Griffiths, 2006). Particularly, the information that is most important during disruption is related to the availability of alternative options, the delay or disruption length, the details provided and the regularity of the service updates (Accent & Rail Delivery

Group, 2017). Providing an adequate level of support while giving customers what they need within these situations is crucial.

The idea of personalisation aims to take this process a step further. While there is some understanding of the key features of "good" information provided during both general rail travel and disruption, personalisation involves tailoring it to the specific needs of the individual. This is not an easy task, particularly considering the complexities involved in managing information within the rail network. A good example of research conducted on this is the DICE (Data to Improve the Customer Experience) project, which aims to improve passenger experience through the use of personal data, while accounting for the privacy concerns involved (DICE, 2019). The project focuses on the challenges surrounding the successful delivery of information to rail passengers, and the manner in which personal data can be used for this purpose. By tailoring information to the requirements of individual passengers, journey planning and management becomes easier, improving one of the main factors that influence satisfaction with the rail service. Additionally, this provides individualised support when helping passengers manage their experiences of disruption, which can be of great benefit.

In line with this, an interesting factor is the notion of passenger segmentation. A key feature within industry reports was the segmentation of rail passengers into three groups: leisure travellers, business travellers and commuters. All three groups, importantly, have different information needs, experiences of disruption, and levels of satisfaction. Commuters, for example, seem to have the lowest levels of satisfaction when compared to the other two groups of

travellers (Department for Transport, Office of Rail and Road, & Transportfocus, 2016). Not only has this form of segmentation been useful for surveys that investigate the performance of the rail service (the National Rail Passenger Survey, for example), it is also a prominent area of research within the transportation literature. There are a lot of factors to consider when thinking about these different types of travellers. The main difference between all the three groups (leisure travellers, business travellers, frequent commuters) is, intuitively, the purpose of their trip. However, while trip purpose is likely to vary for each traveller (a frequent commuter could have both a "work" trip and the occasional holiday, for example), the knowledge gained over time is less likely to do so. In line with this, the literature on traveller types has examined aspects related to habitual travel patterns (Aarts, Verplanken, & Knippenberg, 1998; Wood, Witt, & Tam, 2005) or expert traveller behaviour (Gustafson, 2012). The main difference is the higher level of knowledge or expertise that some groups seem to have, when compared to others, providing them with different preferences and abilities. Psychological theories of information processing and decision making demonstrate the strong impact of knowledge on decision making and information use.

There is a gap to be filled regarding the practical application of these theories to the management of the challenges that the dynamic transport environment of rail have to offer. Previous studies have examined the behaviour and passenger experience of different travellers (Anable & Gatersleben, 2005; Evans & Wener, 2007; Gustafson, 2012, for example), disruption management from the perspective of the rail traveller (Department for Transport et al., 2016, for

example) and the enhancement of rail information systems (the DICE project, Gould, Mackaness, Bechhofer, Stevens, & Cooper, 2016, for instance). The gap in the research requires putting all of those varied but linked facets of the rail experience together. How do you help travellers manage disruption, while keeping in mind the fact that their experiences of it are likely to be quite different? This thesis looks at traveller behaviour as being the answer. The examination of passenger expertise and its impact on information use and disruption management could be the key to a more advanced understanding of the rail traveller, and aid in the personalisation of customer information.

1.2 Research Aims and Objectives

The overall aim of this thesis is to investigate the ways in which information provision during rail travel could be customised based on psychological theories of behaviour. The main focus is the idea of knowledge, or expertise, and the manner in which it could influence these processes. However, not all rail journeys are created equal – rail disruption is a key issue when it comes to understanding rail passenger experience. Thus, the secondary focus of this thesis is information use, and the impact that disruption has on passenger behaviour. From a theoretical perspective, this thesis examines how expertise and information use are manifested within a dynamic environment, such a rail travel. From a more practical angle, the project aims to provide a framework for the presentation of information to rail passengers, during general and disrupted rail travel.

The specific objectives of the research project are:

1. To investigate the landscape of rail information provision, determine the scope of further research into traveller types and different approaches to personalisation.

   Firstly, the aim is to understand the particular issues around information delivery in Great Britain (covering the geographic area of England, Scotland and Wales), and the possible avenues for improving it. Alongside this, the thesis will explore three key challenges for the rail industry: disruption management, information provision and passenger experience, and the links between them.

2. To explore differences in knowledge or expertise between different traveller groups.

   In order to understand the varying informational needs of different groups of passengers, the first step to take would be to understand the nature of these traveller differences. The rail industry groups passengers into commuters, business travellers and leisure travellers - what are the key differences in knowledge and experience between these groups?

3. To explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.

   While the previous objective focused on the existence of different levels of knowledge or expertise, the next step is to understand two distinct aspects of this: a) how this translates into travel behaviour, and namely, information

use; and b) how this data could be captured in a practical manner for the rail industry.

4. To focus on rail disruption, the impact it has on expertise and information use, and the additional support required on the basis of this.

   This objective completes the link between information use, passenger experience and disruption – how does the context of disruption interact with personal experience, and information use?

5. To identify other factors that impact the collection and use of information during the process of rail travel.

   There are numerous external and internal factors that influence how people behave – and use information - when they travel. Yeboah et al (2019) outline some of the main factors that influence information use on public transport: frequency of travel, employment, the stage of the journey, and the sources of information available. In acknowledgment of this, the aim is to explore some of the other proposed factors that could influence information provision, passenger experience and disruption management.

6. To understand what all of this means for information design and personalisation.

   The final objective is to integrate the findings of this thesis into a template to support information provision, particularly during disruption. The key aim is to understand whether there is a requirement for a more theoretical

approach to personalisation, with a specific focus on personal context factors like expertise, travel experience and passenger knowledge.

1.3 Key Areas of Interest

This thesis can be placed within the domain of transportation psychology, and contributes to both the academic and industrial literature on passenger experience and traveller behaviour. The key theoretical areas that this project contributes to are presented in Figure 1.

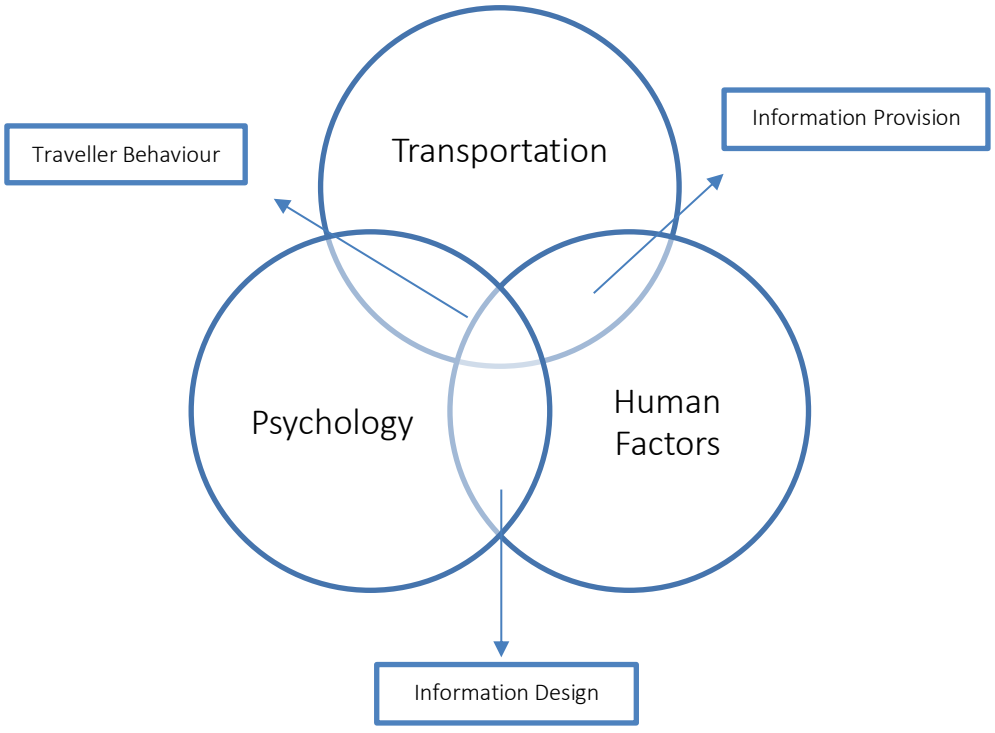


Figure 1. Key themes and theoretical areas of interest of the thesis.

1.4 THESIS OUTLINE

Chapter 1 has introduceed the context of the thesis, with a focus on the landscape of rail travel in GB, the research gap, and the objectives of the project.

Chapter 2 provides an overview of the existing academic and industry literature into passenger experience, information provision and expertise. It provides the foundation for the research conducted for this project, and specifies the main research questions.

Chapter 3 introduces the methodological approach and research framework of the thesis, by introducing the different methods used, along with the reasoning behind, and justification for, their selection.

Chapter 4 covers telephone interviews conducted with members of the rail community, in order to understand the scope for research into traveller types and personalisation, particularly within the domain of disruption management and information design. Additionally, the aim is to deliver new insight which contributes to the academic literature. This chapter addresses the first objective of this thesis: to explore the current state of rail information provision within the industry.

Chapter 5 can be considered as being an extension of Chapter 4, by providing the opposite perspective – interviews with rail passengers. Additionally, it also begins to explore the second objective of this project by looking at the differences between different types of rail travellers. In the second study for this thesis, one-on-one situated interviews were conducted with leisure and frequent travellers regarding their views on information provision, disruption management and their levels of travel experience.

Chapter 6 covers the first quantitative study within this thesis – a large-scale online survey (Survey One) investigating the information preferences of people who travel by rail, and the possible links between travel frequency, travel expertise, and information preferences. The key aim of this study was to understand whether there were links between the different levels of knowledge and information preferences seen during rail travel in general, thus addressing Objectives 2 and 3.

Chapter 7 focuses on Objective 4: how travellers read and understand disruption information, and whether experience and/or knowledge play a role. Travellers were asked questions surrounding their travel frequency and rail expertise, followed by the completion of a repertory grid. This study was conducted in two stages, resulting in the extraction of the key characteristics of disruption information. This was the second survey of the thesis.

Following this, Chapter 8 looks at the preferences of travellers in terms of the information that they receive during disruption. In the third survey study, two additional factors (journey purpose and familiarity with the trip) were investigated alongside travel frequency and expertise, in order to explore the penultimate objective of understanding the other possible factors that impact information use. The vignette survey involved the presentation of a hypothetical disruption situation followed by the evaluation of the "usefulness" of different types of information. This chapter covers Objective 5, aiming to understand the other factors that influence information use during rail travel.

Chapter 9 discusses the main findings of this body of research with regards to the objectives presented in this chapter, with a particular focus on the

implications for information design and personalisation, thus addressing the final Objective for this research project.

Chapter 10 presents the practical implications of this research for both academic and industrial purposes, and the main contributions of this body of work. It concludes with a discussion around possible avenues for future research within this area.

1.5 CONCLUSION

This chapter introduced the Ph.D thesis by describing the context of the present research by outlining the main areas of interest, and the accompanying gaps within the research. It described the aims and objectives of this thesis, followed the outline of the following chapters, and the way they align with each of the main objectives of this research project.

2. Literature Review

2.1 Chapter Summary

The aim of this thesis is to understand how information could be customised using psychological theories around customer behaviour – namely, travel frequency and expertise. The current chapter will describe the context for this project by first presenting a description of the general landscape of rail travel in Great Britain. This will include a discussion surrounding the current state of passenger information provision, followed by research into traveller types, and the links to psychological theories of expertise. The final sections will discuss the influence of knowledge on information provision, followed by the discussion of the manner in which an improved understanding of expertise can help optimise information systems.

2.2 Rail Travel and Information Provision in Great Britain

Rail is a popular choice of public transportation in Great Britain – a statement easily corroborated by the fact that people travelled a total of 130 million kilometres by train in 2018, giving the service 5.9% more in terms of revenue from 2017. According to a recent report by the Office of Rail and Road (2017), rail passengers pay three-quarters of the running costs of the railways, resulting in keen public interest on customer service and value for money. This has been a significant issue in the past few years, with reports showing a large number of

delays, with trains having the worst rate of punctuality in 12 years in 2018. In addition to this, Rail Delivery Group reported a further increase in rail fares by 3.1% from January 2019 (Topham, November 2018). Satisfaction with information provision in general improved in Autumn 2017, but the support provided by train companies during crowding and delays were some of the lowest rated aspects of rail travel (Transportfocus, 2017). In January 2019, however, rail satisfaction was reported at being around 79%, which is the lowest it has been since 2007 - this has been attributed to reduced trust in the service due to poor performance. Satisfaction can be defined as being an element of passenger experience (the physical and emotional interaction that a passenger has with the transportation provider). Camacho et al (2016) describe the use of public transport as being a "service experience built around an affective dimension" (Camacho, Foth, Rakotonirainy, Rittenbruch & Bunker, 2016). It is a key affective factor that contributes to the overall experience of a rail passenger. The lack of satisfaction is likely to dissuade people from taking the train - there are important consequences of a decreased reliance on public transport, and an increased use of cars. 90% of the carbon emissions from the transportation sector come from road vehicles, with 44% of greenhouse gas emissions being attributed to personal vehicles (DfT, 2009). Due to this, the Intergovernmental Panel on Climate Change (IPCC) recommended a shift from personal transport modes to the use of public transport in 2007 (IPCC, 2007). However, in order to achieve this, there needs to be increased motivation to use these forms of transport. This is not the case, due to the increasing cost, or lack of satisfaction with public transportation services, or both. On the basis of this, there has been

a large amount of investment into research surrounding customer perspectives on rail travel, particularly from organisations within the industry. The aim of the present thesis is to examine the customer experience angle, particularly around information provision. The remainder of this section will provide an overview of the current rail passenger experience in GB, as well as customer priorities for improvement.

2.2.1 Journey Satisfaction

In autumn 2017, 81% of journeys in Great Britain were rated as being satisfactory, with the biggest influencers on satisfaction being punctuality and reliability, and the management of delays having the largest impact on dissatisfaction (Transportfocus, 2017a). The complaints made per 100,000 journeys increased between 2017-2018, the main issues being punctuality, reliability, crowding, and both on-board and online ticketing services (Office of Rail and Road, 2018). More recently, specific train operating companies have been in the news regarding their lack of communication to passengers, resulting in widespread dissatisfaction. Govia Thameslink Railway, for example, has been fined the amount of £5 million by the Office of Road and Rail for their failure to properly communicate new timetable changes to passengers, resulting in severe delays and a number of cancellations (Julia Kollewe, 2019).

Keeping this in mind, the rail industry is working towards improving disruption management and information provision services, an example being the Passenger Information During Disruption (PIDD) objectives outlined by Rail

Delivery Group (Accent & Rail Delivery Group, 2017). According to the PIDD year 1 report (Accent & Rail Delivery Group, 2017), passenger ratings regarding the management of delays and cancellations were low, as were ratings of information provision facilities. Passengers were not pleased with the reliability, accuracy or speed of information provided to them, with particularly poor ratings for departure screens, mobile applications and websites. In addition to this, the scheduling of maintenance activities seem to be a source of frustration, mainly with regards to the consistency of the information provided (Transportfocus, 2017c).

Additionally, customers have a preference for communication with staff members, with staff assistance being rated higher than information screens, and the lowest levels of anger during disruption seen when passengers receive information from staff or on-board announcements (Accent & Rail Delivery Group, 2017). Staff are seen as being essential with regards to ticketing, security, assistance and safety, particularly during periods of disruption. Passengers feel reassured by the visible presence of personnel that could assist them, and experiences of disruption are seen as being determined by interactions with staff – proactivity causes increased forgiveness from passengers, while a lack of acknowledgement of the issue causes negative reactions (Transportfocus, 2016). This idea of reassurance points to an important aspect of service provision: customer comfort. Comfort has been defined as a psychological state determined by the relationships between the traveller's personal belongings and the physical environment within the train (Bissell, 2008). When travellers

have the artefacts and a space that meets their requirements, they feel comfortable, and thus, satisfied.

Why is comfort so important? The literature discusses how public transport influences the quality of life of passengers, particularly frequent travellers (Hernandez, Monzon, & de Oña, 2016). Travelling has been highlighted as being both physically and mentally demanding (Wardman, Hine & Stradling, 2001), and more so for public transport than for car use. This is due to longer journey times, physical exertion, higher emotional demand due to increased worrying, and overall, more cognitive effort caused by the need for journey planning (Mann & Abraham, 2006). The frustration of rail passengers adds to this, resulting in reduced satisfaction and appreciation for the rail service. Stanton et al. (2012) capture this in their research, which examines the barriers to a modal shift to the use of the railways. Mirroring the industry research, aspects like reliability, cost, comfort, time, facilities, and journey planning are seen as being constraints to the selection of railway travel. All of these aspects add to the (perceived) 'effort' felt during the journey, resulting in a reluctance to use the service.

Based on an appreciation of these factors, there have been a number of proposed solutions to improve customer experience within the British rail system. A prominent idea is the provision of accurate and timely information to passengers for seamless door-to-door travel. A journey completed via any form of public transport can be divided into a series of stages – Grotenhuis, Wiegmans, & Rietveld (2007) describe this with their proposition of "pre-trip, wayside (at the station) and on-board" journey stages. In addition to this, the

idea of a “post-trip” phase can be added, which refers to the follow-on actions after trip completion, such as the claiming of compensation or provision of feedback. The objective of their paper was to discuss the concept of “integrated multi-modal travel information (IMTI)” (Grotenhuis et al., 2007), and they outline the main information types in relation to each phase of travel. The paper identifies the pre-trip stage as being the main part of the journey for the collection of information while planning travel, while the most important concern when on-board is the management of arrival and interchanges between different forms of transport. Though focusing on multi-modal travel, this provides a very interesting idea of the different types of information available to travellers, and the manner in which they access them. Alongside this, industry research also describes how the use of different information sources varies based on the stage of the journey that the passenger is at. Online sources and mobile applications are preferred prior to arrival at the station (“pre-trip”), departure screens and station announcements are for the “wayside stage”, and on-board announcements are seen as being most useful during the journey itself (Accent & Rail Delivery Group, 2017). This research has produced a series of initiatives, resulting in the development of a Code of Practice by the rail industry. This Code of Practice requires consistent audits of train operating companies to ensure that an adequate amount of information is provided during the “pre-trip” (Office of Rail and Road, 2017a) phase of travel.

In addition to this, independent organisations conduct their own investigations into the efficiency of the rail service, with a prominent focus on passenger experience and satisfaction. A good example of this is the report produced by

Transportfocus (2018) regarding information provision during the upgrade of London Waterloo station. The use of a tracking survey with a group of commuters garnered interesting results. The findings highlight the importance of using a diverse range of channels when providing information - particularly at different stages of the disruption - and the worth of a long-term information strategy in order to ensure that passengers are prepared to plan ahead. The report concluded with a series of suggestions regarding the management of such situations: the use of different types of information, tailoring communications to diverse customer segments, and the use of an appropriate (and apologetic) tone.

Research conducted by Passengerfocus (2014) adds to this, outlining the top priorities of passengers as being value for money, seating, flexibility, timeliness, Wi-Fi and adequate information provision. While there has been progress, reports from 2017 show the exact same customer demands for improvement three years later (Transportfocus, 2017b). Further reports also go on to highlight the frustrations seen during rail disruption caused by routine maintenance, citing timely and trustworthy information as one of the important solutions to passenger dissatisfaction (Transportfocus, 2017c). Beyond this, a more high-level report on the improvement of rail passenger experience was produced by Rail Delivery Group (2016) for the House of Commons Transport Selection Committee, outlining a series of initiatives. Examples are the Customer Heartbeat project, which examines the points at which the rail journey fails to match customer expectations; and the introduction of Customer Champions, who are responsible for the implementation of improvements by collaborating

with train operating companies. The report also reviews key strategies, including the implementation of new GPS technology to track trains, the improvement of Operational Information Systems (OIS) and public address systems, and the introduction of smart-ticketing, to name a few.

Finally, passenger experience is not just a key area of focus for the rail service as it exists – the main challenges and opportunities explored apply to the future of the GB rail service as well. A prominent example is the construction of High Speed 2, a rail system aimed at directly connecting London, Birmingham, the East Midlands, Leeds and Manchester. With the existing interest in obtaining customer insights, recent studies have aimed at using the same to assist the design of High Speed 2 in a passenger-focused manner (Transportfocus, 2018a). This report by Transportfocus highlights the current frustrations of passengers with regards to ticketing, flexibility, the management of luggage and the accuracy of information provided. It goes on to discuss the future of rail travel, and outline the objectives that the industry is and/or will be currently working on: digital ticketing, seamless travel, improved information provision and minimal disruption.

2.2.1.1 Case Study: Ticketing

A major area under investigation with regards to journey satisfaction is the process of ticketing, particularly with regards to customer understanding of the ticketing system, and cost – highlighted as the number one priority for GB rail passengers over the past few years (Passengerfocus, 2014; Transportfocus, 2017b, 2018c). Ticketing serves as a good example of the multi-faceted, complex

issues at play when considering customer satisfaction during the process of rail travel.

The improvement of ticketing processes was one of the initiatives outlined in the Rail Technical Strategy (RTS) (2012) on customer experience, produced by the Rail Safety and Standards Board (RSSB). The main aims of the RTS included seamless multi-modal travel, improved accessibility, the provision of understandable information, intelligent technologies and improved ticketing services. The ticketing process is seen as being complex and confusing (Passengerfocus, 2015), with passengers remarking on a feeling of frustration, particularly with regards to obtaining the best value for money (Transportfocus, 2018a). During a study of customers' experiences regarding the rail ticketing process, a number of mystery shoppers were unable to select the best ticket for their journey from ticket vending machines, with 13% facing the possibility of being worse off financially following the purchase of their chosen ticket (Office of Rail and Road, 2017a). Additionally, long queues during the process reduce the attractiveness of rail travel to the passenger, due to its impact on overall journey time (Passengerfocus, 2010).

Considering the relatively high level of importance placed on information provision, the Department for Transport, along with Which?, Transportfocus and the Office of Rail and Road (2016) proposed a plan of action regarding the improvement of information dispensed around ticketing. The guidelines focused on enhancing information regarding ticket choice, explanations of the ticket types, options for purchase and the process of buying the ticket itself. The Office of Rail and Road (2017a) outlined a set of initiatives in line with this: the review

of train company websites and their provision of ticketing information, mystery shopper research on ticket vending machines, specific initiatives aimed at improving the information itself, and the management of complaints.

In addition to this, organisations within the rail community provide a series of suggestions for the improvement of customer experience, based on independent research into prominent issues. A joint report by the Department for Transport, Office of Rail and Road and Transportfocus (2016) highlights appropriate improvements to the process of claiming compensation: using a range of channels to provide information regarding the process, reducing the time between claim and payment, simplifying the experience, and offering automatic delay repay.

Finally, a recent report by Transportfocus (2016) looks into smart-ticketing and smartcards, and passenger attitudes towards them. While passengers seem to want the convenience of pay-as-you-go, automatic delay repay and smartcard functionality, they have negative views regarding the cost of depositing money into a card. This provides the rail industry with an idea of how to best match their initiatives to the customer – for example, by providing a range of ticket options to match the needs of their passengers (Transportfocus, 2016b).

2.2.2 Disruption Management

Industry reports show that satisfaction with train operating companies falls immediately when services begin to run late: reliability, reduced disruptions and cancellations are top on the list of customer priorities (Smith, 2018). To match

this, the rail community has been focused on improving their understanding of these issues. From an organisational perspective, the mentioned Code of Practice published by Rail Delivery Group provides guidelines surrounding the management of disruption. These cover everything, from the adjustment of information screens to the handling of complaints (Office of Rail and Road, 2017a). The evaluation of service provision in line with the guidelines is conducted by a number of organisations, including the Office of Rail and Road (Office of Rail and Road, 2016, 2017, for example) and Transportfocus (Transportfocus, 2017a; Transportfocus, 2016, for example). The Office of Rail and Road, for instance, investigate the performance of the rail system periodically. In August 2017, their report stated that about 2.4% of trains in Great Britain were cancelled in period 4 of their evaluation in 2017-2018, with 11 days' worth of severe disruption seen (Office of Rail and Road, 2017b). The following report in April depicted a 0.8% increase in complaints for franchised operators in the past year (Office of Rail and Road, 2018). This form of consistent monitoring is an asset to the rail system, providing an evidence base regarding the particular facets of the rail service that require improvement, and the progress of the service providers in handling these issues.

An example of this progress would be the PIDD-29, monitoring the provision of disruption information to customers (Accent & Rail Delivery Group, 2017). The report showed the rating of train companies with regards to the handling of delays and cancellations as being "very poor, with four times as negative ratings as positive". A particular area of concern was information provision, especially departure screens, which are considered as being the primary source of

disruption-related information. Additionally, the compensation process was a source of frustration, with a number of passengers finding the entire procedure a “waste of time” or something that they “couldn’t be bothered” with. The report finds a positive correlation between negative feelings and lower ratings of train operating companies based on how they deal with disruption or cancellation, with frustration mediated by the manner in which this disruption information is received. (Accent & Rail Delivery Group, 2017). There are clear satisfaction-based implications related to the poor performance of public transport services like the railways. Satisfaction is linked to the memory of negative incidents, with the overall approval of public transport services influenced by passengers’ memories of the frequency with which critical incidents occurred (Friman, Edvardsson, & Gärling, 2001).

The basic fact underlying all of this is that passengers need to feel in control of their journey. The confirmation of accurate information, required facilities, accessible tickets, staff support and the lack of unexpected modifications to the trip all contribute to this feeling of control, which is, in turn, impeded by the addition of negative emotions such as worry or stress (Transportfocus, 2018a). Cox, Houdmont, & Griffiths (2006) elaborate upon this, describing the role of control with regards to crowding, and subsequent feelings of stress. Their paper distinguishes between the notion of density (the physical aspect) and crowding (the psychological experience of the density within a train carriage). The experience of crowding results in a feeling of stress, caused by a perceived lack of control and freedom, increasing the intensity of the environment (Cox et al., 2006). Not only does this absence of control reduce general satisfaction, it also

influences the passengers' ability to use their time effectively (Lyons & Urry, 2005). Gustafson (2012), for example, studied business travellers who saw their commute as being a productive period of time within which they could work, and a case study from Tokyo described how commuters paid more money to obtain a travel environment within which they could conduct work-related activities (Ohmori & Harata, 2008). Crowding, and a lack of seating, is an impediment to these processes. The Office of Rail Regulation (2012) explored this within the context of rail travel in GB, and looked at the importance of information regarding seating. They found that passengers requested information on the crowding of carriages, as well as real time updates regarding the disruption of services through delays or cancellations. This is related to the notion of control described by Cox et al. (2006) and Transportfocus (2018a), with passengers preferring to know about the status of their journey in order to feel prepared for it.

There is also the operational angle to be considered, with studies examining the phenomenon of disruption from the perspective of service providers. Disruption is found to be a complex, multi-faceted problem, and moderated by a number of variables, including the time at which it occurs, its cause, the location at which it happens and the coordination between different groups involved (Golightly & Dadashi, 2016). In order to manage these various factors, the previously mentioned initiatives outlined by the Office of Rail and Road (2017a) had provided guidelines to all rail industry bodies, which included the addition of disruption banners on online feeds, real-time information to journey planning tools, and manual announcements during disruption. These are consistently

evaluated, resulting in monitored progress regarding the improvement of customer experience.

This section has provided a summary of rail travel within GB, with a description of the landscape and the existing initiatives surrounding the improvement of passenger experience. While the research presented covers both stakeholder and customer perspectives, what the present thesis requires is a direct comparison between the two, particularly around the issues related to the use of information during rail travel. Namely, within the current context of the rail industry, what are the challenges faced regarding the provision of information to passengers?

2.3 Passenger Experience

Passenger experience has been studied extensively, across travel modes, with satisfaction differing based on various factors, an example being mode of transport used (Anable & Gatersleben, 2005). One of the main concepts explored, particularly with regards to customer experience, has been the notion of information provision – the evaluation of current or potential methods, as well as the suggestion of better ways in which to convey relevant trip-based knowledge. A particular focus of these efforts has been on the journeys of commuters, who tend to have advanced knowledge regarding their trips (Gustafson, 2012), while also possibly being the group of passengers to use the rail service in the most consistent manner. The literature highlights distinct differences between commuters and leisure travellers on the basis of their travel

and information requirements. Anable and Gatersleben (2005), for example, talk about the improvement of travel from the perspectives of both groups, describing the practical requirements (convenience, or cost, for example) of the commuter, and contrastingly, the more affect-based preferences (relaxation, a feeling of control) of the leisure traveller. This is seen in industry-based reports as well, with clear differentiations made between leisure travellers, business travellers and commuters. Highlighted differences seem to be related to the flexibility of travel (Passengerfocus, 2015), the importance placed on value for money (Smith, 2018), satisfaction levels (Transportfocus, 2017a), and views on information provision (Accent & Rail Delivery Group, 2017), to name a few aspects. The following section expands on these ideas.

2.3.1 Passenger Types

The word 'commuter' has been defined in diverse ways in the available literature on travel and transportation. While some papers use the term 'commuting' to refer to the journey between a person's household and their workplace (Costal, Pickup, & Di Martino, 1988), others use it as a general reference to the idea of travel (Office of Rail Regulation, 2014). Keeping this in mind, for the purposes of this review, the term 'commuter' will be used to describe what Evans and Wener (2007) call the 'mass transit user' – the frequent (work) traveller who uses public transport, often during peak hours (Evans & Wener, 2007). This is in contrast with the "leisure" traveller, who is likely to travel less often, and for non-work-related reasons.

As mentioned, in Gustafson's (2012) study on the travel practices of Swedish business travellers, a majority of frequent work commuters tend to make an attempt at productivity during their journeys. Around 50-60% of their participants focused on completing work or studying, and had a preference for a train environment conducive to carrying out these tasks. These types of travellers sometimes even opt to pay a larger amount for this form of comfort (Ohmori & Harata, 2008). This is corroborated by previous research conducted on the nature of the daily commute – studies emphasised on the importance of travel time use, describing this form of productivity as a 'positive utility' (Lyons, Jain, & Holley, 2007), providing crucial benefits to the commuter (Lyons & Chatterjee, 2008; Lyons et al., 2007; Lyons & Urry, 2005), including increased satisfaction during the after-work commute (Ettema, Friman, Gärling, Olsson, & Fujii, 2012). Individuals participating in work journeys have been found to value convenience, aiming to optimise and improve instrumental aspects of their travel – price, or the flexibility of available options, for example - as opposed to the affective nature of their experience (Anable & Gatersleben, 2005). These commuters tend to value the quickest method of travel possible (Hine & Scott, 2000), achieving this through the development of a practiced itinerary, requiring less-detailed information, if any (Grotenhuis et al., 2007). Furthermore, mere experience with the use of public transportation like the railways causes an increase in relevant trip-based knowledge (Dziekan, 2008). Gustafson (2012) describes this as a form of expertise, with regards to the knowledge of specific travel information like departure and arrival times, or different transportation

links. This results in the formation of a daily travel habit, according to some researchers (Aarts, Verplanken, & van Knippenberg, 1997).

The practical investigation into different "traveller types" has been a major area of focus within the industry-based literature – a good example of this would be the description of the different passenger personas (Local Drivers, Urban Riders, Dependent Passengers, for example) described by the Transport Systems Catapult (2015) in their "Traveller Needs" study. Other industry research, as mentioned, divides customers into three types: leisure travellers, business travellers and commuters, looking at them as independent groups on the basis of factors such as travel frequency, trip-based knowledge, and expenditure (Transportfocus, for example, makes this distinction in a number of their reports). Understanding these specific characteristics is seen as being useful when optimising existing services. Additionally, when aiming to encourage a modal shift to rail, Transportfocus (2018) classifies travellers into groups that include "non-users", "infrequent users" and "frequent users", based on travel frequency. Their report suggests differences between groups with regards to the level of perceived trust in the railway service, as well as attitudes towards public transport.

Some travellers see rail travel as an inconvenient option due to factors related to passenger experience, cost and comfort, which introduces the idea of satisfaction. Industry reports use the mentioned traveller groups to understand passenger satisfaction in a more in-depth manner. Passengerfocus (2009), for example, looked at the requirements of business travellers in particular, and their perceptions of the British rail service. While some of the benefits of

travelling via the railways were seen as being the ability to work and not having to pay for parking, disadvantages to this particular group included a lack of reliability of the service, the cost, and the fact that the process was not door-to-door. Public transport is seen as being – particularly to commuters – physically demanding (Mann & Abraham, 2006), causing "commuting stress" during the work-day (Costal et al., 1988), as well as having a higher perceived travel time (Shannon et al., 2006). Commuters rated information provision during rail travel as the lowest, when compared to business and leisure travellers (Department for Transport, 2017). This group of travellers also have the lowest levels of satisfaction regarding their journeys as a whole (Department for Transport, 2017, Transportfocus, 2017a). In order to understand why, a key factor to unpack is the notion of stress, and how it impacts travel decision-making.

2.3.2 Decision Making

Stress has been discussed extensively in the psychological literature surrounding passenger experience – for public transport in particular, this has been attributed to factors like mode changes, waiting times, delays, and noise (Costal et al., 1988). Further, with regards to rail research, this has been credited to operational issues like the experience of crowding (Cox et al., 2006), or the lack of control within the travel situation (Evans, Wener, & Phillips, 2002). There is an interesting interaction between decision making and informational susceptibility under the influence of stress. While stressed individuals have been found to be more open to being given information (Starcke & Brand, 2012),

there seem to be issues surrounding the use of that information. Research depicts a reduction in the efficiency of decision making processes, caused by the hasty evaluation of options, without the complete consideration of all of the potential costs and benefits involved.

Choices made during the process of the daily commute can be described as a form of personal decision making, with the individual attempting to assemble information within the environment, in order to select one of many alternatives (Kemdal & Montgomery, 1997). However, as mentioned, there is much to be discussed with regards to how this changes through the formation of the travel habit, or the influence of real time stress. This seems to involve an interplay between conscious and unconscious systems of decision making (Kahneman, 2011) – while choices made during travel planning might have been a function of the rational conscious system, daily behaviour might be proposed as being a function of the automatic unconscious system, resulting in the possible selection of ineffective options.

An additional factor to consider is the dynamic nature of the travel environment – real time choice situations involve input from a variety of sources, requiring a consideration of both historical and real-time influences. This requires the individual to create their own representation of a constantly evolving environment (Huber, 1997), by attempting to efficiently process both internal and external sources of information. This incorporation of various types of knowledge is cognitively taxing (Slovic, 1972), especially considering the multi-attribute nature of the commuting situation. It could involve the processing of the details of multiple options (departure and arrival times, possible trains), and

making choices based on the same (Harte & Koele, 1997). Thus, this results in the propensity to automatize the process for the purposes of increased cognitive efficiency – as seen in individuals with a salient travel habit (Grotenhuis et al., 2007). Despite the benefits, the automaticity of choice and action could be problematic with regards to the possible issues that could arise within a dynamic, real-time travel environment, like the occurrence of disruption or crowding. The resolution of such situations require the processing of external sources of information, and subsequently, the formation of problem solving strategies, which are both behavioural functions that are disrupted by the tendency to resort to automatic choice selection. Looking at the idea of disruption in the daily commute as an example: automaticity of action could cause the individual to stick to their transportation choice, regardless of the costs of doing so. Thus, understanding this interaction between the various affective, environmental and behavioural factors that influence decision making within the dynamic commuting environment is crucial, in order to better support this type of travel experience in the face of real-time issues like disruption.

The last few paragraphs have discussed the complexities involved in understanding just one of the products of disruptive rail travel experience: travel stress and personal decision-making. Not only is it detrimental to the central cause of improving customer satisfaction, stress influences basic travel behaviour by impacting the decision-making and information use of different types of travellers in varied ways. The following section explores these differences between travellers, with a focus on one of the main factors that could be contributing to them: expertise.

2.4 EXPERTISE & TRAVEL

The literature available surrounding the process of the daily commute suggests that it is largely habitual in nature (Aart et al., 1997). This habit is a product of the frequent repetition of the travel behaviour, within a specific context(s), as well as a product of the same – everyday travel has been found to be affected by lifestyle and location within one's personal 'lifecycle' (De Witte, Macharis, & Mairesse, 2008). The consistent satisfaction caused by the achievement of individual goals – arriving at work on a daily basis, for example – encourages constant performance of the behaviour in the same way, resulting in a reiteration of choices and actions. Middleton (2011) proposes that daily travel behaviours are intertwined with daily routines, adapting to lifestyle changes over time, but broadly maintained through constant repetition. According to other research, this repetitive nature results in an automaticity of cognition, decision-making and action, causing it to become a salient habit (Aarts, Verplanken & van Knippenberg, 1998).

The consequences of this include reduced attention to sources of travel information, affecting decision making processes. This results in a reliance on the same set of actions or behaviours, regardless of the nuances of the situation at hand (Aarts et al., 1998; Aarts et al., 1997). While this has benefits like increased time savings, or a reduction of cognitive effort (Grotenhuis et al., 2007), it sometimes translates into a lack of consideration of possibly superior alternatives – an example being a lack of awareness of alternate modes of transport available (Kenyon & Lyons, 2003), or even the formation of a negative perception of these accessible options (Chorus, Molin, & van Wee, 2006). In

addition to this, due to the commuter's confidence in their own familiarity with the situation, the attainment and consideration of additional information is considered too costly in terms of effort (Chorus et al., 2006). Thus, while this sort of habit aids in the moderation of stress through the provision of a sense of predictability and control (Evans et al., 2002; Grotenhuis et al., 2007), it could curtail efficiency with regards to individual navigation around sudden issues like disruption and crowding through the use of provided information. Personalised information systems are being developed to adapt to contextual factors like disruption (Gould & Atkin, 2015) - it is crucial to consider how that information will be received and used by commuters who are likely to pay less attention ot new information, due to the frequent nature of their travel behaviour. How does this advanced level of knowledge impact their use of information?

Frequent commuters have been considered experts in their domain in the transportation literature (Gustafson, 2012) – this is a product of a practiced itinerary and automatized cognitive processes due to constant repetition of their commute (Grotenhuis et al., 2007). This sort of advanced knowledge results in a different set of information requirements. Experts, in general, make quick decisions through the use of heuristics (Shanteau, 1988), and pay a limited amount of attention to additional sources of information in order to reduce cognitive effort and save time (Grotenhuis et al., 2007). Additionally, expert decision making involves the consideration of pre-existing knowledge, and occurs in a quicker fashion than that of a less experienced traveller (Shanteau, 1988). Finally, expertise comes with the heightened ability to resolve any problems occurring within their domain, and quicker processing of new forms of

information (Farrington-Darby & Wilson, 2006). This affects journey behaviour, resulting in a quicker process of travel, with limited references to external facets within their environment.

These theories suggest that experts have a distinct method of information use, practice, planning and attention. What is interesting, however, is the dynamic nature of the travel environment, and the opportunities offered by the ability to examine expertise within a "real-world" context. Does the dynamic nature of the travel process offer a new set of challenges to the nature of expertise?

2.4.1 Psychological Theories of Expertise

Expertise has been explored extensively by the psychology community over the years. The psychological literature outlines a series of characteristics of "experts", proposing different theories regarding the nature, and manifestation, of their expertise. These theories will be described in detail in this section, and then placed within the context of this thesis.

Experts have been quoted as having "a distinct approach to their work" (Bryant, 2005), which include high self-confidence, the memory of vital information (Ericsson & Polson, 1988), and rapid identification of important patterns (Chi, Glaser & Farr, 1988). Gilmore (1990) also highlights the importance of strategy, describing how experts can select the best way to approach a task on the basis of the context, and its requirements. Experts have been described as having a series of distinct characteristics, with their extensive knowledge attributed to a range of different factors from practice to memory to context.

2.4.1.1 Extensive Experience and Practice

One of the best-known theories of expertise is the idea of practice, and the accumulation of relevant experience. A popular example that has been discussed in the past is Ericsson, Krampe and Tesch-Romer's (1993) theory of expertise being a product of 10,000 hours of deliberate practice, which causes the formation of expert memory, and thus, performance. Skilled performance has been seen as a shift from a novice dependence on abstract principles to a more expert-like reliance on past experience (Benner, 1982).

Other researches have supported this idea by discussing how extensive experience results in the formation of associations within the individual's mind, encouraging the quick recovery of solutions during processes of problem-solving and decision-making (de Groot, 1978). In terms of physical activities, practice has been identified as improving the speed of perception and motor reactions (Ericsson & Charness, 1994). "Deliberate practice" has been highlighted as being vital to the achievement of expert-level performance for these reasons (Charness et al., 2005).

An additional idea that has been discussed in relation to experience and practice is learning. Not only do experts note their past experiences, they also learn from them in a self-regulated manner (Zimmerman & Schunk, 2001). The opportunity for learning from the repetition of past experiences is a hallmark of expertise (Farrington-Darby & Wilson, 2006), and highlights the important role of memory.

2.4.1.2 Memory

According to researchers, experts tend to have a superior memory, and alongside their enhanced perceptual abilities, they find it easy to access relevant knowledge. This is particularly true within their domain of expertise, for which they are able to quickly identify pertinent examples or stimuli (Chase & Simon, 1973). This introduces two concepts: Skilled Memory Theory (Chase & Ericsson, 1982), and domain-specific expertise.

Broadly, experts have been mentioned as having "skilled memory", which can be described as being the ability to store and retrieve information with ease (Chase & Ericsson, 1982), as well as having better short and long-term memory (Glaser & Chi, 1988).

However, more specifically, experts have been repeatedly described as having superior domain-specific memory (Chase & Simon, 1973; Morris et al., 1981; Glaser & Chi, 1988), which can be described as having the enhanced ability to preserve information that is within their area of expertise. While useful, this level of specificity might result in a lack of the same knowledge and superior performance outside of their area of expertise (Shanteau, 1992) – because of the ordering of the knowledge around a specific area, experts become "domain-adapted" (Slatter, 1987), causing a dependency on a very specific set of information and experiences.

2.4.1.3 Attention and Perception

In addition to memory, enhanced perceptual abilities have been seen as being a hallmark of expert behaviour. Abernethy and Russell (1987) discuss how experts attend to information in a manner that allows them to select more significant

pieces of knowledge than novices. Benner (1982) describes this as being due to their ability to see the situation in a holistic manner, easily selecting the important aspects. Experts have advanced perception and attention (Shanteau, 1992), resulting in the ability to extract relevant information, analyse the context, and anticipate future events (Abernethy, 1991; Cellier, Eyrolle, & Mariné, 1997).

2.4.1.4 Information Processing and Use

Not only do experts have the enhanced ability to identify and gather relevant information, the manner in which they process it has also been a prominent area of interest to the psychological community. According to Carter et al. (1988), experts can see links between different pieces of information, and are better (than novices) at mentally representing different possible scenarios. Similarly, researchers have noted that experts are good at seeing patterns (Glaser & Chi, 1988) that aid in the quick retrieval of knowledge and solutions (Larkin, McDermott, Simon, & Simon, 1980).

Experts are also seen as having detailed and current information (Shanteau, 1992), that is relevant to the context at hand – as opposed to novices, who use more high-level, context-free knowledge (Gronhaug & Haukedal, 1995). Additionally, they are known to be thorough but to-the-point, using relevant knowledge (Lawrence, 1988; Gronhaug & Haukedal, 1995) in a summarised manner that matches the situation at hand. Novices are more likely to try and recollect a lot more detail to manage the situation (Schmidt & Boshuizen, 1993). Finally, these enhanced perceptual and cognitive abilities provide experts with

the ability to handle uncertainty (Lipschitz & Strauss, 1997) and adversity (Shanteau, 1992), which influences their problem-solving and decision-making.

2.4.1.5 Problem-Solving & Decision Making

Experts are known to have advanced reasoning skills (Anderson & Leinhardt, 2002), that match their collection of multiple possible actions and strategies when facing a problem. They can identify the consequences of their actions due to the possession of a broad and realistic viewpoint, and have the ability to form informed assumptions on the basis of their vast knowledge (Cellier, Eyrolle, & Mariné, 1997). Additionally, they are able to simplify complicated problems, break them down, and adapt to novel situations (Shanteau, 1992). Put simply, experts have flexibility in their thought processes (Feltovich et al., 1984).

Additionally, theories suggest that experts spend more time examining the situation than selecting a plan of action (Kobus, Proctor, Bank, & Holste, 2000) due to their existing mental representations of similar (past) experiences, resulting in more inferential thinking (Lesgold et al., 1988).

A key example of the decision making and problem-solving seen in experts is Klein's (1989) theory of Recognition-Primed Decision Making. The model describes the manner in which experts are quick and resourceful in their decision-making when faced with complicated issues – they generate solutions, and then evaluate the constraints involved within the situation against these solutions in an iterative manner until they select a plan of action. The main focus of this theory is the idea of mental simulations, which use relevant experiences, knowledge and memories to assess the situation and form a plan. Experts use

their mental resources in an efficient manner, focusing on relevant information and past experience to easily produce new courses of action.

Finally, experts are seen as being inherently adaptive – one of the main arguments around this is the idea of cognitive flexibility, which provides them with the ability to adapt their knowledge and actions to a range of different/novel situations (Ward, Gore, Hutton, Conway, & Hoffman, 2018). As Ward et al. (2018) put it: "the essential characteristics of expertise might be more apparent when engaging in more difficult cases, especially those that occur with relatively low frequency, where adaptation may be necessary". The arguments put forth in their paper, firstly, support Shanteau's (1992) idea of domain-specificity. They also suggest that the real differences between experts and non-experts are seen in situations that require problem-solving, resulting in consistently better performances from the experts.

Looking at all of this from the perspective of human factors and information design, expertise has been discussed in relation to task performance, the design of interfaces, and to better understand the learning and training of humans within different fields (Farrington-Darby & Wilson, 2006). It is within this domain that the present body of research falls, looking within the very specific context of rail travel. Expertise is a function of the factors of the task at hand, with direct relationships seen between the task characteristics and the strategies used by the expert. Shanteau (1992), as mentioned, describes how experts function within the confines of their specific domain, with their skill being a product of knowledge accumulated via interaction with the characteristics of the situation. This can be seen within the expertise of frequent commuters – their travel

choices and patterns are repeated over time, within a dynamic, yet specific, travel context (Ben-Elia & Ettema, 2009).

Based on the transportation literature, there is some evidence for the idea that frequent travellers possess a form of expertise, or habit (Aarts et al., 1997). Dziekan (2008) discusses how continuous exposure to the travel context results in the accumulation of relevant knowledge, while Grotenhuis et al. (2007) directly mention the role of practice – expert travellers show the development of a practiced itinerary, and require less-detailed information. Similarly, Gustafson (2012) discusses how expert/frequent travellers have extensive knowledge of specific travel information like departure and arrival times, and details regarding inter-modal transfers. This inherent knowledge has been seen as causing repetitive action, resulting in less attention paid to additional information due to a reliance on their expertise. Aarts et al. (1997) actually go a step further, attributing this form of behaviour to the development of a travel habit, which creates automaticity of action. Interestingly, expertise has also been described in a similar manner – as a skill that "may be performed almost on auto-pilot" (Bryant, 2005).

Following this, studies have mentioned the dynamic nature of expertise (Shanteau, 1992, for example), and the fact that true experts are inherently flexible and show an ability to adapt to adversity (Ward et al., 2018, for example). Theories that describe frequent travel as being a habit seem to state the opposite: habit is caused by automaticity of action, which can be disrupted by novel situations (Wood et al., 2005). To understand the true nature of travel expertise would be to examine the behaviour of frequent travellers in these

novel situations, which require flexibility and adaptation. Is it habit, which can be disturbed within an unfamiliar context? Otherwise, is it expertise, which should aid the traveller within these problematic situations? A good way to investigate this would be to examine traveller behaviour within the context of disruption: does travel expertise remain the same when faced with a problem-solving situation like disruption?

2.5 Proposed Solutions

A number of studies have examined ideas related to traveller psychology, journey patterns, decision making and habitual travel. A crucial outcome of this form of research has been the suggestion, implementation and evaluation of diverse mediations for the enhancement of passenger experience. This section will provide a brief synopsis of different forms of behavioural and information-based interventions, from both the transportation and psychological literature.

One of the main concepts explored, particularly with regards to customer experience, has been the notion of information provision – the evaluation of current or potential methods, as well as the suggestion of better ways in which to convey relevant trip-based knowledge. Kenyon and Lyons (2003) describe how the provision of better information could lead to better choices being made by passengers, improving their satisfaction, as well as their perception of the customer service received from their transportation provider. A good example of this is the study conducted by Preston, Pritchard and Waterson (2017) around the provision of information related to seat availability. Their findings showed

that some passengers were willing to make the choice to wait for a less-crowded train, prioritising their comfort during the journey, and thus, improving their trip satisfaction.

While these research initiatives have obvious advantages for the customer in terms of cost and time savings, there are benefits for service providers seen beyond the improvement of customer service. Information provision has been seen as being a useful tool for disruption management (Golightly & Dadashi, 2016), or for the control of passenger flow during scheduled maintenance works (Transportfocus, 2018b), for example. The use of information to encourage passengers to take different routes, or modify their journeys according to service disruptions is a crucial example of the important role of information provision from an operational angle.

The personalisation of passenger information is a key area of investment within the rail community – the personalisation of customer experience is one of the twelve "key capabilities" outlined in the current version of the Rail Technical Strategy (Rail Safety & Standards Board, Rail Delivery Group, Rail Supply Group & Department for Transport, 2017). The Capability Delivery Plan outlined in 2017 highlights the importance of developing a better understanding of the customer, in order to adapt to their preferences and requirements in a dynamic manner. The ultimate aim is to provide a tailored information service that makes the process of rail travel as seamless as possible. Industry initiatives reflect this, with a good example being the recent introduction of the "Alert Me by Messenger" function by National Rail Enquiries, which provides personalised travel updates and disruption alerts to the passenger's Facebook account. Another example

would be that of the Rail Research UK Association, who have invested heavily in research surrounding the use of personal data to enhance the experience of customers. Their 'Data to Improve the Customer Experience' (DICE) call consisted of four feasibility studies: the use of personal data to provide more customer-centric information (Gould, Mackaness, Bechhofer, Stevens & Cooper, 2016), provision of seamless and personalised journeys to passengers requiring assistance during travel (Casey, 2016), the use of data to predict crowding on trains (Zhang, Xiaoxiao, & Spurgeon, 2016), and the use of passenger loading data to modify existing travel plans (Preston, Pritchard, & Waterson, B., 2017). All projects aimed to understand how the use of personal data could enhance passenger experience, while appreciating the privacy and safety risks involved. Looking specifically at the methods used in these projects - Zhang, Xiaoxiao, & Spurgeon (2016) developed a model to help passengers in their journey-planning by anticipating crowding on trains. Their paper suggests the extension of that type of modelling into the domain of general journey planning, using travel preferences to suggest personalised options. Gould et al. (2016), on the other hand, used an ontological approach to map the key travel and individual factors that influence travel patterns across multi-modal trips. These factors, and the relationships between them, could ultimately contribute towards personalised journey planning when real-time data sources are added into the model. Both studies focus on machine learning, with a reliance on access to a multitude of data sources. This, however, comes with a series of challenges, particularly when applied to the GB rail service. As outlined in a report by DeltaRail (2015), a "big data" solution will require the ability to gather data from

multiple sources, manage high volumes of it, and adapt to inconsistencies in data formatting – and all of this in real-time. The main challenge is with regards to the current structure of the rail network. Chapter 1 mentioned the division of the central rail information delivery system into Darwin, Knowledgebase and the Online Journey Planner on National Rail Enquiries. While this sounds fairly straightforward, this delivery system consists of both inputs from, and outputs to, a myriad of sources, from National Rail Enquiries to all of the train operating companies to third-party applications and websites. A machine learning-based solution will have to account for the safe storage, management and successful delivery of all of this information in real-time.

In appreciation of this, a more high-level method of personalising customer information would be through the use of passenger characteristics, as implied by the investigation of lifestyle and trip-related factors, as well as studies aimed at teasing out the differences between different types of travellers (Anable & Gatersleben, 2005, for example). The idea of user or market segmentation is not a novel concept when it comes to investigating customer satisfaction – as mentioned, rail-based surveys themselves segment customers into "leisure", "business" and "commuting" travellers. In extension, there is also the idea of traveller "personas" (Transport Systems Catapult, 2015). The passenger types seen in the report by the Transport Systems Catapult (2015) are formed on the basis of a series of lifestyle characteristics, all contributing towards travel preferences. While this is on a higher level than individualised information, it contributes towards the increased relevance of the information provided to people by grouping those with fairly similar travel and lifestyle patterns. This

thesis proposes that the differing levels of knowledge and experience gained from these divergent lifestyle patterns is the key to understanding how customer information could be personalised using psychological theories regarding travel behaviour.

Based on the literature covered, and the context of rail travel, there are some prominent themes within the exploration of expertise and human behaviour. We know that expertise influences decision-making and information use, could that be useful to the context of rail travel? A glaring difference between frequent and infrequent travellers is their accumulation of knowledge and experience. These are two crucial characteristics of expertise, and frequent travellers have been considered as being experts with regards to their journeys (Gustafson, 2012). If these differences between passenger types are a product of expertise, this raises the question: do people view information differently based on their level of experience? If they do, is this a useful tool to understand how to better adapt customer information to traveller needs?

Finally, is it even possible to capture and use expertise in this manner?

2.6 Summary of the Literature

The first few sections of this literature review have discussed three important areas within this body of research: the landscape of rail travel within Great Britain, rail passenger experience, and psychological theories of expertise. The main takeaways are:

1. The occurrence of delays and disruption are a serious issue within the rail industry.
2. These delays and disruptions result in reduced customer satisfaction, which is also caused by inadequate information provision.
3. Particularly, passengers report issues regarding the consistency, accuracy and speed of delivery of information during their rail journeys.
4. Low ratings of customer satisfaction result in negative perceptions of the rail industry.

These issues are being tackled by the rail industry, through investment into research initiatives and feedback programs, in order to improve passenger experience during the process of rail travel.

In parallel, the rail industry is focused on understanding how best to provide information to different groups of travellers. One of the main dichotomies between travellers seen within the literature is the differentiation between 'leisure' travellers and frequent commuters, and their varying travel requirements, particularly regarding informational support. This introduces the idea of traveller behaviour, and the different levels of knowledge across groups. More specifically, how does knowledge influence travel behaviour and information use through the development of expertise?

Both the existing psychological and transportation literature seems to suggest that higher levels of knowledge result in the development of expertise. Table 1 presents some of the proposed characteristics of expertise alongside descriptions of "expert traveller" behaviour within the transportation literature.

Table 1. Expert behaviour and expert traveller behaviour.

Expert Behaviour	Expert Traveller Behaviour
Based on past experience and practice (DeGroot, 1978; Ericsson, 1993).	Practiced itinerary developed based on past travel experiences (Grotenhuis et al., 2007).
Learn relevant contextual knowledge (Gronhaug & Haukedal, 1995).	Learn information relevant to the travel context (Gustafson, 2012).
Distinct and resourceful behaviour (Carter et al., 1988).	Prefer the quickest possible route (Hine & Scott, 2000).
Confident in the face of adversity, have the flexibility to adapt to new problems (Feltovich et al., 1984; Shanteau, 1992).	Develop strategies to deal with possible disruptions or delays (Gustafson, 2012).
Have skilled memory (Chase & Ericsson, 1982).	Perform their travel auto-pilot through the easy retrieval of information (Aarts et al., 1997).
Is domain-specific, according to some researchers (Shanteau, 1992).	Is specific to the domain of travel, or even just the domain of their specific trip (Gustafson, 2012).

According to the transportation literature, frequent commuters seem to exhibit expert behaviour. However, while their behavioural characteristics have been highlighted in various studies (Grotenhuis et al, 2007; Gustafson, 2012, for example), there is limited research involving the direct application of psychological theories of expertise to the study of rail traveller behaviour. The aim of this thesis is to address this by understanding how psychological theories of expertise can provide a more in-depth understanding of traveller behaviour, and its impact of information provision.

The crucial factor to be considered is the nature of the travel environment. Unlike most other cases that result in the formation of expertise, commuting behaviour not only functions within a dynamic environment, it is also a product of it. What can this teach us about adapting information to the needs of different types of travellers?

The research presented suggests that the pinnacle of productive information provision would mean the presentation of high-quality information in an individualised manner, adapted to different stages of the journey, as well as

multiple modes of transportation. This form of informational support would be flexible to any sudden changes through the use of diverse data sources, accounting for all possible contextual influences. While the possibility of an all-knowing, flexible journey planning system is currently under investigation (Gould & Atkin, 2015), the present thesis focuses on the personal context of the traveller. Specifically, it aims to explore the nature of travel expertise, and the manner in which it influences information use. Additionally, the examination of information use by different types of travellers provides an idea of how information provision can be effectively optimised to match the requirements of a rail traveller, based on their prior experience and knowledge.

This Ph.D aims to examine the nature of expertise that is a product of a dynamic, everyday environment, and the challenges that accompany it. Additionally, there is the notion of information use, which has been a popular area of exploration with regards to expert behaviour. The second aim of this thesis is to explore information use within this unique environment, in order to understand how daily learning and adaptation result in the use of information provided by service operators. From the standpoint of the industry, this matches existing research into passenger types and information personalisation, providing a theoretical angle for these ideas to be explored.

Finally, there is the case of Objective 5. This was a late-stage addition to the research, due to the unexpected findings of this thesis. While expertise and travel frequency did provide some of the answers, it was clear that additional factors had to be considered alongside them. In order to achieve this, the objective was added, and aimed at slightly changing the focus from traveller type

to trip type, and travel frequency to journey familiarity. The expertise variables were still examined, in order to measure whether any interactions were to be found. In this manner, the scope of the research was slightly broadened, in order to provide a slightly fuller picture. The ultimate aims were to understand the following:

1. Can a theoretical framework be constructed to identify the different types of travellers?
2. Can we base this framework around expertise?
3. What else is missing within this framework, and how does it influence the practical aim of enhancing information provision?

2.7 CONCLUSION

The present review has provided an idea of the general landscape of rail travel in Great Britain, and the particular challenges faced surrounding disruption and successful information provision. It has also summarised the proposed theories on expertise, and the manner in which frequent commuters exhibit "expert-like" behaviour. Following the discussion of the links between expertise, knowledge-use and travel, this chapter explored existing attempts to improve the provision of information to passengers. With this in mind, the main aim of this Ph.D is to form a template for the successful provision of rail information, with an appreciation for the personal context of the traveller, thus aiding them in effectively managing their own travel experience. The next chapter will describe the methods used to achieve the research objectives of this project.

3. RESEARCH APPROACH

3.1 CHAPTER SUMMARY

Previous chapters provided a description of the current landscape of rail travel in GB, along with the specific challenges faced regarding successful information provision to passengers. They also provide an introduction to the idea of expertise, and its possible role in the improvement in the understanding of passengers behaviour. As well as outlining the research objectives, the present section will describe the approach of this thesis, and the methods that were used. It will focus on outlining a series of diverse methods from different forms of research and explain how these methods can be utilised in the exploration of passenger behaviour during the process of rail travel. This will be followed by a presentation of the research structure.

3.2 INTRODUCTION

Over the past few years, there has been increased interest in the idea of "mixed methods" research, which has been described as being rigorous, with the promotion of best practice through learning and interaction across different disciplines. Wisdom and Cresswell (2013) provide a good definition of the process: "the term "mixed methods" refers to an emergent methodology of research that advances the systematic integration, or "mixing," of quantitative and qualitative data within a single investigation or sustained program of

inquiry". In line with this form of interdisciplinary research, the research in this thesis applied a combination of qualitative and quantitative methods to the exploration of expertise and information use. Input was mainly derived from the methods used in the fields of human factors and psychology, along with the exploration of methods used by both industry-based and academic organisations. It was crucial to ensure that the design of every study was appropriate to address the research objectives. The research objectives, as a reminder, are as follows:

1. To investigate the landscape of rail information provision, determine the scope of further research into traveller types and different approaches to personalisation.
2. To explore differences in knowledge or expertise between different traveller groups.
3. To explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.
4. To focus on rail disruption, the impact it has on expertise and information use, and the additional support required on the basis of this.
5. To identify other factors that impact the collection and use of information during the process of rail travel.
6. To understand what all of this means for information design and personalisation.

3.3 METHODS

This section will describe each research method used, and the question(s) they address. The first two studies were conducted for the purpose of foundational research, garnering a general idea of the main opportunities and challenges regarding the improvement of rail passenger experience in Great Britain. This was followed by three surveys, which explored the different challenges involved in understanding the customisation of rail travel information to different groups of customers. More detailed descriptions of the different studies conducted for this project are presented in the following chapters of this thesis, alongside justification regarding the fit of the specific methods used to the research questions asked.

3.3.1 INTERVIEWS

The main advantage of the interview method is the possibility of gaining rich qualitative data on the topic of study, with the ability to capture nuance and intricate detail. This method has been popular within the field of transportation research over the years - an appropriate example of this would be Hine & Scott's (2000) study on mode choice and the perceptions of public transport users in Scotland. They use a combination of focus groups and in-depth interviews to obtain a rich, descriptive understanding of passenger decision making. With regards to journey experience in particular, qualitative interviews have proven to be immensely successful for the development of a vivid, detailed understanding of passenger activities (Gustafson, 2012). While there have been

proposed issues regarding the interview method - such as possible biases or a lack of control of possible external factors (Potter & Hepburn, 2008) - qualitative interviews are extremely useful for capturing large amounts of detail, and are seen as being a valuable research tool, both in their own right, and in a manner complementary to the collection of quantitative data (Harrell & Bradley, 2009). The semi-structured interview method used in this project has been seen as being appropriate to situations requiring the methodical examination of specific themes or topics, as well as having the flexibility to respond to new ideas or additional detail that may arise (Pietkiewicz & Smith, 2012).

The interviews aim to address the preliminary research questions of this thesis, exploring the perspectives of both sides of the coin by interviewing service providers and stakeholders, as well as different types of passengers. The data was examined using thematic analysis (Braun & Clarke, 2006), a technique that extracts the main patterns seen within the text, easily summarising participant perspectives while maintaining the rich detail present within it.

3.3.1.1 Industry Interviews

Telephone interviews have become more popular over the past few years, and have been used in a number of different domains, including healthcare (Ohayon, Guilleminault, Priest, & Caulet, 1997; Greenfield, Midanik, & Rogers, 2000), psychological research (Carr, 1999), and even transportation research. Dziekan (2008), for example, examined the memory of residents of Stockholm regarding the public transport services that were available to them through the use of telephone interviews. Literature has shown that the results of telephone interviews are comparable to those obtained from in-person interviews in some

cases (Carr & Worth, 2001; Greenfield et al., 2000). This, of course, depends on research context - a study requiring the visual presentation of stimuli, for example, would not benefit from the use of a telephone interview. However, for the purposes of the interviews conducted for the present project, it was a practical and flexible manner in which to gain rich data from participants who might otherwise be inaccessible to the researcher. In the context of this Ph.D, the process of conducting industry interviews vastly benefited – both in terms of time and flexibility – from the use of telephone interviews, allowing access to industry experts across Great Britain. The aim of the telephone interviews (Chapter 4) were to address the first research question: what are the challenges faced regarding the provision of information to passengers? In order to answer this question, members of different organisations working in the rail community were interviewed. Discussions focused around the general landscape of rail information provision in GB, followed by more specific queries about different types of traveller needs and the customisation of information based on them.

3.3.1.2 Situated Interviews

Following this, the other interview technique used was in the form of a journey-shadowing study, with the addition of semi-structured interviews (Chapter 5). Mobility data has become more prevalent within the transportation literature over the past few years, with studies placing importance on two different aspects – mobility patterns and journey experience. In terms of the latter, different studies have used diverse methods. Ettema, Friman, Garling, Olsson and Fujii (2012), for example, analyse satisfaction levels during the work commute using a number of methods, one of which includes the idea of

experience sampling (gathering self-report data from participants during the process of the journey). The situated interviews used for this thesis are similar to this. Whilst sticking to the interview format, the aim was to gain some of the benefits of methods such as experience sampling and real-time movement patterns. In direct contrast with the concept of the telephone interview, a "go-along" (Carpiano, 2009) interview involves the gathering of qualitative data through a face-to-face interaction within the relevant context. For the present Ph.D, this was the rail travel environment. The main benefit was the gathering of experiential, contextualised responses, alongside the mentioned advantages of semi-structured interviews: flexibility and the acquisition of rich data. A key research question of this thesis was explored: are there differences between passengers that travel for different reasons? This was achieved by interviews with both work commuters and leisure travellers.

3.3.2 Survey One: Expertise, Travel Frequency & Information Use

The second research question was examined both qualitatively (by the situated interviews) and quantitatively, through the use of an online survey (Chapter 6). Questionnaires and surveys are often used to examine travel behaviour, exploring diverse aspects like the valued attributes of differing journey types (Anable & Gatersleben, 2005), the use of public transport (De Witte et al., 2008), and levels of commuter satisfaction (Ettema et al., 2012), to name a few examples. Additionally, the survey method has extended its reach beyond academia, proving to be hugely beneficial to industry-based research into the

improvement of passenger experience. A prominent instance of this would be the surveys conducted by Transportfocus across bus, road and rail users (Transportfocus, 2015, for example). Beyond this, more specific surveys and questionnaires have been used to investigate pertinent questions related to customer experience, or novel ideas to enhance the same – examples of this would include studies conducted with regards to seat availability (Pritchard, 2016), and the provision of context-specific data to customers in order to support travel decision making (Gould et al., 2016).

Following the qualitative examination of both industry and customer perspectives on rail travel, the main objective of the first survey was to examine the anecdotal differences seen between different 'traveller types', on the basis of knowledge and information use in a more quantitative, large-scale manner. Additionally, this survey aimed to look beyond just the existence of differences between high and low frequency travellers. It was also focused on understanding whether these differences could be classified as being due to varying levels of expertise, as well as how they impacted the information preferences of travellers.

A web-based survey was selected, enabling access to a large segment of the population in a low-cost manner, allowing for the collection of responses from across GB. In this manner, the goal of gathering the opinions of a representative sample was met, providing a way in which to compare the qualitative responses gained from the interviews to quantitative data acquired from around 300 rail travellers. This data was analysed using a factor analysis, followed by a multiple regression. The factor analysis was conducted to extract the main groups of

information identified by participants. The multiple regression was then used to link these information groups to the measures of expertise and travel frequency. The main benefit of having both the qualitative and quantitative responses was the ability to cross-validate the anecdotal evidence against the survey data, in order to better understand the opinions and perspectives gained, and to examine the extent to which they could be generalised.

3.3.3 Survey Two: Expertise, Travel Frequency & Disruption Content

Disruption during the process of rail travel has been stated as being the cause of passenger stress and confusion (Cox et al., 2006), reducing rail customer satisfaction (Friman et al., 2001). In order to ensure that the view on information use during the process of rail travel accounted for all sorts of situations, it was crucial to examine the nature of rail knowledge and information use in relation to disruption situations. The main research question addressed by the second survey study was: does expertise remain the same when faced with a problem-solving situation like disruption?

Previous research has looked into the management of disruption by operational staff, and the prominent features of such a situation. Golightly and Dadashi (2016) propose a type of predictive approach, with a focus on staff perspectives. Their study used a repertory grid technique to draw out the prominent characteristics of disruption conditions, which is a method that could prove to be useful in understanding the key characteristics of journey interferences. Due to the success seen in their use of this method to examine the nature of

disruption, the current project opted to use the same method to look at information use within disruption scenarios, and the possible influence that knowledge levels had on the understanding of disruption information.

The repertory grid technique is a product of George Kelly's Personal Construct Theory (Tan & Hunter, 2002). According to Kelly, people interact with their surroundings by constantly forming, and then updating, their ideas and expectations of the world, using their experiences to predict future behaviours and events. These perspectives can be considered to be "personal constructs", which can be extracted and examined through the use of the repertory grid method (Edwards, McDonald, & Young, 2009). It provides rich individual perspectives on specific contexts and situations, which are studied in a structured, in-depth manner. Though originally designed for the field of clinical psychology (Edwards et al., 2009), repertory grids are now seen as a valuable tool within the field of human factors, and have been applied to areas such as product design (Baber, 1996), and human-computer interaction (Hassenzahl & Wessler, 2000), for example.

For this thesis, the repertory grid method was used to understand the segments of disruption information that were the most important to participants. The final grid constructed was exported onto an online survey, to access a larger sample. The main aim was to understand how people viewed disruption information presented to them, and how this was influenced by their level of knowledge and experience regarding the rail system. The data collected was quantitative, and a cluster analysis was used to understand how different travellers – grouped on

the basis of their expertise and frequency of travel – viewed and understood disruption alerts.

3.3.4 Survey Three: Expertise, Travel Frequency & Disruption

Information Preferences

Through the presentation of disruption-based vignettes, the final study aimed to understand how different factors could come together to influence how people view and select the information that could help them the most (Chapter 8). Vignette experiments involve the presentation of hypothetical scenarios that call for participant responses in terms of their perspectives, or opinions. These scenarios are formed through the systematic combination of chosen independent variables (in this thesis, trip purpose and journey familiarity), in order to examine the influence that they have on the dependent variables (here, preferences for different types of informational support for disruption management). These types of factorial surveys were originally introduced to psychological research by Peter Rossi and his associates (Rossi, Waite, Bose & Berk, 1974, for example).

The vignette method has since been used in the field of human factors. Brown, Houghton, Sharples and Morley (2015), for example, look at the use of pedestrian navigational aids using this technique. A good example of the success of vignette experiments in the examination of transport behaviour is Aarts et al.'s (1997) study, which uses vignettes to investigate bicycle-use across different travel conditions. Participants were presented with differing outlines of journey

situations in a between-subjects manner, subsequently requiring them to rate the likelihood of bicycle usage. The main benefit of the vignette process – apart from the ease with which the study is administered – is the attainable balance between ecological validity (through the presentation of realistic, relevant scenarios) and reliable quantitative data (Brown et al., 2015). While this will be discussed further in Chapter 8, the key point to note here is the ability for the vignette study to contextualise the data, providing more naturalistic responses than standard survey questions. With this in mind, the aim of the final survey was to look beyond expertise, in order to identify the other factors that influence the use of information, thus addressing the penultimate research objective. An analysis of variance (ANOVA) was used to investigate possible influences of the purpose of the trip, familiarity with the journey, and travel frequency on the information preferences of participants.

3.4 Ethics

Ethical approval for all the studies conducted for this thesis was obtained from the Engineering Ethics Committee at the University of Nottingham, with the following of standard protocol assigned by the committee regarding data recording, collection and storage.

3.5 Research Framework

Having described the methods used within this thesis to examine the links between information use and individual expertise, the present section will

present the framework of research, describing the manner in which the different studies influence and facilitate each other. The basic framework is in Figure 2.

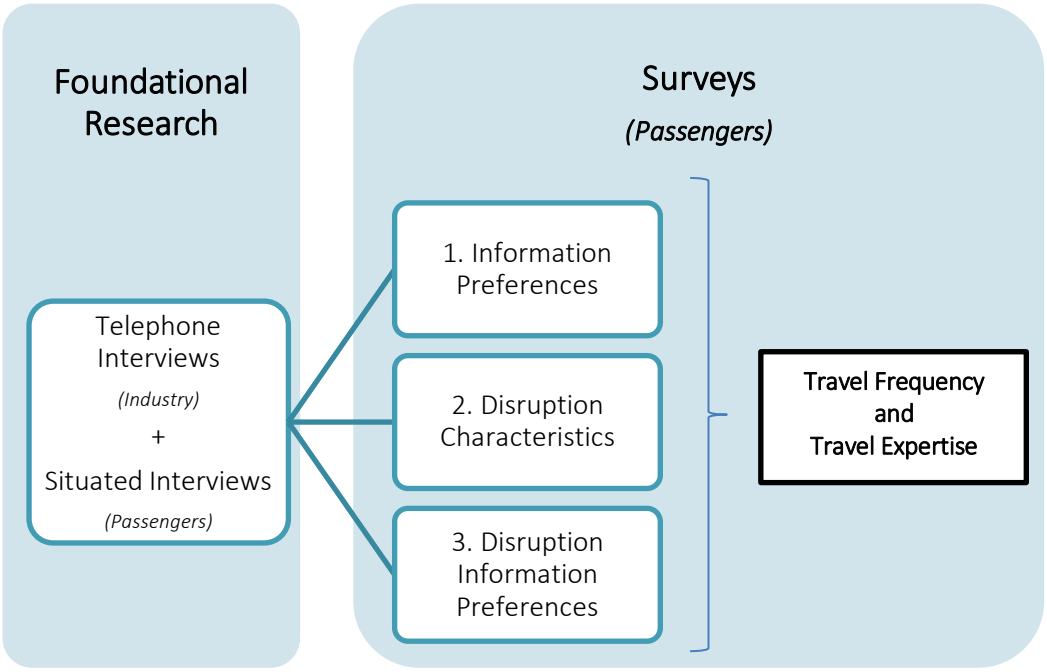


Figure 2. Research framework for the present Ph.D project.

The first two phases of foundational research contribute towards the understanding of the rail landscape in GB, particularly focusing on passenger information provision and traveller knowledge. They created a foundation of knowledge that contributed to the construction of the next three studies. The quantitative studies aimed at examining the key issues uncovered in the interviews in a large-scale, quantitative manner. In particular, the three survey studies examine the central themes of information use and expert behaviour in two contexts: rail travel in general, and during disruption. The links between the research objectives and the studies aimed at addressing them are in Table 2.

Table 2. Methods table.

No.	Research Objective	Method	Data Type
1	To investigate the landscape of rail information provision, to determine scope of further research into traveller types and different approaches to personalisation.	Telephone Interviews	Qualitative
2	To explore differences in knowledge or expertise between different traveller groups.	Situated Interviews	
3	To explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.	Online Survey	Quantitative
4	To focus on rail disruption, the impact it has on expertise and information use, and the additional support required on the basis of this.	Repertory Grid and Online Survey	
5	To identify other factors that impact the collection and use of information during the process of rail travel.	Vignette Survey	

As can be seen, all research objectives have been linked to specific studies, apart from the final one. Though present as a running theme throughout the thesis, this objective will be specifically addressed in the Discussion (Chapter 9) of this thesis, which will bring together the findings of all the studies within the context of information provision. While the theoretical focus of this thesis is the nature of expertise and its impact on travel behaviour, the more practical objective is to improve rail customer information. The final chapter of this thesis will use the insights gained from the research to construct a template for the successful delivery of rail information to passengers. The following schematic (Figure 3) will be presented at the end of every chapter, to depict the progression of the narrative, and summarises the relationship between the objectives and the studies.

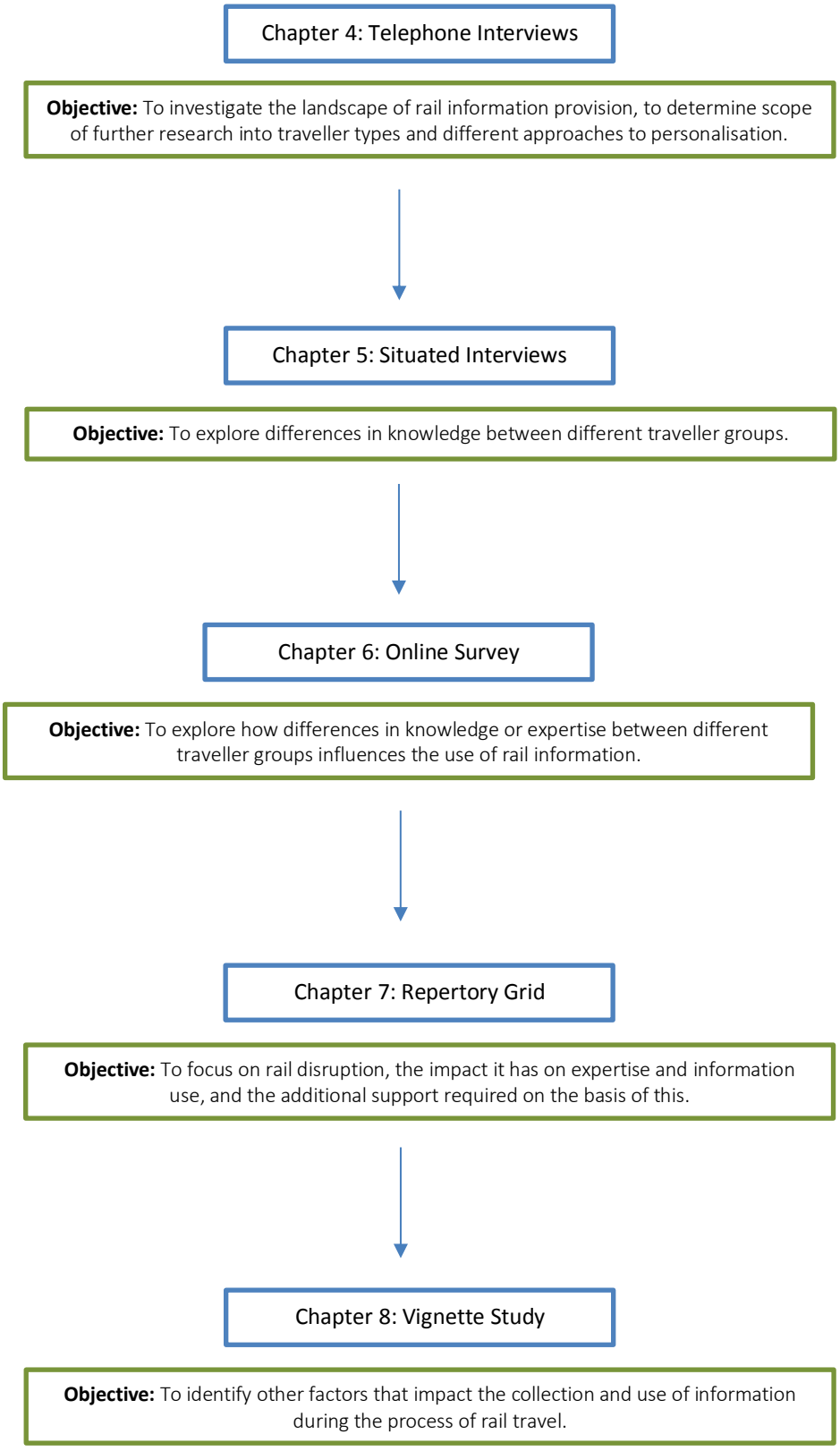


Figure 3. Thesis narrative schematic.

3.6 CONCLUSION

In summation, the present chapter provided an overview of the research methods used in this Ph.D project – semi-structured and situated interviews, an online survey, a repertory grid method, and a vignette study. The range of methods used aimed to comprehensively explore themes surrounding rail travel in GB, information use during the process, the effects of disruption, and the role of passenger knowledge, as well as other contextual factors, on traveller behaviour. The following chapters will describe each of the studies in further detail.

4. Telephone Interviews: Attitudes Towards Information Provision in the GB Rail Community

4.1 Chapter Summary

Information provision is a crucial element of passenger experience, and is a key area of research and innovation for different sectors of the transportation industry. While there is much focus on obtaining feedback and opinions on information provision from passengers, it is also worthwhile to examine current industry perspectives on issues surrounding information delivery. This is useful to develop a comprehensive understanding of the requirements for future rail information provision, both in terms of technology and content. Matching the first research objective of this thesis, the aim of the current study was to better understand industry perceptions of information provision during rail travel, along with the role of underpinning factors, including disruption and traveller knowledge. Twenty members affiliated with the rail industry were interviewed regarding their views. Topics included: the need for passenger information provision, barriers and enablers, information provision during disruption, current research in the area, the influence of pre-existing knowledge, and the predicted future of passenger information. The results were then thematically analysed. Several key ideas emerged: seamless journeys, customer empowerment, information reliability, quality and simplicity, and the

requirement for increased technological investment into information provision systems.

4.2 INTRODUCTION

As discussed in Chapter 2, the optimisation of passenger information is a key issue with regards to the enhancement of customer service. The aim of this study was to contextualise the research conducted in this thesis, in particular, the first research objective: to investigate the landscape of rail information provision, determine scope of further research into traveller types and different approaches to personalisation. A way to achieve this is through the presentation of ideas from both sides of coin: the passengers, as well as industry stakeholders. While there are numerous passenger surveys and passenger-focused investigations conducted (initiatives by Transportfocus, Passengerfocus, or the National Rail Passenger Survey, for example) this needs to be matched by a better understanding of the rail industry, in order to appreciate the possibilities for improvement, and limitations faced on a daily basis. There is value within the industry expert perspective. Industry stakeholders understand the systems-wide situation, and can provide insight into the successful provision of information from the point of view of the rail service. With this in mind, this chapter presents an overview of rail industry perspectives on the key areas that influence provision and innovation for passenger information. This is achieved through the qualitative analysis of interviews with rail stakeholders and industry representatives. In order to uncover the main issues surrounding the successful

provision of rail information, specific interview questions were selected, based on an exploration of the existing industry and academic literature (Appendix A1):

1. Why is there a need for passenger information provision?

   While travel information is fundamental to the very completion of a journey in itself, the quality of information provision has also been highlighted as being influential with regards to factors like mode choice (Dziekan, 2008; Hine & Scott, 2000), journey satisfaction (Friman et al., 2001; Grotenhuis et al., 2007) and disruption management (Cox et al., 2006). This study aimed to explore information provision from an operational perspective - the aim was to match current industry opinions with the academic literature, with the addition of practical perspectives to the existing theoretical propositions.

2. What are the barriers and enablers to successful information provision?

   Following the first interview question, the study aimed to understand the particular challenges to the successful provision of rail information. The industry has investigated passenger experiences of uncertainty and stress in the face of lacking information and reassurance (Cox et al., 2006; Hine & Scott, 2000), as well as the challenges faced by service operators (Golightly & Dadashi, 2016; Golightly & Durk, 2016) – there is a need to build upon this, and to better understand everyday issues faced by the rail industry, with regards to the provision of information to passengers, and their suggestions surrounding its improvement.

3. What are the particular challenges surrounding the provision of information during disruption?

   Disruption management has been examined from the perspective of the customer, looking at passenger experiences (Department for Transport, 2015) and the improvement of rail-based support systems to provide customer assistance (Gould et al., 2016). There has also been investigation into disruption management from the perspective of operational staff (Golightly & Dadashi, 2016). With disruption presenting a range of challenges faced with regards to ensuring the safety, comfort and satisfaction of passengers, this study aimed to understand the particular influence of disruption on the management of information delivery systems, in order to understand the current challenges faced by the industry, and the possible steps that could be taken in order to facilitate the improvement of information provision in the face of rail disruption.

4. What research is being conducted surrounding the improvement of information provision, and/or can you describe an incident that resulted in an improved understanding of how to successfully manage the information needs of customers?

   Additionally, the present study intended to understand what the rail community is currently doing with regards to the enhancement of information provision. The aim was to begin the development of a database of research that is currently being conducted surrounding rail travel and information provision. While only a small number of initiatives and projects

have been gathered, this provides a good foundation for a future information-gathering exercise, which could help encourage increased collaboration and the development of existing ideas.

5. How do you think a passenger's existing levels of knowledge and/or travel expertise could contribute to their attitude towards information provided to them?

   The differentiation between types of travellers is a prominent area of research within the transportation industry – the Traveller Needs survey (Transport Systems Catapult, 2015) being a key example. As mentioned, frequent travellers – mostly commuters – have been identified as having a level of expertise regarding their journeys, resulting in the development of strategies to maximise convenience (Gustafson, 2012). How does this influence the manner in which they travel, particularly with regards to their use of information?

6. What do you think the future of passenger information looks like?

   A major aim of the rail sector is to understand the diverse forms of technology used for the presentation of information and facilitation of travel. This includes an understanding of the capabilities offered, as well as potential repercussions. The examination of this angle was added in order to understand the long-term goals of members of the rail community. By understanding the ideal future of information provision, there is an appreciation for the factors that need further investment and innovation.

These specific questions aim to meet the first objective of this project: to investigate the landscape of rail information provision to determine scope of further research into traveller types and different approaches to personalisation. Additionally, it lays the foundation for the exploration of the second research objective, which looks at the differences between different types of travellers.

4.3 METHOD

4.3.1 OVERVIEW OF METHOD

A semi-structured interview process was selected, aiming to collect qualitative data regarding the opinions and perspectives of members within the rail industry. Semi-structured interviews have been a popular method used to investigate opinions within the transportation industry, with a number of studies reporting their successful use for the investigation of passengers (Mann & Abraham, 2006) and operators (Golightly & Durk, 2016) alike.

Telephone-based interviews were selected (a) for convenience, and (b) to ensure that interviews could be recorded in verbatim for detailed transcription and analysis. Again, an established method of research within the transportation literature (Dziekan, 2008, for example), the interview method allowed for easy access to industry professionals from all over GB, as well as a manner in which to ensure adequate data capture for detailed thematic analyses (Braun & Clarke, 2006).

4.3.2 Participants, Materials and Procedure

Twenty participants were interviewed over the telephone, with explicit consent provided regarding the recording of these interviews both in audio and written formats. Participants were all members of the rail community, and contacts of the researcher, recruited via email. They were selected in a manner that reflected the wide range of perspectives within the rail community, all the way from industry to academia. All participants classified themselves as being professionals within the rail community, with the following occupations:

- Business Development Researcher at a transport organisation (Participant 1)
- Customer Experience Manager at a rail organisation (Participant 2)
- Customer Information Strategy Manager at a rail organisation (Participant 3)
- Rail Researcher at a university (Participants 4, 7, 19, 20)
- Human Factors Specialist at a rail organisation (Participant 5)
- Bid Manager at a train operating company (Participant 6)
- Principal Technologist at a transportation organisation (Participant 8)
- General Manager at a train operating company (Participant 9)
- Project Manager at a train operating company (Participant 10)
- Senior Ergonomist at a rail organisation (Participant 11)
- Information Development Specialist at a rail organisation (Participant 12)
- Control Communications Manager at a train operating company (Participant 13)
- Stations Customer Experience Manager at a rail organisation (Participant 14)
- Stations Operations Specialist at a rail organisation (Participant 15)

- Customer Experience Strategy Owner at a rail organisation (Participant 16)
- Head of Human Factors at a rail organisation (Participant 17)
- Customer Experience Manager at a transport organisation (Participant 18)

Following agreement via email, and the signing of electronic copies of the consent forms (Appendices A2 and A3), a date and time for a telephone interview was agreed upon, and semi-structured interviews were conducted. A voice recorder, as well as handwritten notes, were used to capture data, which was later transcribed manually.

4.3.3 Analysis

Each interview was anonymised and transcribed separately using Express Scribe, which is a professional audio player that aids with the transcription of voice recordings by providing tools to slow down the audio, and to listen and transcribe simultaneously. Approximately 3050 lines of data were obtained. The transcriptions were then reviewed for spelling and grammar, and moved to NVivo for coding and thematic analysis (Braun and Clarke, 2006). Each question was analysed separately through the creation of different mind maps, with the responses of every participant reduced to short statements. These statements were then assigned specific themes. Every interview was coded in an inductive manner, with the themes emerging from the participant responses, as opposed to a pre-constructed framework. These initial themes were then reviewed across all the interviews, with the removal of duplicates and re-iterations.

Following the gathering of the codes, an Excel file was created with the assignment of different sheets to each question. The codes were then grouped based on similarity, resulting in the formation of dominant themes. Following further analysis, each theme was described, and then broken down into possible sub-themes. The transcripts were provided to an external researcher to identify prominent themes within the data, in order to check for inter-rater reliability. The themes highlighted by them matched the analyses conducted for the present study.

These themes were further described through the selection of quotes from the original transcripts, which best summarised and exemplified the ideas presented. This is presented in the following section.

4.4 Results and Discussion

4.4.1 Question 1: Why is there a need for passenger information provision?

The topics covered in response to this question included the aims and objectives of the service providers, journey planning, passenger experience, delays and disruption and the types and quality of information provided to customers (Figure 4).

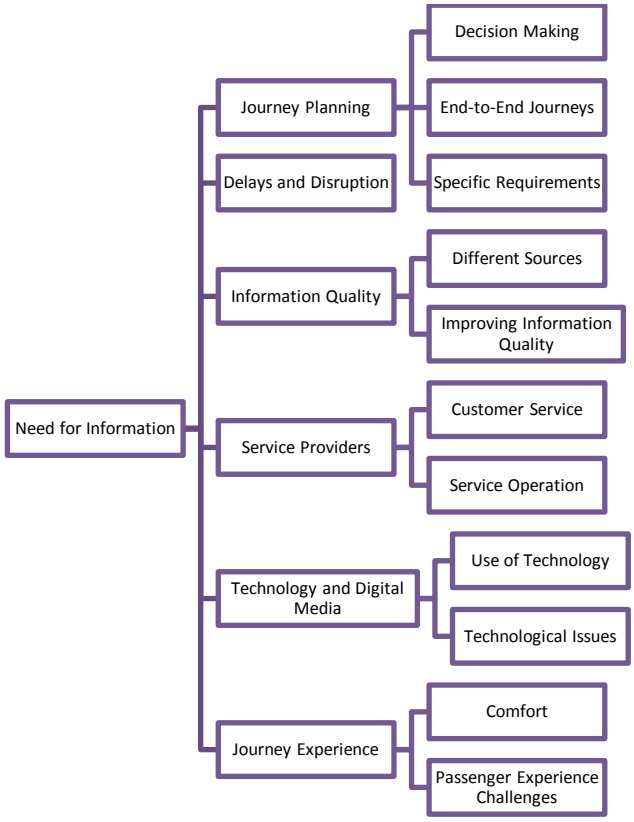


*Figure 4.*Themes and sub-themes from Question 1.

4.4.1.1 Journey Planning

The sub-themes identified for journey planning were decision making, the idea of the end-to-end journey, and particular planning-related requirements for passengers. Participants mentioned the requirement for customers to be able to make their own – and importantly, informed – decisions during their journeys:

"…allowing them ways in which they can tailor the information flow so they don't get overwhelmed, don't get information when they don't need it, they get … useful information, so they can make good decisions" (Participant 16)

Furthermore, there is importance in acknowledging the various decision points that exist throughout their entire journey:

"… you need information throughout the whole customer journey, so from when the customers even thinking of travelling on rail … then planning their

journey … purchasing a ticket, and then obviously information provision to get to the station, to when they arrive at the station, on the train, and when they're arriving at their destination" (Participant 12)

Passengers need to know the following: arrival times, seat positions, service updates during the trip, alternative options (if required), and most importantly, how to complete their trip in itself. The key goal is to combat a lack of knowledge or unfamiliarity through the provision of all the information required to successfully complete a trip on the railways. This matches the customer requirements identified by prominent rail surveys. Transportfocus (2018) reports that accurate information, required facilities, accessible tickets, staff support and the lack of unexpected modifications to the trip all contribute to a sense of control, making the customer feel supported.

4.4.1.2 Delays and Disruption

In 2017, punctuality and reliability had the biggest impact on journey satisfaction, with the management of delays having the largest influence on dissatisfaction (Transportfocus, 2017a). In light of that, participants mentioned the crucial need for supportive updates during delays or disruptions, or even during peak travel times:

"… if they arrive and the train is delayed or there is disruption that's when you need to give additional information to support them…" (Participant 14)

As with the first theme, information provision during these times is a necessity for both passengers and service providers - in supporting customers through their navigation around such instances, the operational factors can managed in a more efficient manner:

"…the main factors driving the need for information provision … from our perspective as an industry: disruption management and safe crowd-flow management" (Participant 11)

As previously stated, information provision during disruption aids both passengers and service providers alike, allowing for incidents to be resolved in a timely and efficient manner.

4.4.1.3 Information Quality

Reliability is key, alongside the provision of information in the quickest possible manner. One of the main takeaways from the analysis of this theme was a comment regarding the need for a human-centred approach to information design and delivery (Participant 8). An appreciation of the end-user – in this case, the passenger – will result in the presentation of information that is adequately designed to fit their needs. An example of this in action is Gould and Atkin's (2015) research, which investigated the improvement of the quality of the information systems themselves, emphasising on the required appreciation of the passenger-specific aspects of the travel situation. Their paper also accounts for the requirement for diverse types of information, from station facilities to weather to service updates. This is matched by the perspectives on passenger information in this study. According to participants, passengers only seem to have access to very high-level information for most of their trips, which is not ideal.

Also, in addition to this, timing of that information is important. An important comment made was the requirement for proactivity during the delivery of information to the customers, for example:

"rather than the customer having to search around…push information to let customers know what amendments are being made" (Participant 18)

4.4.1.4 Service Providers

A number of industry experts mentioned the "expectation" of information during the process of rail travel, and its link to the more high-level aim of providing good customer service. This is exemplified by the following quote from an employee of one of the TOCs operating in GB:

"...many years ago when I started working in sort of this area it was very basic and very limited, the amount of information we give to customers. Now there's so many different sources of information. I think the expectation level is has risen significantly especially in the sort of last five to ten years" (Participant 6)

Efficient information provision is a subset of good customer service, achieved by supporting the passenger through their journey in the best way possible. Successful information provision was also seen as being crucial to the successful management of the rail network:

"…companies provide people with the right information and that could help them with their operations if it means reducing crowding or helping passengers to form a useful part of incident management…" (Participant 5)

Essentially, keeping the passenger informed works to the advantage of the service providers, ensuring that their operations run as smoothly as possible. These comments match the Passenger Information During Disruption (PIDD) objectives outlined by Rail Delivery Group (Accent & Rail Delivery Group, 2017). A major aspect of these objectives include the improvement of information services, and meeting customer expectations.

4.4.1.5 Technology and Digital Media

A common comment made was related to the required appreciation of accessibility issues, and a need to account for customers that do not have access to/are unable to use technology. As mentioned, good customer service would ensure their ability to obtain information in an efficient manner, as well. This would also include the accuracy and reliability of that information. A major issue regarding this is the presentation of different forms and types of information on different information channels, mainly social media. This was highlighted as being a pertinent issue that needs addressing:

"…we're in an age now where obviously social media is so prevalent, and in most instances if there is a big disruption you tend to get more information by Twitter, whether that information is accurate or not …that's probably the biggest challenge - the consistency of information" (Participant 12)

This is matched by customer surveys, with Rail Delivery Group reporting that passengers were not pleased about the information provided to them, with particularly poor ratings for departure screens, mobile applications and websites (Accent & Rail Delivery Group, 2017).

4.4.1.6 Journey Experience

With regards to journey experience, an important idea discussed was the notion of comfort. In order to maximise the comfort of the passenger, three major ideas were brought up: (1) the need for information to ensure that the customer feels relaxed and in control, (2) the provision of an adequate amount of updates, and (3) the manner in which this enables seamless journeys. The aim is to empower customers by ensuring their acquisition of an appropriate amount of

information, so that they can successfully manage their own journeys (Participant 17).

4.4.2 Question 2: What are the barriers and enablers to successful information provision?

This question lead to the emergence of a range of different themes: information distribution across different channels, issues surrounding data reliability and technology, different types of information provided and challenges surrounding their delivery, customer service, disruption, and finally, improvements that have been/should be made to the delivery of rail information (Figure 5).

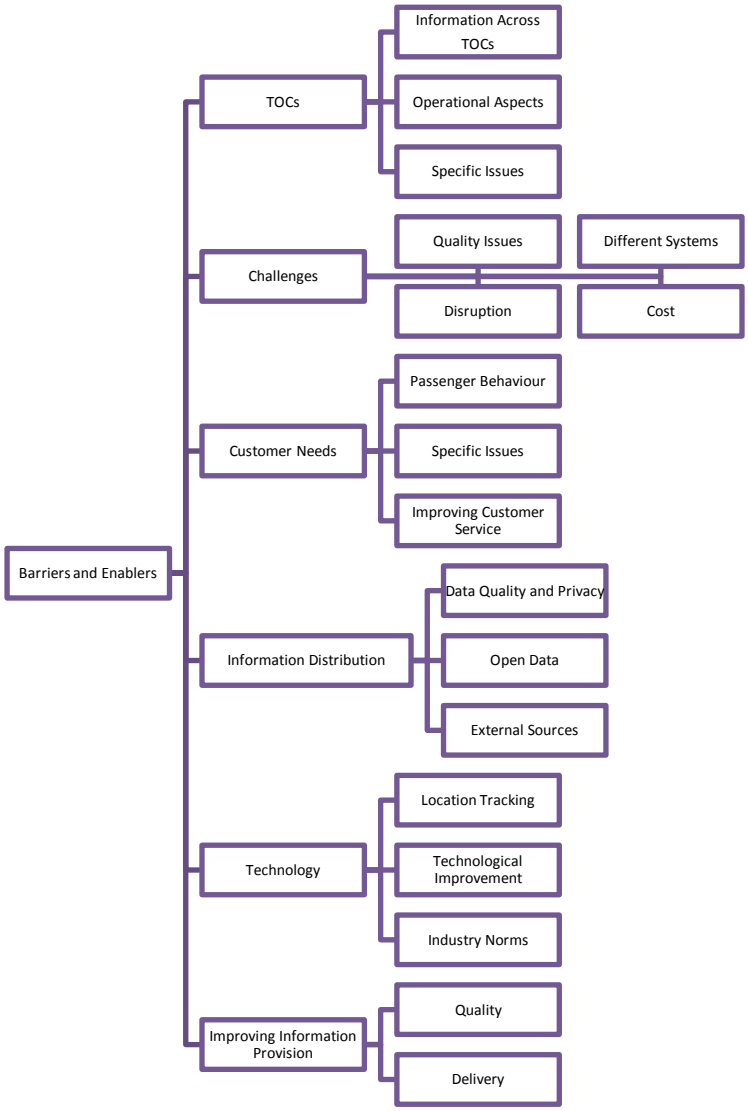


Figure 5. Themes and sub-themes for Question 2.

4.4.2.1 TOCs

A prominent topic discussed regarding the dissemination of information was the challenge surrounding the management of information across the various TOCs, both in terms of its accuracy, and ensuring that all relevant parts of the rail network are accounted for when information is distributed, or changes are made. In addition to this, specific issues borne out of the "fragmented" nature of the industry were discussed, which includes the need for TOCs to distribute information as quickly as possible, and improve operational aspects related to

the same. Particular requirements mentioned, related to the latter, were: the need for communication within control centres, streamlined operational decision making, and reduced variability in staff conduct (Participant 6).

All of these ideas are summarised in one of the main comments made with regards to this theme: TOCs need to be more inclined towards the improvement of the rail service as a whole, as opposed to the enhancement of their own brands. There is a need for improved coordination across the rail network, with the development of similar policies surrounding the distribution of information, and the manner in which it is done.

4.4.2.2 Informational Challenges

The challenges around information provision include difficulties surrounding the presentation of information at the right time, particularly during disruption. There is a significant challenge with regards to quickly identifying the causes of a disruption, and subsequently, providing accurate estimates regarding the time it will take to fix it:

"For instance, when there's a signal failure, where the delay is out of the control of the train operating company, it's very hard to communicate whether you can actually do something about it, and it's very hard to actually estimate how long it will take." (Participant 4)

With regards to general (undisrupted) rail travel, an interesting idea brought up was the notion of "too much information" (Participant 17). This introduces the important idea of quality over quantity – <u>useful</u> information is crucial to customer satisfaction.

This also influences operational aspects of travel: participants mentioned the provision of less information to manage passenger movements. An example provided by a TOC representative described how the company sometimes aims to "manage crowd flow by withholding platform numbers" (Participant 11). A key question that needs to be answered by all providers is, "how much information is the right amount". While there has not been a definite proposition regarding the "correct" amount of information, participants commented on the importance of the provision of "the right information at the right time" (Participant 16). While detail might help, the relevance of the information provided is seen as being more important.

According to participants, informational consistency has improved in the last few years, alongside the introduction of a number of initiatives surrounding the improvement of rail information. Alongside this, however, participants mentioned the specific areas that require continued innovation: further improvement of informational accuracy and consistency, the development of more dynamic and flexible information, and an emphasis on transparency. The end goal is the digital delivery of high quality, understandable information, and as quickly as possible.

This leads directly to another prominent topic of discussion – cost. The provision of "good quality information" is an expensive endeavour, requiring significant investments in time and money:

"TfL [Transport for London] for instance have a lot of … information … it costs money to provide that … So, there's [the idea of] investment, which is often the bottom line" (Participant 8)

According to the Office of Rail and Road (2017), rail passengers pay for three-quarters of the running costs of the railways, with this cost being highlighted as one of the main constraints to the selection of rail travel as a mode of transport (Stanton et al., 2012). The issue here is balancing out customer investment with value for money – what might need to change at this point would probably be the prioritisation of certain aspects of customer service improvements, with increased investment into information provision.

4.4.2.3 Customer Needs

As mentioned, passengers expect information and value feelings of empowerment and control. In order to enable this, they desire real-time, almost immediate, information. While this understanding has been gleaned through previous research conducted and/or industry initiatives (Office of Rail Regulation, 2012, for example), there is now the need to take this further by better understanding the diverse requirements of various demographics:

"There will still be people who … don't have access to … personalised information provision, who will be very much still reliant on some more of the information at the station…I think there will be a move towards a greater availability of information personalised to customers and their particular journeys but I also think that doesn't mean you can just get rid of all the other sorts of information for people who need that more general, old-fashioned information provision too" (Participant 13)

A common topic discussed with regards to informational enhancement has been the idea of personalisation. However, prior to that, there is a requirement for the establishment of trust – passengers need to be able to trust the information

that they have been given, as well as its provider. A manner in which to achieve this, according to one of the participants, is by keeping customers updated through the entire operational decision-making process:

"providing information is as important as making the decisions" (Participant 6)

However, that leads to the required appreciation of existing issues surrounding this advanced level of information provision. Namely, the lack of advanced information in itself. Participants mentioned a lack of dynamic, context-specific information – a prominent problem, for example, is that passengers sometimes have information long before rail staff have it, as described by a TOC member:

"… customers tend to get a lot of the information before our staff do and that is obviously because there's a lot of different systems that access the main information (system) that provides the details" (Participant 9)

In addition to this, due to the current state of rail information systems, there is still a reliance on the broadcasting of information to all passengers, which comes with its own set of challenges, such as an inability to address "inattentive passengers". The topic of customer needs – and the efficient consideration of the same – is a complex one, with a number of issues to be addressed, alongside a lot of room for innovation and advancement.

4.4.2.4 Technology

Looking at discussions surrounding rail technology, participants stated the need for increased investment, particularly in new technologies:

"We don't seem to move with the times with technology… we haven't moved with the times for a number of years, and part of that in itself is down to the suppliers that we use. Two of the main suppliers that we use for information

systems have a monopoly on the industry… they have no interest in developing masses of new technology because they're making so much money off the old stuff that's so easy for them to maintain" (Participant 6)

In extension, when discussing areas worthy of increased investment, participants mentioned, in particular, the automation of information systems, the enhancement of in rural areas, improved location systems (including GPS tracking) for trains, and on-board Wi-Fi.

4.4.2.5 Improving Information Provision

The discussions surrounding this theme formed an easy narrative, from highlighting the issues with external information, and the ideal solution. Participants described the continued the reliance of service providers on train and station-based information provision, and the required improvement of the variety of information provided to customers. As one participant stated, customers should not have to use external sources of information for their journeys. The "solution" to this, as previously discussed, is personalised information provision. This leads into consideration of the notion of data privacy. Participants mentioned the acquisition and use of different forms of data, in order to optimise information systems. Specifically, the importance of access to them. Due to the increased availability of travel data, particularly open data, there has been significant innovation in the area, with the development of applications and information in order to support rail travel. While some of these have been discussed under Question 4 (existing research and projects within the rail community), prominent examples of the same include Darwin for Trains (which aims at displaying contextualised real-time data gathered by the rail

information system Darwin on-board the trains themselves) and Trainmapper (a disruption management tool) – both developed through research conducted by the Rail Delivery Group.

However, an important area of consideration during the rapid advancement of these systems is that of data privacy. Clearly, the idea of personalised information systems is a popular one. However, the development of the same cannot – and should not – happen without an appropriate level of understanding and appreciation for issues surrounding the storage and management of this form of personal data. Treharne and Wesemeyer (2016) mention this in their report on the notion of privacy when sharing personal data. They detail the various considerations to be accounted for when implementing new technologies in rail, particularly with regards to the collection, storage and management of their data. Not only is this level of consideration vital to the provision of good customer service, it is a necessity for customers to be able to trust these sorts of systems, in order to ensure their acceptance of the same.

4.4.3 Question 3: What are the particular challenges surrounding the provision of information during disruption?

Three main themes emerged from the analyses: issues related to operational factors, informational reliability, and passenger experience (Figure 6).

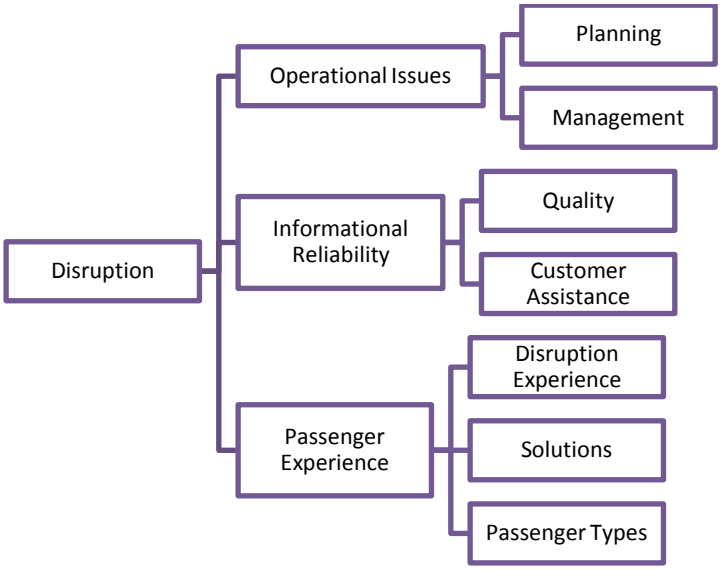


Figure 6. Themes and sub-themes for Question 3.

4.4.3.1 Operational Issues

The two strands of discussion surrounding this theme involved the planning for, and management of, disruption. With regards to the former, participants mentioned the difficulty in adapting to disruption – particularly last-minute problems, or multiple incidents occurring at the same time - due to current operation of the systems in place. For example, one of the participants discussed the role of control centres, and the fact that they are designed only for moderate levels of disruption – this results in challenges surrounding the management of more severe types of disruption:

<in reference to a serious incident> *"Control centres are set up to deal with moderate levels of disruption because nobody can afford to have a spare team of five people that's just sat around doing nothing and waiting for something to happen. So, it's fine when it's a normal disruption, even [with] a little bit [of an] elevated disruption but when it gets to that critical point where it's really,*

really, really bad, everybody just works at 150-200% but it's still never enough"

(Participant 6)

In discussion of management issues, key concerns raised included requirements for: consistency in the way disruption is handled at different locations, keeping staff updated as much as possible, clarity in decision making, and investment in technologies to aid in the handling of live incidents.

Finally, an interesting comment regarding information handling in particular was the notion of "generic information". Participants described a switch from the provision of detailed information to more high-level information during disruption – this is to ensure efficiency in information provision, particularly during times of severe disruption. In these situations, the main goal is to get the most important pieces of information to the customer in the quickest manner, as opposed to focusing on the depth of the information in itself.

4.4.3.2 Informational Reliability

A report by Transportfocus (2018) highlighted the factors that could adequately support passengers during disruption - information tailored to different types of customers, the use of an appropriate tone, and the use of a range of different types of information to inform passengers. Participants of this study mentioned these aspects, with a focus on the need for timely, accurate and consistent information. An important comment made – in line with the idea of "relevance" – was that it is crucial to identify the exact types of information that are useful during disruption. Another participant exemplified this idea by mentioning the importance of disruption length, specifically, as being this sort of crucial/relevant

knowledge. A step further mean being proactive about providing this form of relevant information to customers (Participant 18).

While the entire discussion around information provision during disruption is a product of the requirement for passengers to feel adequately supported, participants described particular issues surrounding the delivery of this sort of assistance. Participants mentioned challenges surrounding access to pertinent information to aid passengers in completing their journey, such as knowledge about which trains will be running following the incident:

<in reference to challenges faced during disruption> *"One is not knowing if we've got the capacity, and the other one is last minute decision making [as] we don't know which train is running"* (Participant 11)

4.4.3.3 Passenger Experience

In continuation of the idea of assistance, it is crucial to consider the experience of the passenger during disruption. In particular, participants discussed the idea of uncertainty regarding completion of the trip – especially regarding finding alternatives - which reduces customer satisfaction. This, however, depends on the type of passenger. Cox , Houdmont, & Griffiths (2006) talk about this from a customer perspective, describing the role of certainty with regards to crowding, and subsequent feelings of stress. Participants of the present study mentioned the increased need for reassurance for infrequent travellers, and/or passengers who are completing a trip that they are unfamiliar with. Customers completing familiar journeys find it much easier to identify alternatives and plan around disruption.

Finally, while the notion of accurate information has been discussed, participants highlighted two vital aspects of dealing with disruption in a manner that appreciates the experience of the passenger. Namely, the provision of a genuine apology to the passenger for the inconvenience that they have faced, followed by good advice regarding navigating around it:

"…providing clear reasoning [as to] why there's a problem, telling people what they can do to get around that, providing alternatives methods of transport, and obviously making sure that we apologise for any inconvenience that's caused and that it's a genuine apology." (Participant 18)

While dealing with disruption is a complex task, keeping passengers adequately supported through the experience is key to ensuring that their experience is the best it can possibly be.

4.4.4 Question 4: Industry research and existing initiatives

The aim of this question was to capture a few examples of research conducted surrounding information provision during rail travel, as well as anecdotes surrounding the management of information systems by on-the-ground members. Table 3 provides a summary of the different projects and initiatives happening across different train operating companies and rail organisations, with short descriptions.

Table 3. Research initiatives, in response to question 4.

Theme	Research Area	Description
Journey Experience	Train Positioning	Conveying information regarding train locations on the platform.
	Carriage Environment	Crowd-sourcing information regarding the carriage environment.
	Journey Satisfaction	Looking at delays, journey length and ratings of indifference, versus measures of journey satisfaction.
	DICE Project	"Data to improve the customer experience".
	Accessibility	Improving accessibility to trains and stations.
	Understanding Tickets	Improving clarity regarding the fare system.
	Disruption Information	Provision of informational leaflets regarding navigating around disruption.
	Live Chat	Providing a "live chat" option at ticket machines for assistance.
	Loading/Seat Availability	Provision of information regarding loading on trains and the availability of seats.
Future Technologies	Bluetooth Beacons	Automatic ticketing through the use of beacons.
	Darwin for Trains	Contextualised Darwin data on trains.
	GPS on Trains	Tracking train locations by equipping all rolling stock with GPS.
	Optimisation of Information Screens	Improved information screens on all trains.
	Trainmapper	Map-based tool to avoid/manage disruption.
	Travel Buddy	A phone-based travel companion to aid with the planning and completion of a trip.
	Wayfinding	Improvements to signage at stations.
Operational Factors	Flooding Incidents	Improved handling of flooding incidents through workshopping.
	Data Access	Increased data availability.
	Customer Service	Introduction of 24-hour customer service helplines.
	Live Information	Introduction of screens with live train times into local areas surrounding stations.
	Traveller Personas	Use of traveller personas to understand different needs of various customers.
	Mobile Applications	Improved design and function of rail applications.
	Train Formation	Improvements in train formation.
	Disruption	Organisation of workshops to learn from last-minute disruption situations.

The research being currently conducted within the rail industry can be neatly grouped into three areas of investigation. Journey experience can be described as being the improvement of customer service, information systems and journey

satisfaction through the development of better tools and more advanced services. The idea of “future technologies” refers to technological advancement within the rail community, with the introduction of new and improved forms of technology. Finally, operational factors can be described as being projects targeted at the functioning of the service operators, and research into the improvement of the running of the rail system in itself.

4.4.5 Question 5: How do you think a passenger's existing levels of knowledge and/or travel expertise could contribute to their attitude towards information provided to them?

This section looks into how passenger behaviour (the actions of a passenger before and during the process of travel) and information use, in particular, influences information provision from the perspective of the service provider (Figure 7).

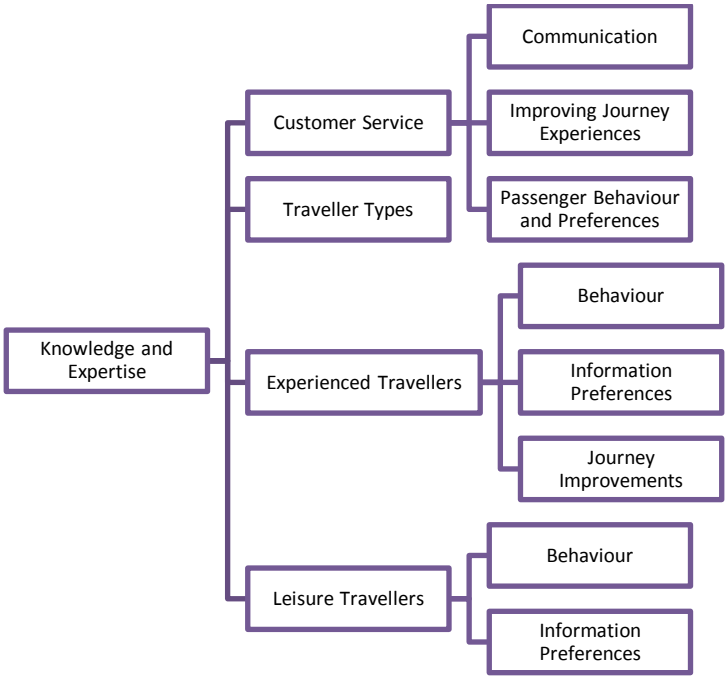


Figure 7. Themes and sub-themes for Question 5.

4.4.5.1 Customer Service

While there are several suggestions regarding the improvement of passenger experiences, it is important to, firstly, understand the needs of the customer. While this has been discussed previously, two main points that emerged related to this were the following: (1) that people just want to know how to get to their destination, and (2) that people sometimes lack the information they need. Understanding these two needs is key, particularly for different segments of the population. In terms of suggestions for improved information services, participants mentioned a few key points: multi-modal information, publicising of TOC social media details, the presence of staff, personalisation, and push notifications. Additionally, participants discussed the idea of intent and proactivity – providing "pre-warnings" during delays or disruptions, to maximise the comfort of the passenger.

4.4.5.2 Traveller Types

The most interesting comment made regarding traveller types was regarding investment – investment into information provision depends on the type of journey that is being completed. In other words, the amount of time and/or monetary investment into providing information to passengers depends on the type of journey that most passengers on that network are most likely to take. A commuter network, for example, would consist of passengers with the need for basic information regarding times and platforms, maybe even seating. A long-distance network, however, would focus on the provision of more detailed information about navigation, ticketing or facilities, for example, in order to cater to a higher likelihood of infrequent travellers. Keeping this in mind, the next two sections discuss the perceived characteristics of frequent and leisure travellers.

4.4.5.3 Experienced Travellers

Participants described these travellers as having a level of confidence regarding their journey, due to their experience and familiarity with their routine, resulting in an accumulation of "subtle, practiced bits of information". This results in specific behavioural characteristics, examples including rarely checking whether their train is on time, and easily navigating around disruption through the use of focused information searches. This mirrors the transportation literature, within which studies have described frequent travellers and/or commuters as having a form of travel expertise (Grotenhuis et al., 2007, for example).

Frequent travellers desire control over their decisions. Due to the nature of their travel, they value the provision of the most basic, relevant information, like

wanting to know if their service operating, for instance. Their (perceived) specific interactions with information provision is particularly interesting, with participants commenting on the reduced attention paid to new information, as well as their confidence in the fact that their own knowledge is sometimes better than the advice provided to them. Essentially, these travellers seem to plan their journey only once, practice it multiple times, and adapt it to changing circumstances quickly. This is captured by the following quotes from the industry members:

"most commuters will know of the alternatives already" (Participant 13)

"know the platform, times when it's busy, where there are seats" (Participant 4)

"…tend to plan their journey for the first time when they get a new job, for example, and they'll have a look and figure what the best route to make that journey is, and unless something quite substantial changes … they probably won't look at how to plan that journey again" (Participant 18)

Participants also listed a series of information requirements, based on their interactions with these customers. As expected, they are perceived as being less likely to use information points at train stations, relying more on mobile applications, if requiring an external source of information at all. Interestingly, the two areas commented upon with regards to information provision to frequent travellers (particularly commuters) were: (a) useful information if their journey has changed, and (b) the length of the train. According to a participant, based on his work on commuter services, the reduction of carriages causes a significant inconvenience to commuters, alongside the delay of the train in itself:

"As long as the train turns up, the infrequent traveller is quite happy, but if you put the wrong amount of coaches on for one particular day, and don't inform our commuters, that would upset them greatly" (Participant 13)

Keeping these ideas in mind, the improvement of the journey of the frequent traveller involves the provision of small amounts of the correct pieces of information, for them to complete their journey undisrupted. The comments made by participants regarding the behaviour of regular travellers mirrored the literature discussed earlier on. Anable and Gatersleben (2005), for instance, talk about the improvement of travel from the perspective of both groups, describing the practical requirements of the commuter, and contrastingly, the more experience-based preferences of the leisure traveller.

4.4.5.4 Leisure Travellers

According to participants, these passengers are likely to be less bothered by delays (due to the nature of their travel), and more reliant on information that is provided to them:

"If there's going to be a significant delay … [an] infrequent customer would be more reliant on the information … [for] our infrequent traveller as long as the train turns up the infrequent traveller is quite happy." (Participant 13)

According to participants, leisure travellers are more likely to use third party applications like Trainline (as opposed to specific TOC websites), less likely to use online facilities in general, and a preference for staff contact (as opposed to the use of social media):

"[they] … would never even think to go through an actual train operator's website to book their tickets. They'll go to someone like the Trainline - the

problem is [that] they're paying the booking fees and won't get the cheapest ticket because they just think, "Oh it's the Trainline, I don't know the name of the train operating company so I'll just go through this generic booking system"" (Participant 18)

Finally, an important point mentioned was the understanding of information in itself. Less experienced passengers may find it hard to understand certain kinds of information during the process of their travel: an example highlighted was that of the fare system and the different types of tickets available. These ideas are in contrast with the perceived characteristics of frequent travellers, discussed above.

4.4.6 Question 6: What do you think the future of passenger information looks like?

As with the question surrounding current industrial research and initiatives, propositions surrounding the possible future of passenger information are presented in Table 4.

Table 4. "Future of passenger information", in response to question 6

Theme	Research Area	Description
Passenger Data	Passenger Flows	Improved understanding of passenger movement.
	Passenger Loading	Improved measures of loading on trains.
	Crowdsourcing	Crowdsourcing data about mass movement and behaviour patterns.
	Trust	Assured privacy for personalisation of information provision.
Future Technologies	Gateless Entries	Automatic ticketing through the use of beacons.
	Augmented Reality	Augmented reality information systems to support rail travel.
	GPS on Trains	Tracking train locations by equipping all rolling stock with GPS.
	Demand-Based Ticketing	The provision of tickets based on demand, as opposed to services running empty.
	Paper Tickets	No more paper tickets.
	Personalisation	Personalised updates straight to mobile phones.
	Wayfinding	Improvements to signage at stations.
	Push Notifications	Push notifications with updates straight to mobile phones.
	Rail Rewards	Reward points for travel pushed straight to mobile phones after completion of a trip.
	Compensation	Compensation automatically pushed to mobile phones.
	Open Data	Open data to encourage third party development of mobile applications.
	Chatbots	Chatbots on online platforms, providing 24-hour help and information.
	Data	Faster data speeds.
	Real-Time Data	More dynamic real-time information.
Journey Experience	Connections	Providing information about connecting trains.
	Multi-Modal	Providing multi-modal journey information.
	Crowding	Efficient management of crowding.
	Pre-warnings	Proactive information provision.
	Guidance Services	Providing guidance to those that can't use technology/require step-by-step guidance.
	Journey Completion	Get customers home as quickly as possible.
	Train Formation	Improvements in train formation.
	Disruption	Organisation of workshops to learn from last-minute disruption situations.

In summation, the aim of the current study was to explore perspectives of members of the rail community regarding prominent topics under discussion in

relation to rail travel within GB. This matched the first research objective of this thesis: to investigate the landscape of rail information provision, to determine scope of further research into traveller types and different approaches to personalisation. The interviews also introduce the second objective by presenting the idea of different passenger types. Beyond this, there were a few overarching comments across all the interviews that were dominant points of discussion throughout the transcription and analyses.

4.4.7 Efficient Information Provision

One of the ideas that was reiterated multiple times – the notion of efficient information provision - is seen as a subset of good customer service by participants, matched by industry research, which reports accurate and timely information as being of high priority to rail passengers in the UK (Rail Delivery Group, 2016; ORR, 2018). Additionally, keeping the passenger informed is seen as an advantage to service providers, ensuring that their operations run as smoothly as possible. Again, this mirrors existing research, with information playing a key role in operational aspects, like disruption management, for example (Golightly & Durk, 2016). Participants mentioned two main ideas with regards to this process of providing travel information – the content of the messages provided, and the manner in which it is done.

With regards to the latter, there have been discussions surrounding the efficiency of existing systems, and the need for technological investment, in order to improve current methods of delivering information to customers.

Despite the advent of these different technologies, the most common method of contact is still the telephone, according to participants – the NRE call centre receives 3 million calls every year (Rail Delivery Group, 2016). There is an interesting interaction of newer forms of digital media with more traditional forms of information gathering. Additionally, participants highlighted a series of areas for future investment: automation, improved reach and location systems and on-board Wi-Fi. The focus on the improvement of information quality involves the examination of the technical aspects involved.

Beyond this, participants mentioned the required improvement to the internal processes – particularly regarding the cooperation between different service providers. Specific issues borne out of the "fragmented" nature of the industry were discussed, which includes the need for TOCs to distribute information as quickly as possible, and improve operational aspects related to the same. These ideas have been expressed in the literature, an example being the need for consistent information to be shared, particular when dispensing it across different platforms (Golightly & Durk, 2016; Stanton et al., 2013). There is a need for improved coordination across the rail network, with the development of similar policies surrounding the distribution of information, and the way it is done. The end goal is the digital delivery of high quality, understandable and relevant information, as quickly as possible. Passengers need to know the following: arrival times, seat positions, service updates during the trip, alternative options (if required), and most importantly, how to complete their trip in itself. The key goal here is to combat a lack of knowledge or unfamiliarity

through the provision of all the information required to successfully complete a trip on the railways.

4.4.8 Information Provision: Challenges

The successful provision of information by service providers is offset by a few key issues. Firstly, cost, and the aforementioned need for continued investment in better technologies, and secondly, a series of factors that cause dissatisfaction to customers. Prominent examples mentioned included delays, crowding, and subsequently, the causation of uncertainty. As seen in the literature, environmental aspects like crowding (Cox et al., 2006) and delays (National Audit Office, 2008) have a negative impact on customer experience. This matches participants' comments: adapting to disruption, in particular, is seen as a major challenge, due to the last-minute nature of the problems and the required management of different information systems. Solutions are also discussed, such as the switch to higher-level information. This has also been reflected in previous rail research – importance is placed on "having messages that are not swamped with trivial information" (Golightly & Durk, 2016), especially during disruption, when conveying accurate information is crucial. This is an appropriate example of the notion of adaptability during disruption – information provision changes as a function of it, resulting in the requirement for a different set of strategies and actions. Disruption can be a stressful experience – the comments made by participants regarding information reliability reiterate existing viewpoints surrounding disruption: the requirement

for companies to get accurate information out to passengers in time (Golightly & Dadashi, 2016; Golightly & Durk, 2016).

4.4.9 Traveller Types

There was discussion around another form of adaptability of information provision and customer service – the consideration of different passenger types. Characteristics of frequent and infrequent travellers were highlighted, resulting in the discussion of the content and extent of information required for each group. While infrequent travellers were seen as requiring more support, frequent travellers seem to confidently navigate around the rail system. This mirrors the transportation literature, within which studies have described frequent travellers and/or commuters as having a form of travel expertise (Grotenhuis et al., 2007, for example). This idea of a differentiation is further highlighted by the discussion of the customer needs of each group. In the literature, as mentioned, Anable and Gatersleben (2005) describe these differences between commuters and leisure travellers in terms of their priorities regarding improvements to their journeys: commuters seem to desire the practical, while leisure travellers appreciate more affective modifications, or "frills", so to speak. These findings, in particular, provide support for the exploration of the specific requirements of different traveller types in the following chapter.

4.4.10 Methodological Learnings

The main advantage of the telephone interview method was the ability to gain access to a range of different stakeholders within the rail industry, and gather their opinions in an efficient manner. Conducting the interviews over telephone allowed them to be fit into the busy schedules of the participants, and the semi-structured nature of the questions provided room for elaboration, resulting in rich qualitative data.

There are, of course, limitations to these conclusions, based on the context of the present study. Firstly, the data collected is all specific to the rail industry in GB. Secondly, despite the collection of rich qualitative data, the sample size is still quite limited, covering only twenty members of the rail community. Finally, the views expressed reflect a range of opinions across different organisations and levels of expertise. In order to further understand the day-to-day, operational challenges and capabilities regarding information provision, a sample purely consisting of on-the-ground and operational staff would probably be required. However, for the aims of the present study, which was to obtain a more general idea of the nature of information provision on the railways from a series of different stakeholders, the sample suited the purposes.

4.5 Conclusion

The aim of the current study was to meet the first research objective of the thesis: to understand the current state of rail information provision, the prominent topics of discussion within the rail community, and the opportunities

available for the improvement of passenger information. Figure 8 presents the findings in relation to the overall narrative of the thesis. The questions covered themes related to efficient information provision, existing research being conducted regarding the same, the idea of passenger types, and the future of passenger information provision during the process of rail travel. The main ideas extracted included an appreciation of the prominent achievements and challenges regarding the successful provision of information to passengers, and the differing priorities of different types of passengers. Following the presentation of the perspectives of the rail community, the next chapter will focus on the other side of the coin: the passengers.

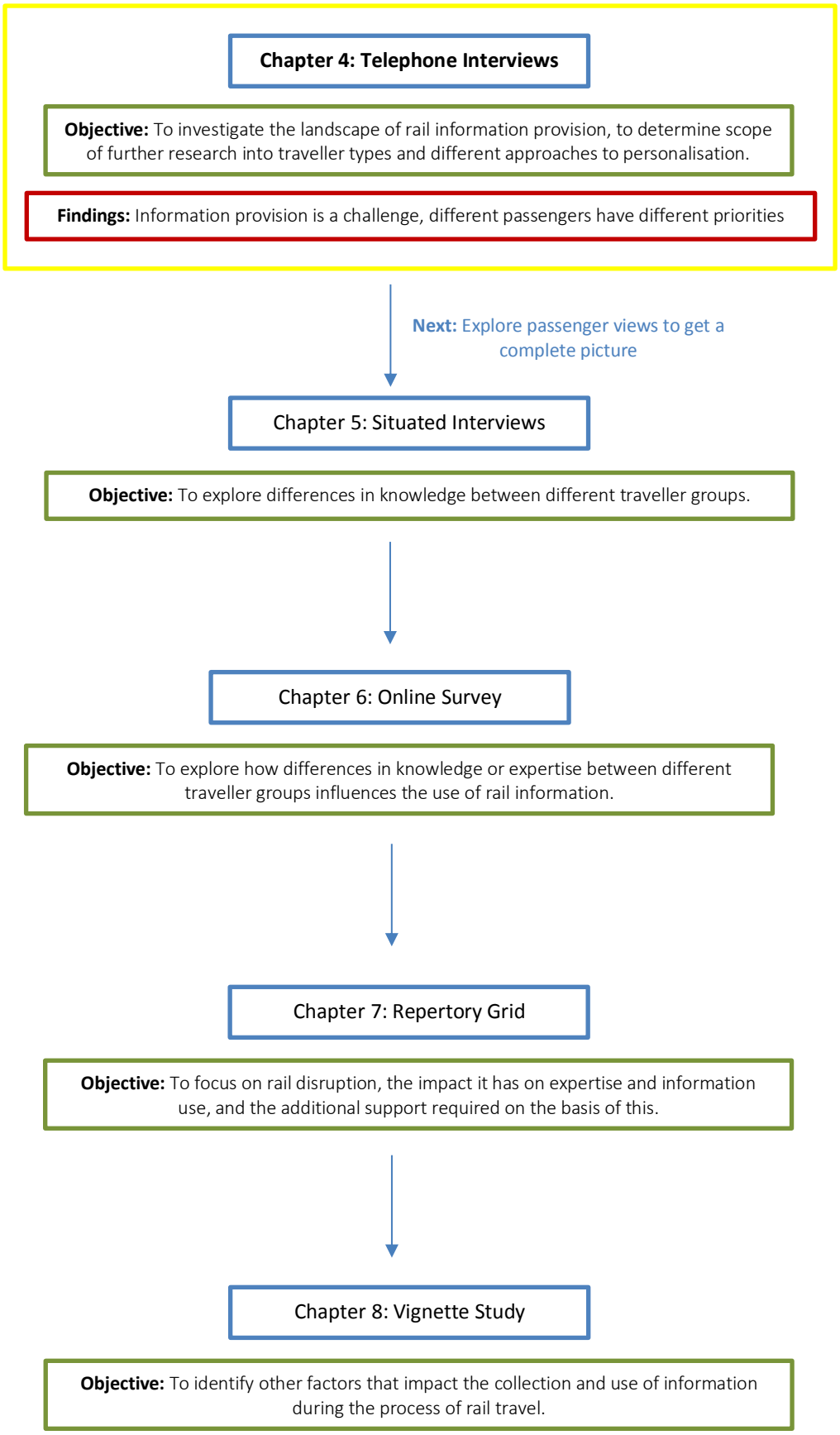


Figure 8. Thesis narrative schematic.

5. Situated Interviews: Passenger Perspectives on Rail Travel in Great Britain

5.1 Chapter Summary

The present chapter offers an in-depth understanding of the journey experiences of rail passengers, with an investigation into the informational priorities of frequent travellers and leisure travellers. The aim of the study was to examine the second research objective of this thesis: to explore differences in knowledge or expertise between different traveller groups. Sixteen semi-structured interviews were carried out with the participants within their travel environment, with the aim of collecting rich qualitative data about their journeys. Questions related to their experience of using the rail service, disruption management, and the possible enhancement of the information provided by the rail service. Through a thematic analysis (Braun & Clarke, 2006), participant perspectives surrounding six main topics were discussed: journey experience, rail infrastructure, crowding, disruption, information provision and travel planning.

5.2 Introduction

One of the main concepts explored within the area of customer experience has been the notion of information provision. A prominent example is the study

conducted by the Office of Rail Regulation (2012) with South West Trains on seat availability. One of the major findings was that around ¾ of customers had not viewed the information, suggesting the requirement for greater visibility of pertinent travel knowledge. Understanding both the content and delivery mechanism of information required within the specific context of a travel situation is crucial to delivering a satisfactory experience.

An important aspect of this is the existing knowledge of the passenger regarding the nuances of rail travel. An instance of this would be the consideration of frequent commuters. To refer back to the literature on this traveller type, studies have proposed that they tend to value the quickest method of travel possible (Hine & Scott, 2000), achieving this through the development of a practiced itinerary, thus requiring less-detailed information - if any (Grotenhuis, Wiegmans, & Rietveld, 2007). They also tend to value the "instrumental" (or practical) factors of their trip over the "affective" facets (Anable & Gatersleben, 2005). The experience that commuters have with the use of public transportation like the railways causes an increase in relevant trip-based knowledge (Dziekan, 2008), or expertise (Gustafson, 2012). To explore this further, the aim of the present study was to analyse the journey behaviour and information use of frequent commuters, comparing them to leisure (less/non-frequent) travellers, in order to explore the possible differences between their priorities, journey behaviours and information. Through this, the second research objective of this thesis was investigated: to explore differences in knowledge or expertise between different traveller groups. Additionally, following the industry interviews conducted, the aim of the

present study was to gain perspectives from the other side, which had not yet been investigated within the context of this thesis. The goal was to compare and contrast the views of the industry and the manner in which customers experience rail travel in GB.

5.3 METHOD

5.3.1 OVERVIEW OF METHOD

A "go-along" method (Carpiano, 2009) was implemented, in order to situate the interview within the travel context and understand the concerns and actions of the traveller in accordance with the relevant environment. The observations and comments of the participants are grounded in their lived experience, providing a more naturalistic form of data collection. The objective of this interview method is to "not only observe people's neighbourhood environments, but to also study people's perceptions, processing, and navigation of their environments" (Carpiano, 2009). Following data collection, thematic analysis was used to elicit the main concerns of both groups of passengers (Braun & Clarke, 2006).

5.3.2. PARTICIPANTS

Sixteen rail travellers were recruited for semi- structured "go-along" interviews (Carpiano, 2009). Eight of them were frequent travellers of different occupational backgrounds - they were employed at the time and commuted to

work via rail anywhere between three to five days a week. Following this, the interview process was replicated with eight leisure travellers, who were travelling for a variety of (non-work-related) reasons. This was an opportunity sample, recruited via the circulation of emails and posts on social media (Appendices B1 and B2). In the interest of safety, all participants were either known by the research team, or contacts of colleagues and acquaintances. Participant contact and travel details were noted by the researcher and the primary supervisor of the Ph.D project (Table 5). A lone worker protocol was designed for the process, which will be described in further detail later in this section.

Table 5. Participant details.

Frequent Travellers				
Participant No.	Gender	From	To	Journey Duration
1	Male	Nottingham	Lincoln	56 min
2	Male	Long Eaton	Leicester	24 min
3	Male	Nottingham	Sheffield	54 min
4	Male	Gloucester	London	1 hr 57 min
5	Male	Mansfield Woodhouse	Nottingham	47 min
6	Male	Nottingham	Birmingham	1 hr 12 min
7	Female	Birmingham	Nottingham	1 hr 11 min
8	Female	Matlock	Nottingham	1 hr 10 min

Leisure Travellers				
Participant No.	Gender	From	To	Journey Duration
1	Male	Nottingham	Sheffield	50 min
2	Male	Long Eaton	Sheffield	50 min
3	Female	Nottingham	Luton	1 hr 20 min
4	Male	Nottingham	Tamworth	50 min
5	Male	Nottingham	Ely	1 hr 40 min
6	Female	Birmingham	Nottingham	1 hr 12 min
7	Female	Birmingham	Nottingham	1 hr 12 min
8	Female	London	Nottingham	1 hr 40 min

5.3.3 MATERIALS

Questions asked were developed following the review of both academic and industrial literature on passenger experience, as well as through consultation with rail industry experts (Appendix B5). Pen-and-paper transcriptions were made of the entire conversation with each participant – this method was chosen in order to avoid any issues that could arise regarding making audio or video recordings in a public place. As a railway carriage consists of a number of passengers – particularly during peak travel times – the possibility of gaining consent to be recorded by everyone in the carriage would have been quite difficult.

Six broad questions were selected:

1. How did you plan your trip? What information did you refer to?
2. What would your options be if this journey was disrupted?

3. Have you had any previous experiences with disruption? How often are your journeys disrupted?
4. What are the sources of rail information that you trust?
5. If you use/would consider using a mobile application to gather rail information, what would features would it ideally have?
6. Do you have any other observations regarding your experiences using the GB rail service?

5.3.4 Procedure

The interviews occurred during a selected train journey for each participant, beginning with an initial introduction at the platform, and ending upon arrival at the destination. The interviews began with general discussions about the process of planning their travel, followed by conversations around the planned questions. The interviews started when the journey began and ended either when the participant had responded to all the questions, or when the journey ended. There were, as to be expected, differences in the amount of data gathered based on the length of the journey. On the shorter journeys (mainly, the journey that was 24 minutes long), there was only room for the traveller to answer the questions asked. On the longer journeys, participants would provide more detailed answers, refer to their environment, or describe specific instances to illustrate their point – one participant, for example, described an instance of a train being on fire, which caused a significant delay to his trip to work, to

explain his rail experiences. In addition to this, some examples of environmental prompts were the amount of crowding on the train, onboard announcements and the weather.

5.3.4.1 Lone Worker Protocol

The purpose of the lone worker protocol was to ensure the safety of the investigator, while in the field and away from the university. A supplementary document was submitted for approval to the Ethics department alongside the Ethics application forms. It identified the possible risks involved in the study procedure, and specific steps taken to mitigate them.

The rail journeys were organised via email, with a copy of the arrangements sent to the lead supervisor. Participant details (name, phone number, journey times) were noted on an Excel file shared with the supervisor. In addition to this, participants were asked to present a photographic ID to the lead researcher upon arrival at the platform. Prior to the interviews, the supervisor and administrator of the Human Factors Research Group at the University of Nottingham reviewed each interview on a case-by-case basis, ensuring that the travel times (standard working hours) were appropriate, and relevant details had been collected.

During periods of data collection, the lead research notified the primary supervisor by text message at the following points:

- Upon arrival at the station.
- Upon meeting the participant.
- Upon boarding the train.
- Upon arrival at the destination, and the end of the study procedure.

- Regarding onward travel plans.

Though not required for the duration of the study, the absence of a text would have resulted in two staggered phone calls to the researcher from the supervisor, followed by a call to the police if there was no reply. The investigator was also required to carry cash for a possible emergency, and to inform the supervisor of contingency plans in the case of a major disruption.

5.3.5 Analysis

The main researcher for this project captured the written information in a notebook, which was then transcribed onto a Word document. This final document was sent to participants for them to check whether or not their comments or perspectives had been captured accurately, or whether they had anything that they wanted to elaborate on.

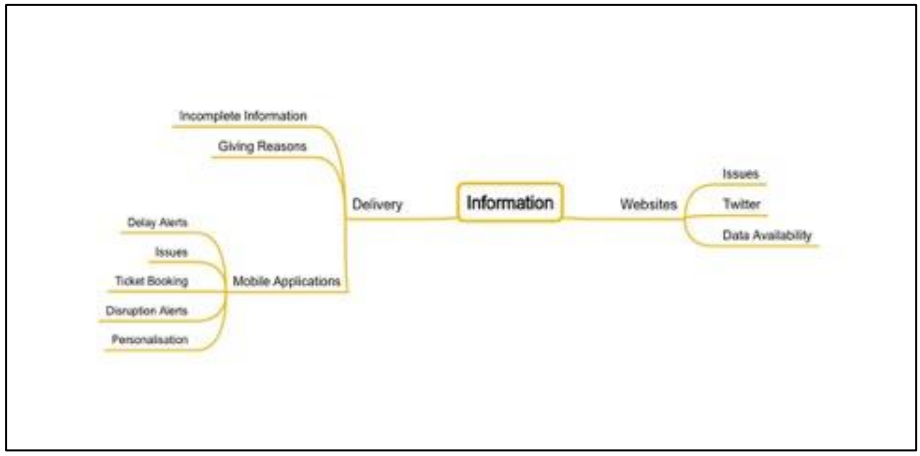
The interview questions were analysed thematically (Braun & Clarke, 2006), involving an in-depth examination of the transcripts, and a preliminary drafting of comments. The answers gathered for these interviews were all analysed together. The aim was to understand the main opinions of passengers with a focus on their experiences, as opposed to the gathering of specific answers for questions related to customer experience, as in the previous study. The written notes were typed out, and a preliminary analysis of the data resulted in the extraction of high-level thematic areas. Each interview was examined, with the main points extracted highlighted, and colour-coded. A different colour was assigned for every new code that

emerged. The transcripts were then collated and similar codes were grouped to form broader themes and sub-themes. The transcripts were coded inductively, resulting in the extraction of six main themes, with individual sub-themes (Table 6).

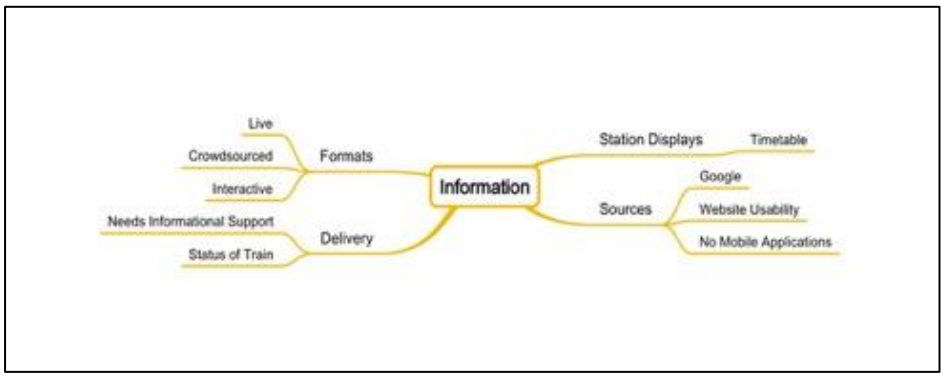
Table 6. Themes extracted from the interview analyses.

Theme	Description
Journey Experience	General factors influencing the experience of travelling by rail.
Infrastructure	The layout/build of trains and/or stations.
Crowding	Psychological impact of a high level of density in the rail carriage.
Disruption	Delays/cancellations caused by issues with infrastructure, rolling stock, accidents, and weather conditions.
Information	Factors related to sources and types of information referred to before/during/after rail travel.
Planning	Process of decision-making and subsequent actions taken before/during/after rail travel.

Figures 9a. and b. provide an example of the sub-themes extracted from the coding of the interviews for one of the themes ("Information").



9a. Interview themes for commuters.



9b. Interview themes for leisure travellers.

Figure 9. Example of the interview coding of sub-themes for "Information".

5.4 Results and Discussion

This section will involve a detailed examination of each thematic area, along with the provision of examples from the interview transcripts. It will conclude with a reference back to the main research objective of this study: to explore differences in knowledge or expertise between different traveller groups.

5.4.1 The Journey Experience

This theme describes the general factors that influence the experience of travelling by rail. Some of the ideas brought up by both groups of travellers included the activity of working during the process of travel (for example, Commuter 8 ensures that she gets a table during her trip, so that she can work), a preference for rail travel over other modes (half of the commuters find it easier to travel via rail to work, and Leisure traveller 1 "feels more in control while on the train"), and comments on the high frequency of travel conducted (two commuters and three leisure travellers discuss their high level of rail experience). The first two sub-themes are the focus of entire areas

of research – activities conducted during the process of rail travel (Lyons & Urry, 2005, for example) and the exploration of travel mode preferences (Bamberg, Ajzen, & Schmidt, 2003, for example). The final sub-theme, however, is interesting, suggesting that the knowledge and/or rail experience of the participants were not defined by their groups – participants seem to fall on a continuum – rather than a dichotomy - between "novice and expert" (Benner, 1982). Thus, the exploration of the differences between the information-use of different types of rail travellers might require a more phased approach, exploring the process of learning that might transform novice travellers into experts regarding specific journey factors.

As seen in the literature, commuters seemed to be more concerned about the "instrumental" aspects of the journey (Anable & Gatersleben, 2005). Seat availability is mentioned as being of particular importance to Commuters 4 & 7, for example, and 3 commented on "working around" any issues on the trip, with getting to work on time being the main priority (as stated by a majority of the commuters). Mirroring Anable and Gatersleben's (2005) study as well, the leisure travellers valued both "instrumental and affective" factors equally. The sub-themes from this group cover a range of factors, from the impact of route knowledge on travel behaviour (Leisure traveller 7 mentioned going straight to the platform without a reliance on any information on specific routes due to a familiarity with the trip) to how often travel is conducted (8 had a varied travel frequency) to a consideration of other modes (2 and 7 explored the best travel option across various modes of transport) and more broadly, the experiences of rail in GB, compared to other countries (Leisure

travellers 2, 7 and 8 discussed their preferences for rail services in countries like Italy and China, for example). The concerns regarding the experience of rail travel differed between groups, as seen by the contrasting sub-themes extracted from the interviews.

5.4.2 Infrastructure

This theme explores the structural issues mentioned by participants in their discussion of train and station layouts. Both groups discussed the issues of mobile connectivity (Commuters 1 and 7 mentioned an inability to check for information due to a lack of reception, as did Leisure travellers 2 and 8) and station layouts (Commuter 1 discussed the specific issues he has with the lack of a back entrance at his local station, as well as the small number of ticket machines, for example, while Leisure traveller 1 had difficulty locating the bathroom during her travels). Note that mobile connectivity is a particularly interesting instrumental factor within this context, due to its recent transformation from being a more novel facet to being considered a necessity.

In accordance with the previous discussion surrounding the differing priorities between the groups, the commuters stated that the main solution to a better rail infrastructure was the improvement of the trains themselves (Commuters 1, 5 and 8). The leisure travellers, on the other hand, delved deeper into the experiential factors of the journey, and discussed the disruptive nature of loud announcements (Leisure traveller 1, for example), the temperature within the carriage (1 and 2), and the impact of the behaviour of other passengers on

journey experience (1 and 3). This, as previously mentions, matches the literature: commuters have more practical travel concerns, as opposed to leisure travellers who value the improvement of the experiential aspects of the journey more (Anable & Gatersleben, 2005).

5.4.3 Crowding

Within the transportation literature, crowding has been defined as being a "psychological phenomenon" caused by a high level of density in the rail carriage (Cox, Houdmont, & Griffiths, 2006). Both participant groups had different ideas regarding this aspect of rail travel, with no commonalities in the sub-themes extracted from the two sets of interviews.

Commuters commented on the fact that they could simply adjust to crowding – Commuter 2, for example, mentioned just asking people to move around if possible. However, a prominent feature of the discussions surrounding crowding was the consideration of the factors that cause it. Most commuters remarked that journeying through specific regions resulted in a larger number of people within the train carriage (Commuters 4 and 7 mentioned travel to and from London, for instance, while Commuter 6 commented on the occurrence of crowding on his trip due to the fact that "Birmingham is a big city"). In extension, commuters also remarked on the link between the route travelled on and crowding. Commuters 2, 6 and 7 discussed their preferences for travelling with certain train operating companies, due to their efficiency with regards to the management of crowding, comparing them with other service

providers. In this manner, commuters seem to understand the nuances of the "crowding" experience, based on their observations, and see it as an issue to adjust to during their travel.

Alternatively, leisure travellers – as noted previously – focused more on the actual experience itself, rather than the practicalities of it. Half of the travellers brought up crowding as a factor that negatively impacted the experience of rail travel – Leisure traveller 3, for example, stated that he "doesn't want to feel like a sardine". In addition to this, the travellers mentioned the lack of seating as a pertinent issue – Commuters 6 and 7, for instance, stated that the lack of a seat would ruin the journey for them. Again, the focus was on the environmental and emotional factors, rather than just the necessities required to complete the trip.

5.4.4 Disruption

This theme encompasses factors related to delays or cancellations caused by issues with infrastructure, rolling stock, accidents, and/or weather conditions. Almost all participants, across both groups, mentioned a memory of a significant disruption incident. All the commuters described a major disruption that they had faced while travelling via rail, while six of the eight leisure travellers had an incident to discuss. These include references to extremely long delays, major issues with rolling stock, extreme weather, signalling issues, serious accidents and issues with information provided. However, most travellers also mentioned that the occurrence of major disruptions was rare -

seven of the eight commuters stated that their trip to work was usually fine, with a very low chance of disruption. Mirroring this, seven of the eight leisure travellers stated that they had either never/very rarely had a major disruption while travelling via rail. The experience of a major rail disruption seems to be both memorable and fairly rare. Finally, both groups mentioned the process of obtaining refunds. Commuter 5, for example, described his appreciation for having been able to obtain a refund for a bad disruption experience, and some leisure travellers (5 and 8, for example) discussed their (lack of) knowledge of the refund process.

Commuters focused on the occurrence of delays, and discussed the causes associated with them, as well as their experiences of them. Commuters mentioned the occurrence of a fairly regular delay on their trip to work (Commuters 3, 6 and 7, for example), while some went on to state that they even expect the occurrence of some sort of delay (Commuter 8). However, in accordance with their previous statements surrounding the lacking occurrence of frequent disruption, commuters (3 and 5, for example) mentioned that they only face short delays on their trips.

Beyond this, commuters were keen to discuss their perspectives on the causes of disruption on the railways. Commuter 1, for example, mentions the increased occurrence of disruption on journeys of a longer distance. This group of participants, additionally, particularly focused on the difference between the journey to and from work. Commuters 1, 2 and 4 mentioned that their return journeys were much more likely to be busy, while others (6 and 7, for instance) stated that they were more concerned about disruption on the way to work.

Unsurprisingly, time is a major factor to be considered when discussing the impact of disruption on the journeys of work commuters.

Contrastingly, some leisure travellers mention a lack of concern with delays – Leisure travellers 6, 7 and 8 stated that their rail travel was flexible, making it possible to work around any delays. The pertinent areas of concern, however, were related to information provision and uncertainty. These participants discussed a feeling of helplessness in specific disruption situations. Leisure traveller 1, for example, stated that there's nothing she can do if the train is simply standing still, while 4 and 8 described the confusion and uncertainty experienced by being in situations where no information was provided. Participants described processes of checking for information at the station, and particularities surrounding the reliability of the same. This will be discussed in further detail in the following section.

5.4.5 Information

In accordance with their views on disruption management, leisure travellers commented on the fact that more information to support their travel would be preferable (traveller 5), especially during disruption (8). They also commented on the value of knowing about the status of the train (3 and 8), which could include updates about journey progress (8), arrival times (2), or even live passenger comments regarding the train environment (3). In addition to this, these participants commented on their use of more traditional sources of information, like timetables at station (Leisure traveller 6), as well as a desire

for more diverse forms of information provision. Common opinions expressed included the provision of interactive information boards (8), and a higher level of trust for live and crowdsourced information (travellers 2 and 3). Finally, when it came to sources of information, these travellers were likely to rely on more general search engines like Google for the location of travel information (participants 2 and 7, for example). Leisure traveller 7 specifically commented on a preference for the use of Google due to usability concerns with other travel-planning mobile applications. She, along with other participants in this group (2 and 4), mentioned that they didn't consider rail-related mobile applications useful, and preferred to use either websites or Google for the purposes of journey planning.

In contrast, the commuter interviews involved references to multiple online and mobile-based sources of information, with a range of opinions surrounding specific features of these sources, and the factors that would improve them. Firstly, commuters commented on the nature of information provided – Commuter 8, for example, described having to compare information across different sources in order to get a clear idea of the situation at hand, while Commuter 1 talked about his appreciation for the provision of reasons in the case of a delay or disruption. As mentioned, participants in this group also discussed the particularities of different information sources. Most commuters mentioned their preferences for specific websites, with some having personal accounts on them (Commuter 7). In contrast, others described having no specific source due to a perceived similarity of data across all sources (1), or a reliance on the "main source": National Rail Enquiries (3 and 4).

Additionally, the commuters were the only ones to mention the use of Twitter as a source of information regarding their rail journeys. This group also discussed specific issues they had with train operating company websites and mobile applications. Commuter 1, for example, described his issues with the layout of the train operating company website that he has to refer to for his commute, while Commuter 3 commented on issues with the notifications he receives via the rail travel application he has on his phone. Finally, this group of travellers had a number of suggestions regarding specific mobile application features that would be useful to them – this included the provision of detailed disruption information (3), the ability to book tickets efficiently on the application (4) and the personalisation of the mobile application to their travel needs (1, 6 and 7).

The commonalities between the two groups with regards to information use surrounded four sub-themes: informational reliability, travel planning, sources and staff. Firstly, members of both groups commented on the fact that the staff are usually helpful (Commuter 2, and Leisure travellers 1 and 8, for example). Secondly, most participants across both groups mentioned that it was essential that information provided was timely and reliable, especially with regards to the navigation around problems faced during the process of travel. Both leisure travellers and commuters commented on looking up information only if there's an issue, resulting in an increased emphasis on the accuracy of the same. Additionally, most participants stressed upon the requirement for updated information on online sources and mobile applications and described their use of multiple sources. Some participants, for example, mentioned the

use of specific websites for planning their journey (Commuters 4 and 7, Leisure travellers 3 and 7) and other sources for service updates (Commuter 8, Leisure traveller 1). Finally, both groups had specific suggestions – based on their informational needs – for additional mobile application features that could adequately support their travel: push notifications for delay alerts (Commuter 7, Leisure traveller 1), mobile ticketing (Commuter 1, Leisure traveller 4), platform information (Commuter 4, Leisure traveller 6) and the provision of alternative routes in the case of disruption (Commuter 2, Leisure traveller 8). While these basic features are available across different applications – Trainline, for example, has delay alerts, and certain train operating companies provide mobile tickets – this points towards the requirement for a single, accessible, comprehensive source of information that caters to the various needs of diverse groups of travellers.

5.4.6 PLANNING

Regarding the process of journey planning, both commuters and leisure travellers had several similar comments to make about different stages of the journey, ticketing, train times, and alternative modes of transport. The main sources of confusion for both groups were the purchase of tickets (Commuter 1, Leisure traveller 4, for example) and the availability and/or use of alternative routes during disruption. Most of the participants expressed a lack of knowledge about alternative routes for their journey (nine out of sixteen). While some could come up with alternative options when asked, participants

also mentioned that their possible "alternative plans" would be inconvenient for them. Commuter 6, for example, mentioned that his alternate plan would get him to work late, while Leisure traveller 5 stated that it would result in missing out on planned events in his itinerary. Participants also discussed the process of making connections - Commuter 3 and Leisure traveller 8, for example, commented on an increased level of stress regarding the trip if there is a connection to be made during their journey. Both groups also discussed the different stages of their trip. In order to begin their journey, several participants talked about having to account for multiple modes of transport. Commuters 2 and 3, for instance, had to consider the availability of bike storage on the train whilst making their trip to work. Additionally, while half of the participants stated that their trains were fairly standard and reliable, some described having to plan other events in their day around train times and possible delays. Commuter 7 stated that she arranges meetings based on her train times and the likelihood of delays, while Leisure traveller 8 described picking off-peak trains in order to be home with her children in the evening. Participants also mentioned an uncertainty about journey progress while on the train – Commuter 3, for instance, mentioned that it's hard to tell if a train is delayed. Finally, both groups commented on various pre-trip experiences, such as having to rush during their journey (Leisure traveller 1) - sometimes due to last minute platform changes (Commuter 5) - or having to consider the weather before leaving the house (Commuter 4, Leisure traveller 4, for example).

With regards to the differences between groups, the main concern of the leisure travellers was cost – both with regards to their consideration of alternative

modes of transport, and their ticket bookings. This group of participants mentioned looking across a variety of travel modes and comparing them based on ticket prices (five out of eight of them). Similarly, Leisure travellers 6 and 7 described buying off-peak tickets, often without seat reservations, due to the lower cost and flexible travel times (as opposed to the purchase of an Anytime ticket). Finally, the key difference between this group of travellers and the commuters was the increased amount of planning – half of the participants mentioned arriving quite early in order to make sure to get the train that they desired, and described still having to rush, due to concerns regarding missing the train.

In contrast, half of the commuters described getting to the station right before the train was due to leave, with some of them finding out about disruption only upon arrival due to little or no reference to information prior to leaving the house (Commuters 2 and 3, for example). Additionally, commuters valued the shortest trip home (6 and 7), as seen in the transportation literature (Hine & Scott, 2000). Finally, while the commuters did mention having cost-related concerns (Commuters 1 and 3 don't consider the season pass to be worth the money, for instance), their main comments regarding the tickets purchased – in contrast with the leisure travellers – revolved around the type of tickets they buy (season or Advance ticket and why, for example), their choice to reserve seats to ensure a comfortable journey (Commuter 7), or their opinions on mobile ticketing (Commuter 1 stated a desire for mobile tickets, while Commuter 6 did not see it as a requirement, and Commuter 3 uses them already). This reduced concern surrounding planning and ticketing mirrors the

existing literature regarding the reduced information-seeking behaviour of experts (Shanteau, 1988) and regular travellers (Gustafson, 2012).

5.4.7 Observations: Traveller Behaviour

As mentioned, the main benefit of the situated interviews was to ground participant responses within their "lived experience" (Carpiano, 2009) – while this comes with the benefit of environmental triggers for the responses gathered, accompanying participants on their journeys also provided an opportunity to gather some interesting observational data. The main takeaway was with regards to the aforementioned differences in the travel behaviour of leisure and frequent travellers, which were a product of both experience and the purpose of the trip. As seen in the paper by Anable & Gatersleben (2005), leisure travellers were equally focused on factors that were crucial to the completion of their trip and additional affect-related factors. A few participants, for example, were extremely concerned by the temperature inside the train carriage and excessive crowding. They paid as much attention to these factors as they did to the gathering of information. In contrast, the frequent travellers mostly commented on the "instrumental factors" (Anable & Gatersleben, 2005) – delays to their journey, and a lack of seating.

Additionally, there were clear discrepancies in travel behaviour – this was expected, based on the literature around both frequent commuters and experts. Most of the frequent travellers arrived at the platform right before their train. An example that was quite amusing in hindsight was an interview with one of

the work commuters, who arrived right in time for the departure of the train, much to the relief of the lead researcher, who had been getting increasingly worried about their lack of appearance. In contrast, all the leisure commuters got to the station well before their train, particularly when they had to travel to the airport. An interesting contrast was between two specific participants, one travelling for leisure and another for work: while the leisure traveller mentioned arriving at the train platform 20 minutes prior to the departure time, the work commuter said that he was accustomed to leaving his house 20 minutes before his train. This discrepancy is interesting, as it influences their use of information as well. These differences between the leisure travellers and work commuters provide good anecdotal evidence for the existence of key differences in the travel behaviour based on knowledge and experience.

5.4.8 Methdological Learnings

With more focus being placed on the efficient provision of information to rail passengers, and an increase in the number of sources of information that contribute to the planning and management of this form of travel, there is value in exploring the best way to provide information in a manner that caters to diverse groups of travellers. The combination of observational and qualitative interview data regarding differing journey experiences conducted by this study contributes towards the development of a rich understanding of the manner in which to tailor information provision to varied passenger groups.

One of the main limitations for this study, however, was the small sample size. Due to the study design and complexities involved, it was not possible to conduct the interviews with a larger sample. However, the choice was made to prioritise the nature of the data over the size of the sample – as mentioned, the process resulted in rich observational data regarding the interaction between the individual and the context, as well as environmental prompts for the individual to recall more pertinent information. Additionally, the aim of this study was to provide a foundation for future research – the following studies examine some of the main themes of interest presented by participants in this study with a larger sample.

5.4.9 Next Steps

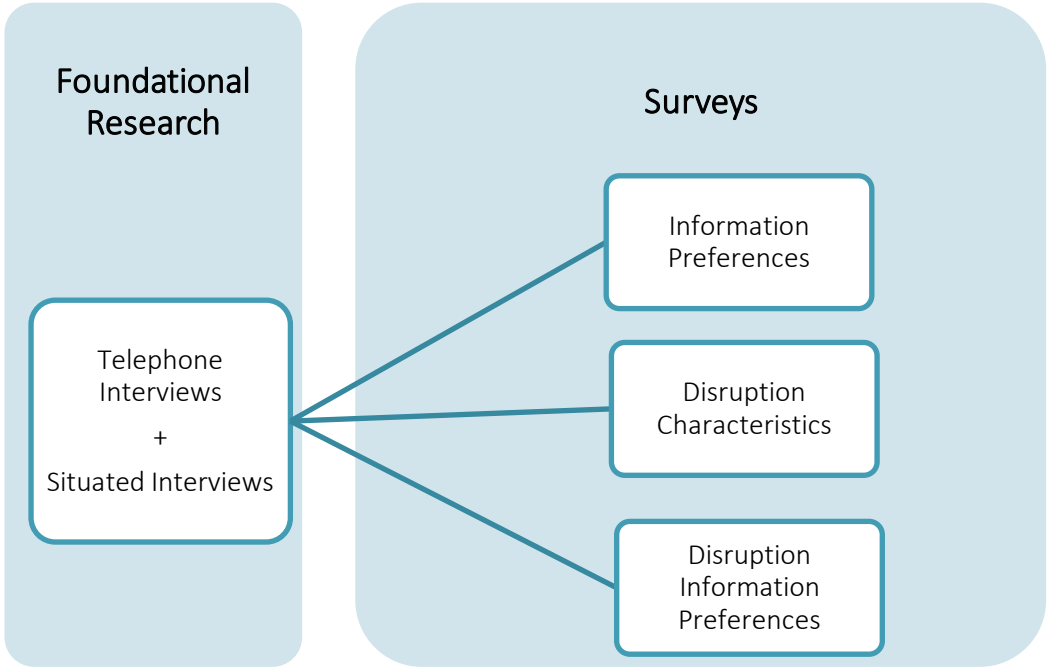


Figure 10. Research framework for the present Ph.D project.

Referring back to the research framework (presented again, as Figure 10), the industry interviews and passenger interviews provide the foundation for the future research in this thesis. Following the exploration of the industry perspectives in the previous chapter, the situated interviews provide an idea of the passenger perspectives. The analyses address the second research objective of this thesis: to investigate whether different groups of travellers travel differently. In short, it is fair to say that this is true. There are distinct differences in the opinions, travel behaviour, and information use of leisure travellers and frequent commuters. This sets the scene for the next three studies within this research project - in particular, the first survey within this thesis.

The next logical step would be to examine this amongst a larger sample, which is the aim of the following study, which looks at expertise and travel frequency, and its link to the information requirements of rail travellers. The output from both of the interviews highlighted a few pertinent areas that were of concern to customers – these were used to guide the selection of the survey material for the following study, and help shortlist the final items presented to the participants.

More importantly, the main takeaway from both interviews were the similarities between the industry perspectives and passenger comments on two important areas of exploration within this thesis: the differences in passenger knowledges, and the key challenges involved with regards to handling rail disruption. This provided strong support for the next phases of research, by

confirming the fact that a) passenger differences do exist, and b) disruption management is a major challenge for both parties.

5.5 CONCLUSION

This study analysed a series of semi-structured rail traveller interviews in order to develop an in-depth understanding of the passenger experiences of frequent travellers, in order to compare their travel behaviour with that of leisure travellers. This matched the second aim of the thesis: to explore differences in knowledge or expertise between different traveller groups. There are differences in the way these two groups of participants approach processes of journey planning and information-seeking. Commuters require less information and place more importance on shorter journeys and practical trip improvements. Further, there is a clear distinction between the more "instrumental" concerns (Anable & Gatersleben, 2005) of commuters, as opposed to experiential concerns of the leisure travellers. Figure 11 presents the findings in the context of the overall narrative. The next chapter will explore this further, by looking at the differences in the information preferences of rail passengers with varying levels of travel experience and expertise.

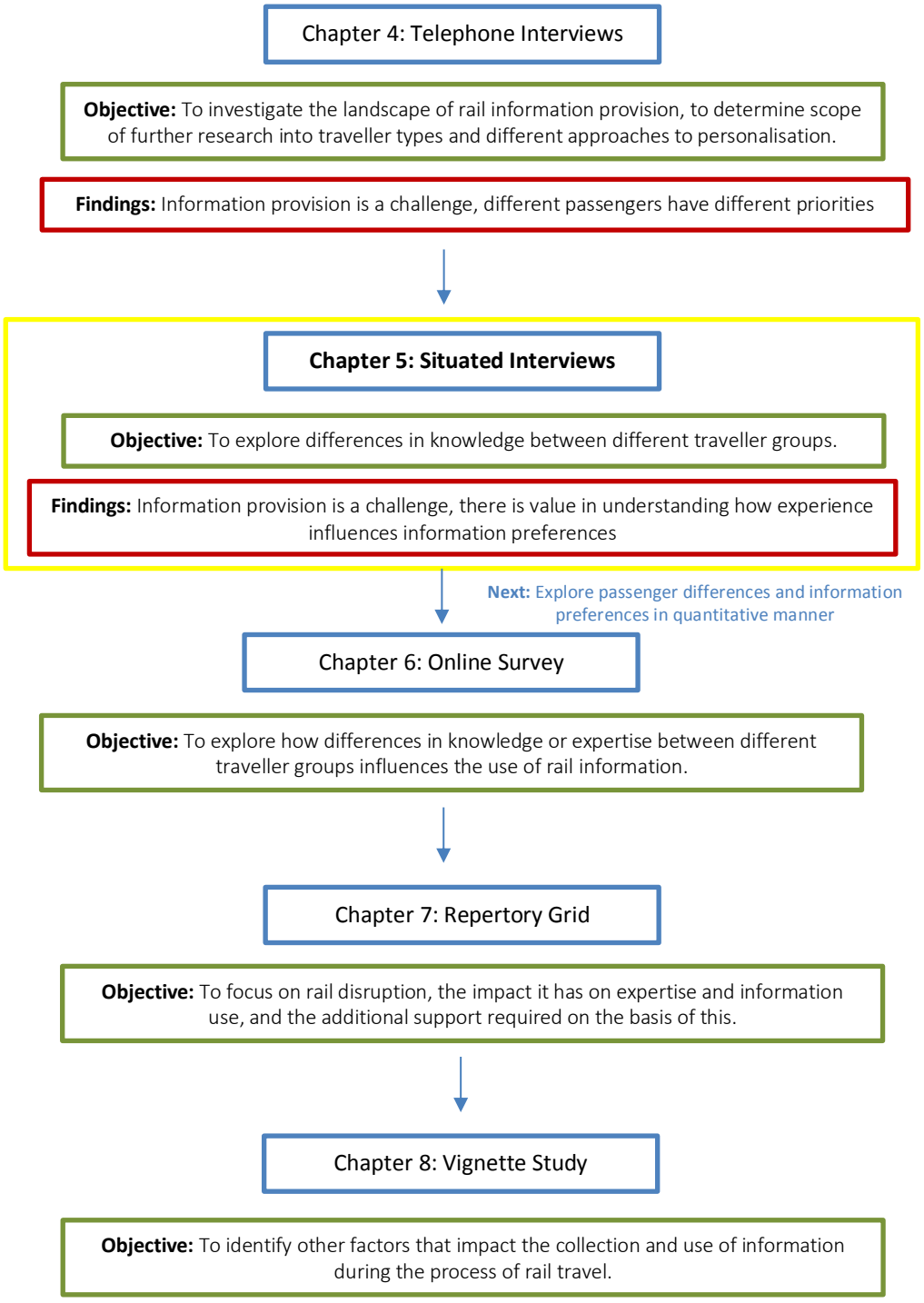


Figure 11. Thesis narrative schematic.

6. Survey One: Expertise, Travel Frequency & Information Preferences

6.1 Chapter Summary

The current chapter examines the link between expertise, travel frequency and information preferences, aiming to expand upon the findings of the previous studies in a large-scale, quantitative manner. Specifically, this chapter investigates the third research objective of this thesis: to test how differences in knowledge or expertise between different traveller groups influences the use of rail information. Through the use of a survey method, participants were asked to provide ratings of their own level of expertise and frequency of travel, both on the railways in general, and with regards to specific journeys completed. They also rated a series of information functions based on how useful they were to the process of rail travel. An analysis of the results shows that a) the information functions provided by the rail industry fall into some very distinct groups, and b) both travel frequency and expertise play a small role with regards to passenger preferences for these different groups of information.

6.2 Introduction

With increased rail industry investment into passenger satisfaction and customer experience, there is a requirement to ensure the quick delivery of the

most relevant information to passengers. The recognition of this objective has led to an interest in the personalisation of customer information. The precursor for effective personalisation is an understanding of the factors that influence customer behaviour. As discussed in previous chapters, one of the proposed influences is the level of knowledge possessed by the traveller. There is a strong relationship between expertise or knowledge and information use – expertise is learned through the gathering and processing of task-relevant information over time, resulting in the development of patterns that cause expert behaviour (Zimmerman & Schunk, 2001; Shanteau, 1992). As seen in the passenger interviews presented in Chapter 5, frequent travellers obtain and use information in a different manner, moulding it to the context on the basis of past experience. This matches the existing literature on expert behaviour – experts have detailed knowledge (Shanteau, 1992), and show better use of it (Gobbo & Chi, 1986). In addition to this, the "expert" within the travel context (the frequent traveller) has been highlighted in both the industry stakeholder interviews within this thesis, and the transportation literature (Aarts et al., 1998; Grotenhuis et al., 2007), as requiring less attention to information, and being more confident in their actions and decisions. Based on this, the aim of the present study was to use these differences to understand how information preferences could vary between different types of travellers. The main research objective was to explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.

At this point, two salient elements regarding expertise are worth re-iterating – firstly, the relationship between expertise and frequency of travel; and secondly,

the notion of domain-specific expertise. As mentioned, frequent travellers and/or commuters are considered to be experts due to their continuous interaction and familiarity with the travel context, resulting in the gathering of advanced relevant information and experience (Dziekan, 2008; Gustafson, 2012). This is matched by the psychological literature, which describes the link between the repeated practice of a specific task or skill, and expertise (Ericsson & Harris, 1989, for example). This suggests a link between increased travel frequency – more "practice" and familiarity with the task of travelling – and higher levels of relevant (travel) expertise. As noted in the previous studies, both industry members and passengers themselves comment on the link between travel behaviour and situational familiarity.

In addition to this, previous research has commented on the task specificity of expertise, both within the psychological literature (Chase & Simon, 1973; Glaser & Chi, 1988; Shanteau, 1992), as well as transportation research – Gustafson (2012) describes frequent travellers as being experts "within their domain". With this in mind, there is the suggestion of a possible difference between expert knowledge when it comes to rail travel in general versus specific trips that travellers have advanced knowledge about. Previous studies conducted as part of this thesis suggest just the same – participants in the situated interviews note that their advanced knowledge is with regards to the trip that they complete frequently, with new journeys requiring planning from scratch. This suggests that there is a difference between "general" and "specific" trips based on the amount and type of information required. With regards to personalisation, an appreciation of these different requirements is important: people with a high

level of expertise regarding a specific journey would probably require a lot less informational support for that trip, as opposed to a completely novel train journey. Understanding the extent of domain specificity with regards to travel knowledge could provide an easy solution to immediately identify differing trip-based needs.

Based on the mentioned theories – as well as previous research conducted for the present project - a set of experimental hypotheses were made regarding rail travel frequency and trip-related expertise:

1. Frequent travellers will rate themselves as having higher expertise. This is based on the existing literature around practice and familiarity of the travel context (Aarts et al., 1997; Dziekan, 2008, Ericsson & Harris, 1989).
2. This will also extend to travel on a specific trip – this is related to the research on domain specificity (Shanteau, 1992). Additionally, previous studies in this thesis highlight the advanced knowledge of commuters only regarding their commute, and not rail travel in general.
3. In relation to the previous point, people will also generally rate themselves higher on trip-specific expertise than they would on general expertise. There will also be a positive correlation between taking a specific trip and general expertise.
4. The most important information to passengers will, firstly, be basic knowledge about successfully being able to complete their trip – not only intuitive, this is also a key aspect of investigations into stress and control (Cox et al., 2006).

5. Cost is seen as being one of the top priorities for customers, based on industry research (Passengerfocus, 2014, for example) – cost-related information will be rated highly.
6. Other prioritised forms of knowledge include information regarding seating (Office of Rail Regulation, 2012) and timing (Transportfocus, 2017b), both of which should also be rated highly.
7. Finally, delay repay is currently a major area of investment within the rail industry (Transportfocus, 2016). This should probably be a priority to rail passengers as well.

Finally, the main research objective for this chapter was to test how differences in knowledge or expertise between different traveller groups influences the use of rail information. The final hypothesis for the study addresses this:

8. There will be differences between the informational preferences of travellers with high and low levels of self-rated expertise, as well as high and low levels of travel frequency.

6.3 METHOD

6.3.1 OVERVIEW OF METHOD

Surveys have been used extensively to examine passenger behaviour and customer experience in both the academic (Cox et al., 2006; Grotenhuis et al., 2007; Hine & Scott, 2000) and industry (Office of Rail Regulation, 2012; Transportfocus, 2017a) research. An excellent example of the benefits of the use of this method within the last few years has been the Traveller Needs and UK

Capability study (Transport Systems Catapult, 2015), which managed to capture opinions from participants across the country, looking at a variety of topics ranging from travel mode preferences to accessibility issues to attitudes towards future research. The online survey method was selected for the present study to gather a substantial body of quantitative data from across Great Britain, related to both travel behaviours and preferences, in a manner that was quick, efficient and had the potential to access a large sample of the population.

6.3.2. Design and Materials

The survey was implemented using JISC Online surveys (formerly known as Bristol Online Surveys).

6.3.2.1 The Expertise Section

Section one asked participants a series of "expertise-related" questions. Based on the literature on: a) the relationship between journey frequency and expertise and b) the difference between general rail travel and trips completed for specific purposes, four questions were asked.

1. General Travel Frequency: *"How often do you travel on the railways?"*

   This was a multiple-choice question, with the following options:

   Daily, 2-3 times a week, Weekly, 2-3 times a month, Monthly, Once every few months, Few times a year, Once a year, Never

2. General Rail Travel Expertise: *"What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?"*

Each participant had to rate the questions on a 7-point rating scale, with "1" meaning no knowledge at all to "7" standing for expertise.

3. Specific Trip: *"Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family""*

   A yes or no question.

4. Specific Trip Frequency: *"How often do you make this trip?"*

   Same multiple-choice options as Q1.

5. Specific Trip Expertise: *"If you answered "Yes" to the previous question, what level of expertise do you think you have regarding that specific journey?"*

   Same rating scale options as Q2.

Though seemingly objective words, the terms "often" and "comfortable" were not given a specific definition, due to the subjective nature of rail travel. The intent was to avoid prescribing the researcher's own beliefs regarding what aspects like familiarity with the travel process and frequency of rail travel mean. Additionally, it is worth mentioning the difference between the options provided for the Expertise questions and the Travel Frequency questions. While the Expertise questions are on a scale of 1-7, the Frequency questions were assigned specific options ("Daily", "Weekly", etc) due to the complexities involved in allowing participants to self-select their own travel categories – allowing participants to provide their own specific values (which could be anything from 2 times a week to 14 times a month) would have made it difficult to categorise the data due to the risk of not having enough instances of each option. This

resulted in the use of an ordinal scale, which requires non-parametric statistics: Spearman's (instead of Pearson's) correlations and Mann-Whitney tests (instead of t-tests), for example.

6.3.2.2 The Information Functions

The process of designing this section began with an audit of multiple rail-related/travel-planning/ticketing/public transportation websites and mobile applications. Every individual type of information provided to customers was gathered, ranging from fare finders to travel planners to weather reports. "Similar" items were then grouped – for example, information about power sockets, pets and bike storage options were all grouped under "onboard facilities". The following types of information were excluded from the final list, due to the focus of this study on basic rail-based travel planning and information use:

1. Information that people would like to have out of personal interest, which could be considered as being "add-ons" to the main travel planning process (tourism information, carbon calculators, information for rail enthusiasts, for example).
2. Information that was aimed at business accounts or travel management services, as the aim of this study was to look at individual rail travel.
3. Application-specific information, such as feedback regarding the performance of a mobile application.
4. Website accessibility features – inclusive design is the focus of a vast amount of research (Petrie, Hamilton & King, 2004; Petrie & Bevan, 2009, for example), and should be examined extensively on its own.

5. Additional personal features, such as the ability to create travel playlists, volunteering opportunities or Nectar points.

Following the exclusion of these factors, and the removal of duplicates, the list was narrowed down to 61 information functions. These were then sent to four members of different sectors of the rail community, who were asked to rate all them on a rating scale of 1 (“Completely Useless”) to 7 (“Extremely Useful”) based on their usefulness to the process of rail travel. These four industry experts were selected due to their deep knowledge regarding rail passenger experience and the design of transportation information. The aim was to select the information that the rail industry deemed as being most appropriate, and have it evaluated by users.

The top-rated functions across all four participants were selected, resulting in a final list of 36 information functions (Table 7) for the survey. Within the survey, these functions were rated on a scale of 1 (“Completely Useless”) to 7 (“Extremely Useful”). The statement preceding the rating was:

“Here is a list of information functions provided by train operating companies in the UK. On a scale of 1-7, please rate how useless (1) or useful (7) to your train journeys you'd consider these functions to be.”

Table 1. Final list of information functions provided in the survey.

The ability to reserve a seat
A tool that lets you find the quickest route possible for your journey
The ability to purchase a flexible ticket for your journey
Information regarding alternative routes you can take if there is a disruption
Information about how to contact the train company/a helpline
A guide to different ticket types and what they mean
The ability to provide feedback about your journey
The provision of announcements if there's a delay
The ability to speak to station/onboard staff if you have any questions/concerns or for updates regarding your journey
A tool that allows you to plan your journey from door to door
Information about Oyster cards or other local travelcards
A tool that lets you find the cheapest fare for your journey
Information about refunds
Information about the platform that the train will be arriving at
The provision of a route map for your journey on your phone
The provision of a guide to navigation around the station on your phone
The ability to book tickets on a website
The ability to book tickets on your mobile phone
The provision of live train times on your mobile phone
Real-time updates regarding the progress of your journey
Push notifications to your phone with information about your journey as you approach the station
The ability to get travel updates from Twitter for your journey
The provision of push notifications to your phone with information about delays or disruption during your journey
Information surrounding crowding (how busy the train is)
The provision of reasons for a delay or disruption, if there is one on your journey
Car parking information at stations
Information about train and/or station facilities (toilets or catering, for example)
Information at the station regarding the availability of WIFI on the train/at the station
Information surrounding delay repay schemes
The ability to contact train operating companies on Twitter
Information about local travel options for your onward journey
Push notifications to your phone regarding the status of your connections
Information regarding how to get to and from stations
The provision of updates surrounding timetable changes (for example, the change to the winter timetable)
Information about local travel or connections to be made during or after your trip
Information about service alterations or engineering works

The final list of questions was reviewed for length and the study was completed by the researcher and one of the industry experts in order to check for readability and overall time taken. Apart from this, due to the standardised nature of the survey format, no other pilot study was conducted.

6.3.2.3 Demographics

The following items of demographic data were collected from participants in the final section of the survey: age, gender, location, area of residence, education and occupation. In addition to this, questions were asked regarding smartphone use, preferred methods of ticket-booking, and the possession of a social media account. The entire survey is available in Appendix C1.

6.3.3 Participants and Procedure

312 participants were recruited through a variety of formats: email, various forms of social media, "call for participants" websites, word of mouth and the distribution of flyers at academic events. Upon clicking the link, participants were shown an introductory information page, and an option to provide their consent towards participating in the study. They were also informed regarding optional entry into the prize draw for a chance to win one of three £40 Amazon vouchers, and finally, provided with the contact details of the main researchers. Following the introductory page, they were led to the first section of the survey.

6.3.4 Analysis

The data collected from all participants was anonymised and exported onto a CSV file. The email addresses were only used to contact the three winners of the prize draw, as stated in the introduction to the survey. Results were analysed using Microsoft Excel and the statistical software SPSS. There was a removal of the data of certain participants due to a lack of response to all of the questions

asked. Therefore, the total number of participants used for the purposes of the main analyses was 293.

6.4 RESULTS

6.4.1 PARTICIPANT DEMOGRAPHICS: DESCRIPTIVE STATISTICS

An overview of the main demographic features of the sample has been presented in Table 8. Beyond these factors, no other participant analytics (time taken to complete the survey, for example) was conducted due to time limitations of the research project, and the vast amount of data collected.

Additionally, due to the nature of the data collected, more specific demographic analyses (mean, standard deviations of factors like age, for example) could not be completed due to the gathering of the data in the format of a range, as opposed to individual data points. The collection of demographic information was intended to be used as a measure to understand the population surveyed, and the extent to which the results can be generalised – an overview of the people involved. This was achieved through the type of data collected, as can be seen in Table 8.

Table 2. Basic descriptive statistics for the demographic factors

Demographic Factor	Statistics
Age	Most participants were between the ages of 18-34 .
Gender	Apart from 11 people, the rest of the participants identified as female (50.6%) or male (45.8%).
Location	The highest number of participants were from the East Midlands (41.3%), and then London (17%).
Area	Most participants either lived in urban (46.8%) or suburban (44.6%) locations.
Education	The most participants had either an Undergraduate (30.8%) or a Masters (30.4%) degree.
Occupation	A large proportion of participants were employed (59.9%), followed by 31.1% students.
Ticket booking	Most participants booked tickets through a ticketing website (30.8%), and then through the website of a train operating company (23.7%).
Smartphone	Most participants had a smartphone (92%).
Social media	Most had a social media account (92%).

6.4.2 Expertise and Travel Frequency: Descriptive Statistics

The data was initially analysed using a Shapiro-Wilks test for normality – all Shapiro-Wilks values were shown to be significant ($p < .001$), depicting the lack of a normal distribution. The main skew observed is with regards to the expertise questions, with most people rating themselves as having higher than mid-scale levels of expertise regarding both rail travel in general, as well as specific journeys. Descriptive statistical tests were then conducted for the expertise questions. These are in Table 9.

Table 3. Basic descriptive statistics for the expertise and travel frequency questions.

Travel Frequency and Expertise Questions (scale of 1-7)	N	Mean	Median
General Travel Frequency	293	4.25	4
General Expertise	293	5.28	5
Specific Trip Frequency	293	5.22	5
Specific Trip Expertise	248	6.09	6

There are a smaller number of people who answered the question regarding trip-specific expertise (248), as compared to all the other questions (293) – this was accounted for in further analyses conducted. Figures 12-15 depict participant ratings for all four questions.

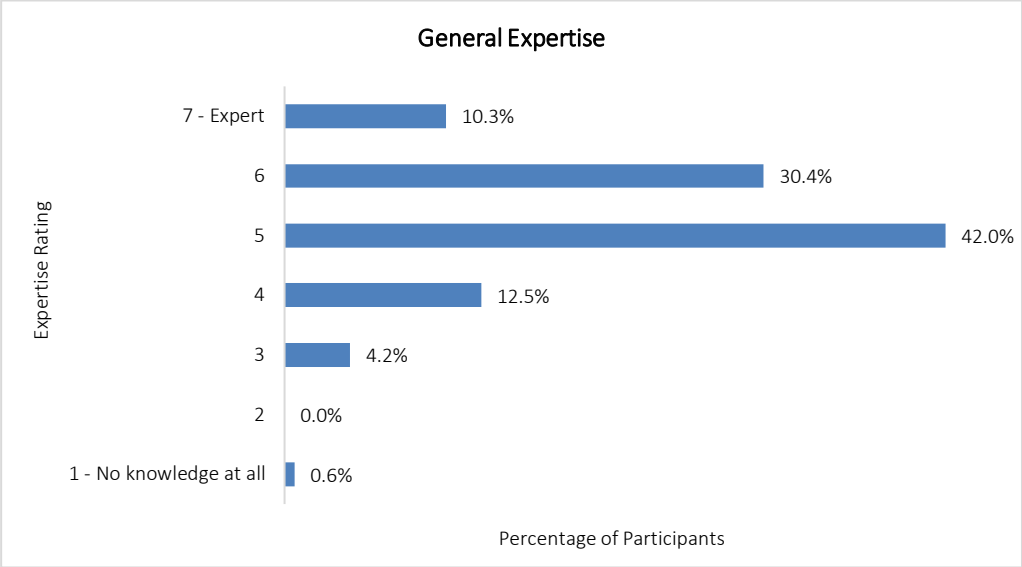


Figure 1. Expertise Ratings: General Expertise (*N* = 293).

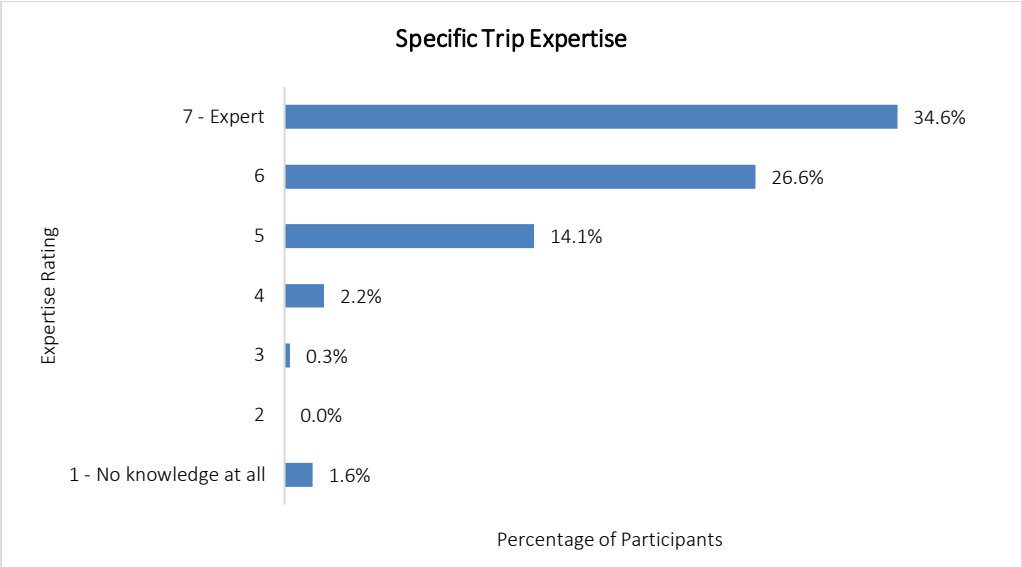


Figure 2. Expertise Ratings: Specific Trip Expertise (*N* = 248).

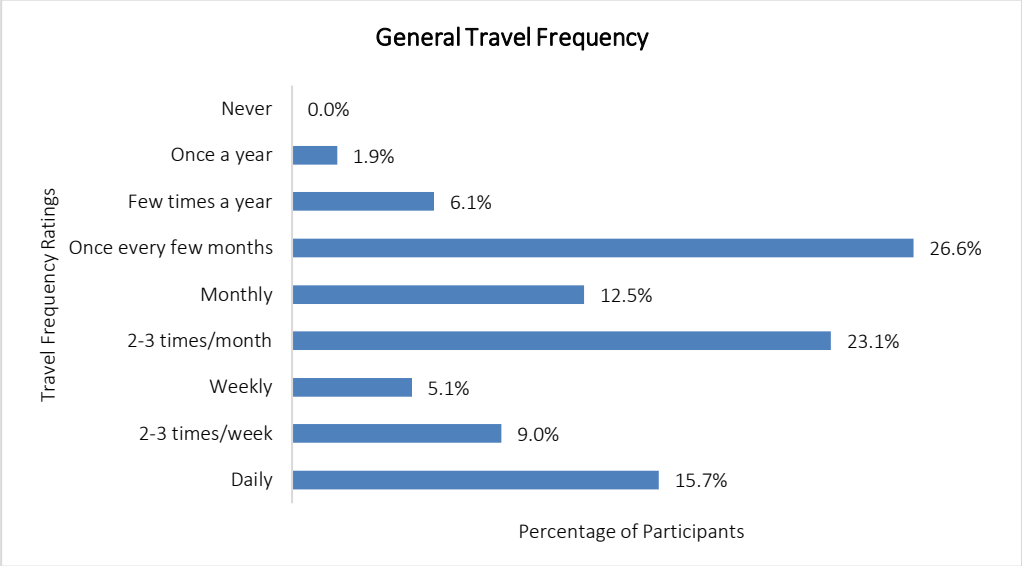


Figure 3. Travel Frequency Ratings: General Travel Frequency (*N* = 293).

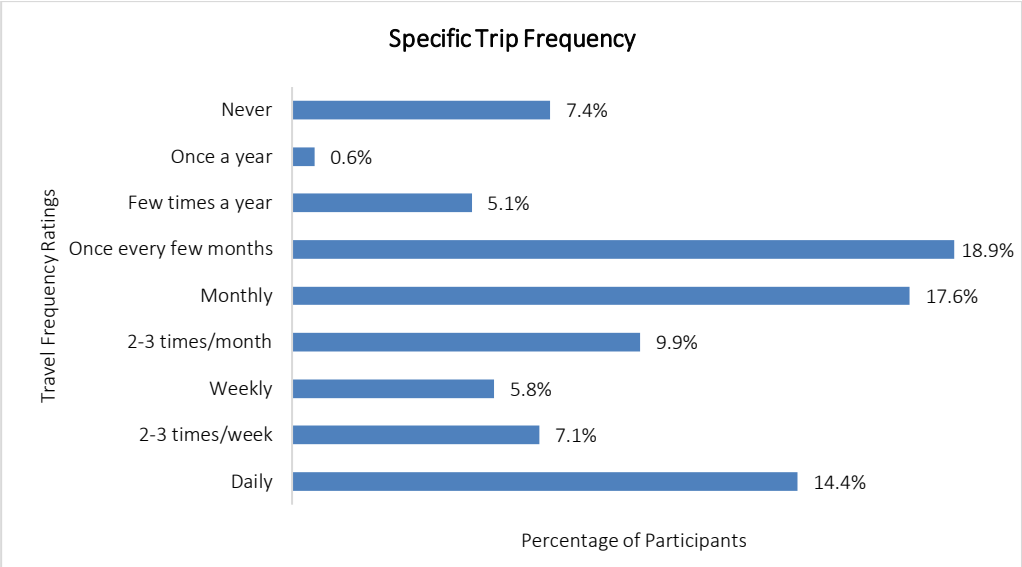


Figure 4. Travel Frequency Ratings: Specific Trip Frequency (*N* = 293).

6.4.3 Expertise and Travel Frequency: Correlations

The data was rescaled for this step, in order to simplify analyses – the ratings for the expertise questions were converted to a similar scaling to the travel frequency ratings (1 = lowest, 7 = highest).

Table 10 shows the correlations between the different expertise and travel frequency questions. Spearman's Rho was used to conduct the analyses due to the non-parametric nature of the data.

Table 4. Expertise and travel frequency correlations.

Spearman's Rho		
General Expertise x General Travel Frequency (N = 293)	Coefficient = .339	$p < 0.001$
General Expertise x Specific Trip Frequency (N = 293)	Coefficient = .369	$p < 0.001$
General Expertise x Specific Trip Expertise (N = 248)	Coefficient = .590	$p < 0.001$
Specific Trip Expertise x Specific Trip Frequency (N = 248)	Coefficient = .370	$p < 0.001$

The high positive correlation between expertise and travel frequency provides support for the notion that higher travel frequency results in a perception of one's expertise being higher, and thus, hypothesis one: frequent travellers will rate themselves as having higher expertise.

6.4.4 Expertise and Travel Frequency: Wilcoxon Signed Rank Test

Additionally, a Wilcoxon signed-rank test was conducted in order to examine the difference between ratings on general and specific expertise. The test showed a significant difference between general and specific expertise (Z = -9.493, p < .001), with the mean rating for Specific Expertise (6.09) higher than that for General Expertise (5.28). This provides support for the second and third hypotheses – people will rate themselves as having higher expertise regarding specific trips that they complete, as opposed to general rail-travel expertise.

6.4.5 Expertise, Travel Frequency and Demographics: Mann-Whitney U Tests

An analysis was also conducted to establish the link between expertise, travel frequency and participant demographics. There were significant results only for two demographic factors: gender and age.

6.4.5.1 Gender

A Mann-Whitney U test showed that there was a significant difference between genders on the basis of the following factors:

1. General Travel Frequency (U = 9683.00, p < .05), effect size = 0.12, women had higher median (5) than men (4).
2. General Expertise (U = 9650.00, p < .05), effect size = 0.13, men had a higher median (6) than women (5).
3. Specific Travel Frequency (U = 7160.50, p < .05), effect size = 0.12, both men and women had the same median rating (5).

However, the effect sizes for all were “small”, based on Cohen’s classification: 0.1 (small effect), 0.3 (moderate effect) and 0.5 and higher (large effect).

6.4.5.2 Occupation

A Mann-Whitney U test showed that there was a significant difference between being employed or not on the basis of the following factors:

1. General Travel Frequency (U = 8616.00, p < .05), effect size = 0.20, people who were unemployed/students had a higher median (5) than those who were employed (4).
2. General Expertise (U = 9496.00, p < .05), effect size = 0.14, both had the same median (5).
3. Specific Travel Frequency (U = 6514.50, p < .05), effect size = 0.193, people who were unemployed/students had a higher median (5) than those who were employed (4).

Again, the effect sizes for all were “small”, based on Cohen’s classification: 0.1 (small effect), 0.3 (moderate effect) and 0.5 and higher (large effect).

6.4.6 Interim Summary

The results presented so far show significant positive correlations between expertise and travel frequency, both for general rail travel and specific journeys. Additionally, people tend to rate themselves quite highly on all of the expertise questions, with the lowest mean/median lying at 5 out of 7. This can be seen in Figures 8 and 9. Comparatively, Figures 10 and 11 (Travel Frequency) show more distributed participant responses.

The Wilcoxon signed-rank test shows support for the notion of domain specificity of expertise – there is a significant difference between the ratings of specific-trip and general rail travel expertise, with participants seeing themselves as being more knowledgeable regarding the former.

Finally, there are some relationships between the demographic factors and expertise and travel frequency.

6.4.7 Information Functions: Analyses

6.4.7.1 Descriptive Statistics

Table 11 depicts the mean ratings for all the information functions (out of 7).

Table 5. Basic descriptive statistics for the information function ratings.

Rank	Function	Mean (N = 293)	Std. Dev.
1	A tool for cheapest fare	6.34	1.255
2	Ability to book tickets on the website	6.32	1.128
3	Provision of live train times on your mobile phone	6.23	1.19
4	Tool for quickest possible route	6.17	1.251
5	Provision of announcements if there's a delay	6.15	1.192
6	Information about train platform	5.98	1.348
7	Real time updates regarding journey progress	5.97	1.378
8	Ability to book tickets on your mobile phone	5.92	1.429
9	Information regarding alternative routes during disruption	5.86	1.44
10	Ability to purchase flexible ticket	5.75	1.475
11	Ability to speak to staff about concerns	5.64	1.559
12	Service alterations or engineering works	5.63	1.407
13	Push notifications for delays or disruption	5.46	1.635
14	Information about refunds	5.43	1.412
15	The ability to reserve a seat	5.3	1.917
16	A guide to different ticket types and what they mean	5.3	1.585
17	Tool that allows you to plan your journey from door to door	5.28	1.718
18	Updates surrounding timetable changes	5.09	1.696
19	Reasons for delay or disruption	5.08	1.674

Rank	Function	Mean (N = 293)	Std. Dev.
20	Push notifications about connections	5.01	1.787
21	Information about delay repay	4.91	1.616
22	Information about how to contact the TOC	4.77	1.614
23	Crowding information	4.77	1.694
24	Provision of a route map for your journey on your phone	4.76	1.764
25	Push notifications with information about your journey	4.74	1.777
26	Information about travelcards	4.65	1.711
27	Information about local travel options for onward journey	4.44	1.714
28	Local travel or connections after your trip	4.39	1.726
29	Information about facilities	4.28	1.648
30	Provision of a station guide	4.23	1.769
31	Information about WiFi	4.23	1.832
32	Information about how to get to and from stations	4.23	1.84
33	Ability to provide feedback	4.17	1.764
34	Car parking information for stations	3.45	1.879
35	Travel updates from Twitter	3.3	1.885
36	Ability to contact TOCs on Twitter	3.27	1.88

6.4.7.2 Factor Analysis

The factor analysis method is suited to the compression of test variables for the purposes of further analyses, particularly in order to uncover possible underlying factors (Field, 2009). The main aim of a factor analysis is to identify the latent variables or groups underneath a large number of different factors, thus reducing redundancy in the data by summarising the overarching themes. Essentially, it is a grouping tool. For this study, the aim was to explore whether the various information functions could be grouped in a meaningful way, based on their perceived usefulness by participants.

The factor analysis was conducted using a Maximum Likelihood method of extraction along with an orthogonal (Varimax with Kaiser normalization) rotation. Firstly, a Kaiser-Meyer-Olkin measure of sampling adequacy resulted in

a value of .896, showing that factor analysis was an appropriate test for the data. According to Kaiser (1974), any value between .8 to .9 is desirable, depicting a high relationship between the variables. Secondly, Bartlett's test of sphericity was significant (χ^2 (630) = 5346.655, $p < 0.001$), indicating the significance of all correlations within the matrix, and thus, the suitability of the model to the dataset. Both tests are to ensure that the model is an appropriate fit to the data. Eigenvalues are a measure of quality or fit of the specific data points to the factors extracted. SPSS selects the underlying groups or factors with eigenvalues that are high enough (greater than 1) for them to be considered a part of the final model. For this study, it selected 8. However, the first 6 factors explained around 50% of the variance, with the 7th and 8th factor adding only a little more to the explanation. Each factor is potent with regards to explaining a fair proportion of the variance without over-fitting the data, which is an issue that must be accounted for. The aim was to pick out a model that adequately summarised the data and extracted the latent variables in a manner that did not over-complicate things with the inclusion of possible repetitive elements and outliers.

The rotated component matrix - which represents the distribution of the information functions across the 6 factors - has been presented in Table 12.

Table 6. Rotated component matrix from the factor analysis of information function ratings.

Information Functions	Factors					
	Basic Journey Planning	Alterations	Help & Feedback	Mobile Device	Facilities	Contact Details
Information about how to get to and from stations	.753					
Local travel or connections after your trip	.674					
Information about local travel options for onward journey	.628					
Push notifications about connections	.614			.425		
Push notifications with information about your journey	.573			.466		
Updates surrounding timetable changes	.499					
Provision of a station guide	.479					
Crowding information	.434	.434				
Push notifications for delays or disruption	.437					
Provision of announcements if there's a delay		.748				
Service alterations or engineering works		.655				
Information regarding alternative routes during disruption		.556	.427			
Reasons for delay or disruption		.511				
Information about train platform		.457				
Information about refunds		.433				
Ability to purchase flexible ticket			.705			
A guide to different ticket types and what they mean			.631			
Information about how to contact the TOC			.549			
Information about travelcards			.496			
Ability to speak to staff about concerns			.480			
Ability to provide feedback			.414			

Information Functions	Factors					
	Basic Journey Planning	Alterations	Help & Feedback	Mobile Device	Facilities	Contact Details
Provision of live train times on your mobile phone				.815		
Ability to book tickets on your mobile phone				.673		
Real time updates regarding journey progress				.607		
Push notifications for delays or disruption				.559		
Car parking information for stations					.759	
Information about facilities					.700	
Information about wifi					.563	
Ability to contact TOCs on Twitter						.859
Travel updates from Twitter						.828
Ability to provide feedback						.427
Cumulative Variance	**10.94%**	**20.56%**	**28.86%**	**36.34%**	**43.77%**	**50.55%**
Eigenvalue	**3.94**	**3.46**	**2.99**	**2.71**	**2.66**	**2.44**

As can be seen, the 6 factors explain a little over 50% of the variance in the data. These factors were labelled based on their contents as the following:

Factor 1: "Basic Journey Planning"

Factor 2: "Alterations"

Factor 3: "Help and Feedback"

Factor 4: "Information on a Mobile Device"

Factor 5: "Facilities"

Factor 6: "Contact Details"

The lack of a higher proportion of variance explained by the six factors can be partially attributed to the exclusion of some of the information functions by the statistical program due to their lack of fit to the model, some of those being highly rated by participants:

#1 A tool for the cheapest fare

#2 The ability to book tickets on the website

#4 A tool for the quickest possible route

#15 The ability to reserve a seat

#17 A tool to plan a journey from door to door

#24 A route map for your journey on your phone

6.4.8 Expertise, Travel Frequency and Information Functions:

Regression Analysis

Prior to discussing the regression analyses, as a reminder:

1. Expertise has been rated on a scale of 1-7: the higher the rating, the higher the perceived level of one's own expertise
2. Travel Frequency, on the other hand, goes from "Daily" to "Weekly" to "Monthly" to "Never". Thus, higher ratings would mean a lower travel frequency.

A stepwise hierarchical regression was conducted, in order to examine the relationships between expertise, travel frequency and the information functions. First, the General Expertise variable was entered, followed by the addition of the General Travel Frequency. The same was done for Specific Expertise and Specific Trip Frequency.

The following tables depict the relationships between the different factors, travel frequency and expertise.

6.4.8.1 General Expertise and General Travel Frequency

6.4.8.1.1 Factor 1 ("Basic Journey Planning") x Expertise and Travel Frequency

Table 7. Model summary for Factor 1 (Basic Journey Planning) x General Expertise.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	1.002	.300		.001
General Expertise	-.190	.056	-.196	.001

R^2 = .038, Adjusted R^2 = .035

General Travel Frequency was excluded from the model, as it did not add anything of statistical significance. There is a negative relationship between general expertise and the ratings of the group of information functions that relate to journey planning (*B* = -.190). The R^2 shows that about 3.8% of the variance can be explained by this factor, and the results can be generalised to a larger population (Adjusted R^2 = .035, quite close to the R^2). The results of the ANOVA showed that the model was a significant fit to the data ($p < .001$). Thus, the higher the general expertise the lower the rating of usefulness for information related to Basic Journey Planning.

6.4.8.1.2 Factor 2 ("Alterations") x Expertise and Travel Frequency

Table 8. Model for Factor 2 (Alterations) x General Expertise, General Travel Frequency.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	-1.171	.297		.000
General Expertise	.222	.055	.229	.000
Step 2	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	-.583	.383		.129
General Expertise	.171	.059	.176	.004
General Travel Frequency	-.074	.031	-.147	.016

STEP 1: R^2 = .052, Adjusted R^2 = .049
STEP 2: R^2 = .071, Adjusted R^2 = .065

Results show a positive relationship between general expertise and Factor 2 (*B* = .222). The R^2 shows that about 5.2% of the variance can be explained, and the results can be generalised (Adjusted R^2 = .049, quite close to the R^2). The addition of the second predictor (Travel Frequency) improves the prediction of the model - the R^2 is now .065, which means that 6.5% variance can now be accounted for. Together, both predict that the higher the expertise and frequency of travel, the higher the perceived importance of information regarding alterations.

6.4.8.1.3 Factor 5 ("Facilities") x Expertise and Travel Frequency

Table 9. Model summary for Factor 5 (Facilities) x General Expertise.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	B	Std. Error	Beta	Sig.
(Constant)	.989	.300		.001
General Expertise	-.188	.056	-.193	.001

R^2 = .037, Adjusted R^2 = .034

As with Factor 1, General Travel Frequency was excluded from the model, as it did not add anything of statistical significance to it. There is a negative relationship between general expertise and the "Facilities" factor (*B* = -.188). R^2 shows that about 3.7% of the variance can be explained by this factor, and results can be generalised (Adjusted R^2 = .034). The results of the ANOVA showed that the model was a significant fit to the data ($p < .05$). Thus, the higher the rating of general expertise, the less likely the passenger is to consider information regarding Facilities as being important.

6.4.8.1.4 Factor 6 ("Contact Details") x Expertise and Travel Frequency

Table 10. Model for Factor 6 (Contact Details) x General Expertise, General Travel Frequency.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	-.292	.305		.340
General Expertise	.055	.057	.057	.331
Step 2	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	1.758E-16	.058		1.000
Step 3	**B**	**Std. Error**	**Beta**	**Sig.**
(Constant)	.328	.138		.018
General Travel Frequency	-.077	.029	-.152	.009

STEP 3: R^2 = .023, Adjusted R^2 = .020

General Travel Expertise was excluded from the model in Step 3, as it did not add anything of statistical significance to it. In addition to this, Steps 1 and 2 were not statistically significant. The only model obtained was from Step 3 – the analysis of the relationship between General Travel Frequency and Factor 6. There is a negative relationship between travel frequency and Factor 6 (B = -.077). R^2 shows that about 2.3% of the variance can be explained by this factor, and results can be generalised (Adjusted R^2 = .020). The higher the frequency of rail travel, the higher the ratings of importance for "Contact Details". The ANOVA showed that the third model was a significant fit to the data (p < .001).

6.4.8.1.5 Factor 3 ("Help and Feedback") and Factor 4 ("Information on a Mobile Device") x Expertise and Travel Frequency

There were no significant models found when conducting the regression analysis between the expertise and travel frequency questions and Factors 3 ("Help and Feedback") and 4 ("Information on a Mobile Device").

6.4.8.2. Specific Expertise and Specific Travel Frequency

6.4.8.2.1 Factor 2 ("Alterations") x Expertise and Travel Frequency

Table 11. Model summary for Factor 2 (Alterations) x Specific Trip Expertise.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	B	Std. Error	Beta	Sig.
(Constant)	-1.160	.362		.002
Specific Expertise	.204	.058	.226	.001

R^2 = .051, Adjusted R^2 = .047

Specific Trip Frequency was excluded from the model, as it did not add anything of statistical significance. There is a positive relationship between specific trip expertise and the "Alterations" function (B = .204). The R^2 shows that about 5.1% of the variance can be explained by this factor, and the results can be generalised to a larger population (Adjusted R^2 = .047, quite close to the R^2). The results of the ANOVA showed that the model was a significant fit to the data (p < .01). Thus, the higher the expertise on a specific trip, the higher the rating of usefulness for information related to Alterations.

6.4.8.2.2 Factor 5 ("Facilities") x Expertise and Travel Frequency

Table 12. Model for Factor 5 (Facilities) x Specific Trip Frequency.

	Unstandardized Coefficients		Standardized Coefficients	
Step 1	B	Std. Error	Beta	Sig.
(Constant)	-.363	.146		.014
Specific Trip Frequency	.077	.031	.163	.014

STEP 1: R^2 = .027, Adjusted R^2 = .022

Results show a positive relationship between Specific Trip Frequency and Factor 2 (B = .077). The R^2 shows that about 2.7% of the variance can be explained, and the results can be generalised (Adjusted R^2 = .022, quite close to the R^2). The ANOVA showed that the model was a significant fit to the data (p < .05). Results show that the higher the frequency of travel, the lower the perceived usefulness of information regarding Facilities.

6.4.8.2.3 Factor 1 ("Basic Journey Planning"), Factor 3 ("Help and Feedback"), Factor 4 ("Information on a Mobile Device") and Factor 6 ("Contact Details") x Expertise and Travel Frequency

There were no significant models found when conducting the regression analysis between the specific expertise and travel frequency questions and Factors 1, 3, 4 and 6.

6.4.9 Expertise, Travel Frequency and Excluded Information Functions: Correlational Analyses

In addition to the six factors, correlation analyses were conducted to examine relationships between the expertise and travel frequency questions, and the information functions that were excluded in the factor analysis. The significant analyses have been reported below:

6.4.9.1 The ability to reserve a seat

There were significant positive correlations between information regarding seat reservations and both general travel frequency (r = .180, p < .01) and specific trip frequency (r = .218, p < .01). The lower the frequency of travel, the more useful passengers find the ability to reserve a seat.

6.4.9.2 A tool for the quickest possible route

There were significant positive correlations between the usefulness of tool that informs the passenger about the quickest route and general rail travel expertise (r = .116, p < .05). The higher the level of expertise, the more useful passengers find information that helps them select the quickest route.

6.4.9.3 The ability to book tickets on the website

There were significant positive correlations between information regarding seat reservations and both general travel (r = .180, p < .01) and specific trip frequency (r = .130, p < .01). The higher the frequency of travel, the less useful it is to passengers to book tickets on a website.

Beyond this, there were no significant correlations between expertise and travel frequency and the other three excluded variables: a tool to plan a journey from

door to door, a tool to find the cheapest fare, and a route map for the journey on a mobile phone.

Prior to the discussion, a summary of the results can be found in Table 19.

Table 13. Results summary table.

Factors		General Travel		Specific Trip	
		Expertise	Travel Frequency	Expertise	Travel Frequency
1	Basic Journey Planning	Higher expertise, lower ratings	Excluded	Not significant	Not significant
2	Alterations	Higher expertise, higher ratings	Higher travel frequency, higher ratings	Higher expertise, higher ratings	Excluded
3	Help and Feedback	Not significant	Not significant	Not significant	Not significant
4	Mobile Device	Not significant	Not significant	Not significant	
5	Facilities	Higher expertise, lower ratings	Excluded	Excluded	Higher trip frequency, lower ratings
6	Contact Details	Excluded	Higher travel frequency, lower ratings	Not significant	Not significant
Excluded Information Functions		**General Travel**		**Specific Trip**	
		Expertise	**Travel Frequency**	**Expertise**	**Travel Frequency**
1	A tool for the cheapest fare	Not significant	Not significant	Not significant	Not significant
2	The ability to book tickets on a website	Not significant	Higher travel frequency, lower ratings	Not significant	Higher trip frequency, lower ratings
4	A tool for the quickest possible route	Higher expertise, higher ratings	Not significant	Not significant	Not significant
15	The ability to reserve a seat	Not significant	Higher travel frequency, lower ratings	Not significant	Higher travel frequency, lower ratings
17	A tool to plan a journey from door-to-door	Not significant	Not significant	Not significant	Not significant
24	A route map for your journey on your phone	Not significant	Not significant	Not significant	Not significant

6.5 Discussion

6.5.1 Expertise and Travel Frequency

To restate, the original hypotheses of this study regarding rail expertise and travel frequency were:

1. Frequent travellers will rate themselves as having higher expertise. This is based on the existing literature around practice and familiarity of the travel context (Aarts et al., 1997; Dziekan, 2008, Ericsson & Harris, 1989).
2. This will also extend to travel on a specific trip – this is related to domain specificity (Shanteau, 1992).
3. People will also generally rate themselves higher on trip-specific expertise than they would on general expertise. There will also be a positive correlation between taking a specific trip and general expertise.

The results match these hypotheses - the correlational analyses show that there are links between the different types of expertise and travel frequency. In line with this, the literature shows that continuous travel results in increased contextual knowledge and thus, higher levels of expertise (Gustafson, 2012). Results also showed a significantly higher rating for trip-specific expertise versus general travel expertise – people are more likely to rate their level of expertise as being higher on a specific trip, providing support for the idea of expertise being domain-specific (Shanteau & Stewart, 1992) and context-dependent (Ben-Elia & Ettema, 2009).

Other results that match the predictions of the study include:

4. The most important information to passengers will be basic information about successfully being able to complete their trip.

   In line with this, the most highly rated information types were, in order: information about cheapest fares, online tickets, live train times, route planning, delay announcements and then, platform information.

5. Cost is seen as being one of the top priorities for customers, based on industry research (Passengerfocus, 2014, for example).

   This hypothesis matches the results, as the "tool for the cheapest fare" has the highest mean rating out of all the information functions.

6. Other prioritised pieces of information include information regarding seating (Office of Rail Regulation, 2012) and timing (Transportfocus, 2017b), both of which have above-average ratings of usefulness.

7. Finally, the hypothesis about delay repay being a major priority.

   Surprisingly, delay repay information was one of the lower rated information types. A possible reason for this could be delay repay being regarded as being an "additional" piece of information (to basic journey planning and execution) by participants, as opposed to being immediately necessary for the process of rail travel.

The following section will address the main hypothesis for this study: there will be differences between the informational preferences of travellers with high and low levels of self-rated expertise, as well as high and low levels of travel frequency.

6.5.2 Information Functions

Through the process of the factor analysis, six "types" of information were identified:

Factor 1: "Basic Journey Planning": This can be described as the main information required to plan and execute a trip whilst travelling via the railways.

Factor 2: "Alterations": Information regarding any changes to the journey, service updates or disruptions that may require the sourcing of additional information.

Factor 3: "Help and Feedback": This can be described as being information pertaining to interactions with the rail system – either through the requirement of assistance or the provision of feedback.

Factor 4: "Information on a Mobile Device": This refers to information that is specifically provided via a mobile device, possibly when the traveller is in transit or on the move.

Factor 5: "Facilities": Information regarding train or station facilities, including parking and Wi-Fi, for example.

Factor 6: "Contact Details": This refers to the ability to contact train operating companies, primarily through Twitter.

The participant ratings of information functions suggest that information that is provided to rail passengers falls into some very distinct groups or types. This could be extremely useful in the planning of information systems. While the aim of the current study was to develop of an understanding of the link between expertise and information use, results suggest a manner in which to design of

information systems in a way that maps onto how people organise and understand the information provided to them.

As mentioned, there were specific pieces or types of information that did not fall into any of the categories:

#1 A tool for the cheapest fare

#2 The ability to book tickets on the website

#4 A tool for the quickest possible route

#15 The ability to reserve a seat

#17 A tool to plan a journey from door to door

#24 A route map for your journey on your phone

Three of these results are among the top-rated information functions (tool for the cheapest fare, ability to book tickets on the website, tool for the quickest possible route), possibly resulting in them being outliers. Based on a basic re-assessment of the factors, the other three don't fit neatly into any of the categories. There are no other tools that are similar to the "ability to reserve a seat" and the "provision of a route map on your phone" functions. The idea of the "ability to plan the journey from door to door" is basically covered by the information functions that fall in the "Basic Journey Planning" factor, making it redundant to the final grouping.

6.5.3 Information Functions, Expertise and Travel Frequency

As mentioned, the eighth hypothesis of this study predicted a difference between the preferences of travellers with high and low levels of self-rated

expertise and travel frequency. There was some support for this, with expertise and travel frequency explaining some of the variance seen in the participant ratings of the different information factors.

6.5.3.1 Information Factors

Tables 20 and 21 summarise the correlations between the different factors and excluded information functions respectively with both general expertise and travel frequency.

Table 14. Summary of regression analyses for the factors.

Factor	General Expertise and Travel Frequency	Variance
Basic Journey Planning	The more likely that someone is to consider themselves an expert, the less likely they are to value this factor.	3.8%
Alterations	The more likely that someone is to consider themselves an expert, the more likely they are to value this factor.	5.2%
	This effect increases in the same direction with the added consideration of travel frequency.	6.5%
Facilities	The more likely that someone is to consider themselves an expert, the less likely they are to value this factor.	3.7%
Contact Details	The more often that someone is likely to travel, the more likely they are to value this factor.	2.3%
TOTAL		16.3%
Factor	Specific Expertise and Trip Frequency	Variance
Alterations	The more likely that someone is to consider themselves an expert, the more likely they are to value this factor.	5.1%
Facilities	The more often that someone is likely to travel, the less likely they are to value this factor.	2.7%
TOTAL		7.8%

When examining the findings, some of the results align with the existing literature regarding both expertise and views on commuter behaviour. The relationships between the "Basic Journey Planning" and "Facilities" factors and both types of expertise match the existing literature - expert travellers have extensive knowledge of their journeys, which they have planned previously, paying little attention to additional information (Aarts et al., 1997; Grotenhuis et al., 2007; Gustafson, 2012). In this case, that information is regarding journey planning and facilities available. In addition to this, frequent travellers have been

highlighted as having relevant trip-specific and contextual knowledge (Dziekan, 2008; Gustafson, 2012) – this can be seen with regards to the relationship between frequent travel in general and the "Contact Details" factor. While expertise may not be related, frequent travellers would value the ability to contact train operating companies for real-time issues and have them resolved in a quick manner. Twitter is a good example of this, which is the main component of the "Contact Details" factor – communications via Twitter have been found to save time with regards to solving rail service issues (Golightly & Durk, 2016).

The most interesting result is the relationship between general expertise, general travel frequency and the "Alterations" factor. There are two possible explanations for this link. Firstly, there is the fact that frequent (and expert) travellers understand the importance of service updates and notifications regarding disruptions. This is supported by a similar relationship seen between "Alterations" and specific expertise. The only type of information of use to those with high specific trip expertise is information about possible alterations to their trip, which matches both the literature about expert travellers valuing the quickest possible route (Hine & Scott, 2000), and focusing on the practicalities of their journey over other factors (Anable & Gatersleben, 2005).

Secondly, there is the idea of context. Previous research has suggested that commuters develop specific travel patterns and preferences on the basis of the formation of a salient habit (Aarts et al., 1998). This habit has been highlighted as being context-dependent – a change in context, could thus, result in a "breaking" of the habit, resulting in the traveller being more open to modifying

it, and thus, open to attending to the information that is provided to them (Wood et al., 2005). While the focus of this study has been on expertise, there is a noted link between expertise and practice (Ericsson & Charness, 1994) – habitual repetition of travel behaviour within a travel context is no different from this idea of practice. In a scenario requiring information regarding service alterations, this practiced behaviour/habit is "broken", so to speak, due to a modified context, resulting in the requirement for information. The main message here is that people care about what information they get during disruption, and their appreciation for its value increases with more extensive knowledge and experience with the process of rail travel.

Finally, the lack of a relationship between the "Help and Feedback" and "Information on a Mobile Device" factors and general expertise and travel frequency could be due to a range of different reasons. Considering the nature of the "Help and Feedback" factors, a possible explanation could be with regards to its standalone nature – the information residing within this group could be seen as being secondary to the central travel process, accessed only when encountered with novel situations. Beyond this, 92% of participants state that they have a smartphone – the ubiquitous nature of the "mobile device" could mean a lack of a differentiation between participants with regards to their ratings on this factor. For both factors, all participants could be considered being on equal footing with each other, resulting in similar patterns of ratings for the information functions that form both.

6.5.3.2 Excluded Variables

Table 15. Summary of correlational analyses for the excluded information functions.

Factor	Expertise and Travel Frequency
Ability to reserve a seat	The less often that someone is likely to travel, the more likely they are to value this factor.
Tool for the quickest possible route	The more likely that someone is to consider themselves an expert, the more likely they are to value this factor.
Ability to book tickets on the website	The more often that someone is likely to travel, the less likely they are to value this factor.

Moving onto the excluded variables, the relationship between travel frequency and seating information matches the literature on expertise and the lack of attention paid to additional information (Grotenhuis et al., 2007). While this could be seen as a contrast to the previous ideas presented in this thesis regarding commuters just "wanting a seat" (Chapter 4), the key takeaway here is that it is the lack of value placed on information regarding obtaining a seat, not the availability of the seat itself.

Secondly, the "ability to book tickets on a website". The most straightforward explanation for this is the likelihood of frequent travellers owning a season pass or a more long-term ticket, as opposed to booking separate tickets for every trip on a website.

Finally, a key point within the literature is that commuters value the fastest route (Hine & Scott, 2000). This matches the relationship seen between expertise and the "tool to plan the quickest possible route". The results support the notion that expert travellers value information regarding this, with those with higher levels of expertise placing more value on getting to their destination as quickly as possible.

6.5.4 Methodological Learnings

The main benefit of the online survey was the ability to gain access to a large sample, in order to further explore the main ideas presented in the interviews around different information preferences based on levels of expertise. Through the use of this method, existing ideas regarding the importance of certain types of information (information regarding lower costs, or seating, for example) could be strongly validated, and broad themes for information delivery were highlighted (the final six factors).

As mentioned at the beginning of the study, the data collected was not normally distributed. While the factor analysis and regression did not have to be modified based on this, it could explain certain results, such as the observed variance seen in the regression analysis. As noted earlier on, 42% percent of people considered themselves to be fairly close to expertise with regards to general rail travel, and almost 35% saw themselves as experts regarding their specific trips. Simply, people see themselves as being quite knowledgeable about rail travel. A possible issue could be the method in itself – self-report data has been known to be problematic in the past due to issues surrounding exaggeration (Northrup, 1997), social desirability bias (Edwards, 1953), or participants answering in concordance with their assumption of the study hypotheses (Garcia & Gustavson, 1997). The possibility here could be an overestimation of expertise, resulting in the skew of the results.

Beyond this, considering the strong correlation – and suggested link – between expertise and travel frequency, there is a question to be asked here regarding the extent to which travel frequency influences expertise. While there is a

definite correlation between the two, what remains unclear is the exact role of frequency of travel in the formation of expertise or advanced knowledge.

Finally, returning to the main hypothesis – the link between information preferences and expertise. A caveat with regards to the study is the amount of variance explained by expertise and travel frequency, both with regards to the factors and the excluded variables. Cumulatively, all explain 35.8% of the variance in the ratings of information functions, at best. A key factor to consider here is the possible influence of a range of different factors on information preferences during rail travel, from access to the information, to individual differences, to the use of other modes of public transportation, and even personal lifestyles. Future studies within this thesis will explore some of these aspects.

6.6 CONCLUSION

In summation, this chapter tested the relationship between expertise and information preferences through the use of a large-scale quantitative survey. Firstly, results showed that the information most valued by passengers was related to finding the cheapest fare – providing support for existing rail research. Additionally, a strong relationship was found between rail-related expertise and travel frequency, though the exact nature of that relationship deserves further exploration. Both influence how people rate different types of information, which can be neatly classified into six distinct groups. Some types of information were valued a lot more than others – people who had a higher

frequency of travel, for example, placed a lower value on booking tickets on a website or reserving a seat, while those with higher travel expertise saw information regarding finding the quickest route as being quite valuable. Importantly, the findings suggest that information regarding service alterations is valuable to travellers with high knowledge and trip frequency, highlighting the crucial role that disruption plays in the experience of rail travel. The next chapter will explore the impact of disruption on the information requirements of travellers, with a focus on the links between expertise, travel frequency and the comprehension of disruption alerts. A progression of the thesis narrative has been presented in Figure 16.

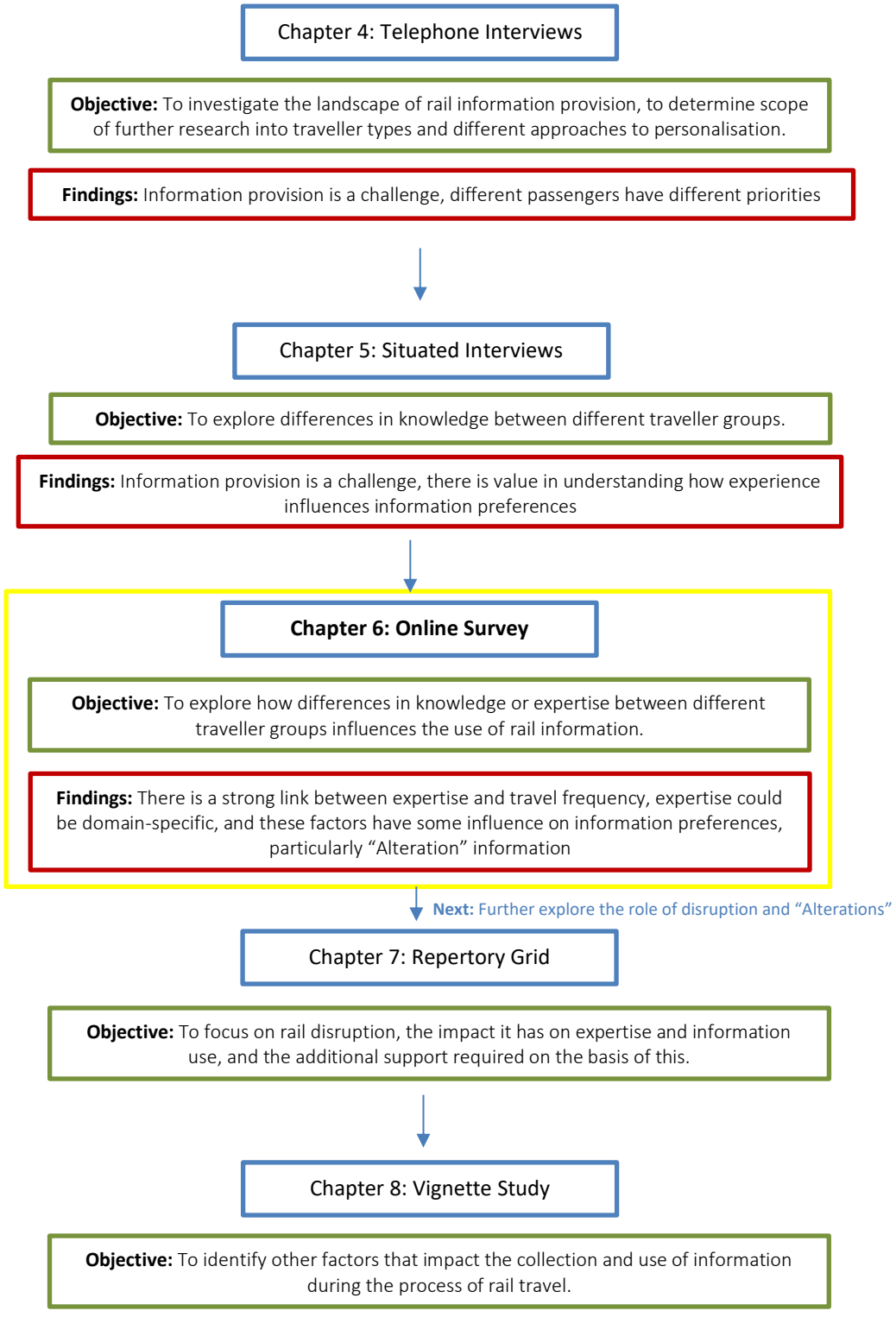


Figure 5. Thesis narrative schematic.

7. Survey Two: Travel Expertise, Travel Frequency & Disruption Content

7.1 Chapter Summary

The exceptional circumstances involved in rail disruption situations provide a series of new challenges, which have the potential to influence important factors including information use and journey satisfaction. The present chapter looks at the nature of this, and its possible links to expertise. More specifically, it explores the fourth research objective of this thesis: to examine the impact that rail disruption has on expertise and information use, and the additional informational support required based on this. Using a repertory grid process, the present survey was conducted in three phases. The first two, as in standard repertory grid protocol, included construct elicitation from the presentation of disruption alerts, and repertory grid ratings of those constructs against the same alerts. The final phase included the export of the repertory grid onto an online survey platform, in order to examine the impact of expertise and travel frequency on the understanding of disruption content. The chapter concludes by discussing the important role that uncertainty plays in the consideration of passenger perceptions of disruption alerts, as well as the differences seen in the perception of disruption information by frequent and infrequent travellers.

7.2 INTRODUCTION

In order to account for rail travel as whole, the notion of disruption – and its impact on passenger experience – should not be ignored. One of the main ways in which disruption influences customer experience is through the creation of uncertainty. As mentioned earlier on in the thesis, passengers are likely to feel stress under uncertain circumstances (Cox et al., 2006), which could result in a loss of confidence in the rail service due to inconsistency of performance (Office of Rail Regulation, 2014). Reviews of passenger priorities highlight both up-to-date information provision and reduced disruption as being crucial to the improvement of rail services in the UK (Passengerfocus, 2014; Transportfocus, 2017b), providing a clear idea of the value of gaining an improved understanding of these issues for the industry. Additionally, the interviews with both passengers (Chapter 5) and members of the rail community (Chapter 4) within this thesis highlighted disruption as being a significant concern across both sets of stakeholders, impacting both customer experience and operational aspects of the rail service.

In addition to this, the idea of personalisation has been a major priority for the rail industry over the past few years, with an increased investment into research into the optimisation of information systems through the use of the same (Treharne & Wesemeyer, 2016, for example). To continue looking at methods of achieving this through an enhanced understanding of traveller expertise, it is necessary to refer to the described notions of domain specificity and adaptability. The first question to ask is: if travel knowledge results in a form of expertise, how is this influenced by exceptional circumstances, such as

disruption? Previous studies of expert behaviour have shown different findings. Some studies report that expertise allows for the ability to handle uncertainty (Lipschitz & Strauss, 1997). Importantly, there is a large body of research that supports the idea of expertise being inherently adaptive in nature. Ward, Gore, Hutton, Conway, & Hoffman (2018) argue in favour of this, stating that it is within novel, problem-solving situations that peak expert performance is seen, due to the essential requirement for experts to be proficient and flexible, and to easily adapt to novel situations within their domain.

Finally, as mentioned, researchers have argued that expertise is domain-specific (Shanteau, 1988), and can be disrupted within novel situations. The previous study provided support for this notion, with participants rating their own expertise regarding a specific rail journey as being significantly higher than their general rail-related expertise. If this is the case, will their expertise/advanced knowledge cease to exist when faced with a novel situation, such as disruption? The aim of this study was to ensure that the nature of expertise and information use was examined keeping disruption in mind, in order to understand how this unique phenomenon can change and/or influence fairly standard preferences and behavioural patterns. This matches the fourth research objective of this thesis: to examine the impact that rail disruption has on expert behaviour and information use. How do people view disruption information? What are the crucial factors to be considered when providing information during disruption?

Based on the theories presented, the experimental hypotheses for the present study are as follows:

1. Participants with higher levels of expertise will have a more detailed understanding of disruption information than those with lower levels of travel expertise.
2. Participants with higher levels of travel frequency will have a more detailed understanding of disruption information than those with lower levels of travel frequency.
3. Participants will express the clear requirement for disruption information to:
    a. Alleviate feelings of stress and uncertainty
    b. Cover all of the basic information required to support them
    c. Help them navigate around the situation.

7.3 METHOD

The repertory grid method, as described in Chapter 3, uses both qualitative and quantitative data to elicit the individual perspectives of participants, and the factors that they consider the most crucial within the specific context explored. For the purposes of the present study, a repertory grid method was a useful way in which to extract the underlying characteristics that people might see as being crucial to the delivery of disruption information. The aim of eliciting the key features of disruption information from participants is to understand how passengers view existing alerts, with a focus on the factors that influence the experience of rail disruption.

The traditional repertory grid process has three phases: construct elicitation, grid construction and grid completion. Participants are presented with the initial elements (in this study, the disruption alerts). Through an interview process, they elicit a series of underlying constructs by comparing these elements to each other. These constructs are then placed on a grid, and presented to the same participants, for them to rate the elements against the constructs. A more detailed explanation of the process can be found in the book published by Fransella, Bell and Bannister (2004) on the method.

Though initially designed for an interview-based format, the repertory grid has since been modified by different researchers in order to suit the specific purposes of their studies. Golightly and Dadashi (2016), for example, conduct the study in two different phases, with the construct elicitation and grid completion conducted with different participant groups. Some researchers choose to elicit constructs from the participants, while others choose to provide them, going directly to the grid phase, depending on their study requirements (Edwards et al., 2009). Tan and Hunter (2002) discuss the use of repertory grids to develop larger experimental instruments – a small sample size is tested with a repertory grid, and the analyses is used to develop a larger questionnaire, for example. This was the method chosen for the present study. In order to suit the purposes of the present research, this study involved two phases of a traditional repertory grid process, followed by an online survey.

7.3.1 Construct Elicitation and The Repertory Grid

7.3.1.1 Design and Materials

In order to design the first phase of the study, a random selection of disruption alerts were obtained from the National Rail Enquiries website, which were then filtered down to 10 items. These alerts (Table 22) were selected in order to capture a range of disruption situations, as well as the presentation of information in different ways, and with varying levels of detail.

Table 22. Final list of disruption alerts.

Code	Disruption Alert	Key Characteristics
E1	There will be minor delays on your route today.	Minor delay
E2	A broken rail is causing disruption to trains on your route. Please allow for delays of up to 60 minutes to your journey.	Broken rail, long delay
E3	A problem at a level crossing is causing disruption to trains. Trains may be cancelled, delayed by up to 5 minutes or revised.	Level crossing issue, uncertain outcome
E4	The fault with the signalling system has been resolved, and trains in the area are starting to return to normal. Until then, trains may be delayed by up to 15 minutes or cancelled until 11:00.	Signalling fault resolved, uncertain outcome
E5	A fault with the signalling system is disrupting trains. Heathrow connect services are suspended.	Signalling fault, important connection
E6	A speed restriction is in place over a defective track, causing disruption to journeys. As trains are required to run at a reduced speed, congestion may build up quickly causing services to be delayed, revised, or cancelled at very short notice.	Speed restriction, uncertain outcome
E7	A number of incidents have occurred today on your rail network. These have ranged from train faults to passengers being taken ill on trains. They are working hard to restore train services to a normal working timetable however as a result of these incidents, they are still experiencing delays and services may still be subject cancellations and short notice alterations.	General uncertainty

Code	Disruption Alert	Key Characteristics
E8	Heavy rain has flooded the railway line. This means that trains between these stations may be cancelled or delayed by up to 15 minutes or more.	Heavy rain, uncertain outcome
E9	The train which was involved in an operational incident has now moved, allowing the line to reopen. Whilst services recover, train services running through this station may be cancelled or delayed by up to 20 minutes. Disruption is expected until 12:00.	Operational incident, uncertain outcome
E10	A track circuit failure means that trains have to run at reduced speed. This will cause delays of up to 10 minutes until 13:00.	Track circuit failure, short delay

7.3.1.2 Participants

The first stage of the study (Construct Elicitation) was carried out with 10 participants, recruited through a 'call for participants' email (Appendix D1). Participants were between the ages of 18 and 57, and lived in and around the East Midlands, UK.

The second stage (Repertory Grid) was conducted with 6 out of the original 10 participants. While the aim was to get all 10 participants to complete the grid, unfortunately, this was not possible due to the lack of response from 4 of the participants. The aim was to ensure that the same participants contributed to the construction of the grid, and then rated it afterwards, in order to ensure continuity. While more participants could have been added at a later stage to increase the sample size, the researcher wanted to avoid the possibility of p-hacking - the addition of participants until results attain significance (Head et al., 2015) - and complications involved in analysing the grid ratings attained from a sample that had previously seen the material, and a new sample that had not.

7.3.1.3 Procedure

7.3.1.3.1 Phase 1: Construction Elicitation

Following the presentation of the information sheet and consent form (Appendices D2 and D3), the alerts were presented to the participants using a triadic elicitation process, which is one of the more common methods used (Edwards et al., 2009). This process involves the presentation of three elements at the same time to the participant, who is then asked to group two of the elements, whilst differentiating them from the 'leftover' element. For example, if a participant were to be presented with elements 1 ("There will be minor delays on your route today"), 5 ("A fault with the signalling system is disrupting trains. Heathrow connect services are suspended.") and 8 ("Heavy rain has flooded the railway line. This means that trains between these stations may be cancelled or delayed by up to 15 minutes or more."), they might choose to link elements 5 and 8, differentiating them from element 1, based on the fact that there is information regarding the cause of the delays in those two, unlike in element 1.

This process was conducted through a series of individual face-to-face interviews, attempting to ensure that all combinations of elements were presented, and all conceivable constructs were elicited. However, due to the possibility of participant fatigue and the saturation of results (the lack of discovery of new information despite continued data collection, resulting in the possible redundancy of the data), the interviews were concluded when participants were no longer able to think of new constructs.

7.3.1.3.2 Phase 2: The Repertory Grid

The second phase involved the collection of all constructs extracted (216 in total), which were then reviewed for repetition and clarity. Following this process, the constructs were filtered down into a final list of 27. They were then converted into a binary format and placed on a grid constructed using Microsoft Excel. The final list has been presented in Table 23.

Table 23. Repertory grid constructs.

Definite delay length = 1 <TO> Indefinite delay length = 7
Short delay = 1 <TO> long delay = 7
Low cancellation likelihood = 1 <TO> High likelihood of cancellation
Minor disruption = 1 <TO> Major disruption = 7
Single stage of travel to complete = 1 <TO> Have multi-modal travel plans = 7
Flexible travel plans = 1 <TO> Travel plans are not flexible = 7
Know about alternative routes = 1 <TO> Don't know about alternative routes = 7
Know what to do = 1 <TO> Don't know what to do
Can work around it = 1 <TO> No way of working around disruption = 7
Minor inconvenience = 1 <TO> Major inconvenience = 7
Recovering efficiently = 1 <TO> No efficient recovery = 7
Solutions provided = 1 <TO> Solutions not provided = 7
Low stress = 1 <TO> High stress levels = 7
Feeling secure = 1 <TO> Feeling insecure = 7
Impacts specific route only = 1 <TO> Impacts all routes on the network = 7
Not travelling to the airport = 1 <TO> Travelling to the airport = 7
Localised issue = 1 <TO> General issue = 7
Information provided =1 <TO> No information provided = 7
Facts provided = 1 <TO> No facts provided = 7
Polite language used = 1 <TO> No polite language used = 7
Time estimates given =1 <TO> No time estimates given = 7
Clear message = 1 <TO> Unclear message = 7
Information given in advance = 1 <TO> No advance information = 7
Possible arrival times provided = 1 <TO> Possible arrival times not provided = 7
Ongoing updates given = 1 <TO> No updates given = 7
Guaranteed outcome = 1 <TO> Uncertain outcome = 7
Explanation provided = 1 <TO> No explanation provided = 7

The elements (the disruption alerts in Table 20) were then presented alongside these constructs (Table 21), with participants rating each element against every construct, based on how relevant they are to the individual elements. As in

traditional repertory grid methods (Edwards, Mcdonald, & Young, 2009), these constructs were rated on a grid by six out of 10 of the participants that completed phase one of the study. The formalisation of the final grid performed the function of a piloting process for the final survey.

These ratings were then combined, and a cluster analysis was used to extract "higher-order" constructs – this was for the construction of the final phase of the study (Figure 17).

The cluster analysis method works by grouping together elements (in this case, disruption alerts) based on the literal distance between them based on a specific metric (in this case, their ratings). The statistical package hierarchically groups the "closest" disruption alerts (based on the pattern of their ratings) and then evaluates the groups based on the sum of squared distances between the ratings of the different alerts. Once it has assigned the alerts to groups in a manner in which the lowest sum of squared distance is achieved, the final dendogram (like the one in Figure 17) is produced.

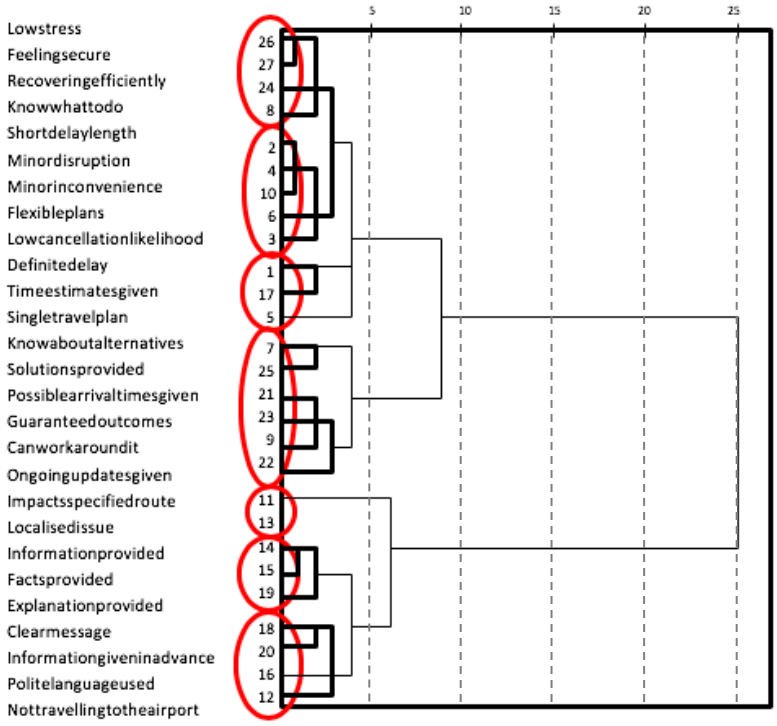


Figure 17. Dendogram: extraction of higher-order constructs from the cluster analysis (N = 6).

There are 7 clear clusters that emerge from the construct elicitation (Table 24).

Table 24. Online repertory grid constructs.

1	"Confident"	This alert makes me feel confident and secure in this situation.
2	"Impact"	This alert helps me understand the impact of the disruption.
3	"Certainty"	This alert makes me feel certain about the status of the situation.
4	"Solutions"	This alert provides me with solutions.
5	"Specificity"	This alert makes it clear that the disruption is for a specific route.
6	"Basic Information"	This alert provides me with basic information required during a disruption.
7	"Clear and Considerate"	This alert delivers the information in a clear, considerate manner.

7.3.2 The Online Survey

7.3.2.1 Design and Materials

The online survey was constructed using JISC Online surveys (formerly known as Bristol Online Surveys) and distributed through the provision of an online link to participants (Appendix D4).

7.3.2.1.1 The Expertise Section

As in the previous chapter, participants were asked the following questions regarding their own rail travel and experience:

1. General Travel Frequency: *"How often do you travel on the railways?"*

   This was a multiple-choice question, with options ranging from daily rail travel to once a year or never having travelled by rail.

2. General Rail Travel Expertise: *"What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?"*

   Each participant had to rate the questions on a 7-point rating scale, with "1" standing for expertise to "7" meaning "no knowledge at all".

   Due to the required re-scaling of the findings in the previous study, the expertise questions were asked in the same "direction" as the travel frequency questions (high expertise and high travel frequency are both at the start of the rating scale) in this study.

3. Specific Trip: *"Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family""*

   A yes or no question.

4. Specific Trip Frequency: *"How often do you make this trip?"*

   Same multiple-choice options as Q1.

5. Specific Trip Expertise: *"If you answered "Yes" to the previous question, what level of expertise do you think you have regarding that specific journey?"*

Same rating scale options as Q2.

7.3.2.1.2 The Repertory Grid

Participants were presented with the higher-order constructs extracted from the clustering of the data from phase 2 (Table 22) in a grid format, against the "elements" (the disruption alerts, Table 20). The aim was to understand the extent to which the disruption alerts fulfilled the information needs of participants by matching them to the key characteristics obtained from the repertory grid process. These alerts were evaluated based on the constructs by being rated against them on a scale of 1 ("completely irrelevant") to 7 ("extremely relevant").

Following this, the constructs were ranked against each other based on importance, again, on a scale of 1 ("least important") to 7 ("most important"). This was to understand which characteristics of disruption information were seen as being most important to participants.

7.3.2.1.3 Demographics

The following items of demographic data were collected from participants in the final section: age, gender, location, area of residence, education and occupation. In addition to this, questions were asked regarding smartphone use, preferred methods of ticket-booking, and the possession of a social media account.

7.3.2.2 Participants and Procedure

The survey was distributed through social media, word-of-mouth and email, resulting in an opportunity sample of 59 participants. Upon clicking the link, participants were shown an introductory information page, following which, an option to provide their consent towards participating in the study. They were

also informed regarding optional entry into the prize draw for a chance to win one of three £10 Amazon vouchers, and finally, provided with the contact details of the main researchers. Following this, they were led to the first section of the survey.

7.3.3 Analysis

The data collected from participants was anonymised and exported onto a CSV file. The email addresses were only used in order to contact the three winners for the prize draw, as stated in the introduction to the survey. Results were then analysed using Microsoft Excel and SPSS.

7.4 Results

7.4.1 Participant Demographics: Descriptive Statistics

Table 25 features a summary of the participant demographics for the study.

Table 25. Summary of the demographics of the participants.

Demographic Factor	Statistics
Age	Most participants were between 25-34 years old.
Gender	Apart from 1 person, the rest of the participants identified as female (56.9%) or male (41.4%).
Location	Most participants were from the East Midlands (62.7%).
Area	Most participants lived in an urban area (52.5%), and some in a suburban location (39%).
Education	The most participants had either a Master's (39%) or an Undergraduate (27.1%) degree.
Occupation	A large proportion of participants were either employed (42.4%) or students (42.4%).
Ticket Booking	Most participants were likely to use a ticket-booking website (31%), or the website of a specific train operating company (25.9%).
Smartphone	All participants had a smartphone (100%).
Social media	Most had a social media account (93.2%).

7.4.2 Expertise and Travel Frequency: Descriptive Statistics

In addition to this, data surrounding the travel frequency and expertise of participants was gathered. As in the previous study, most people rated themselves as having higher than mid-scale levels of expertise regarding both rail travel in general, as well as specific journeys. Descriptive statistical tests were conducted for the expertise questions. These are in Table 26.

Table 26. Basic descriptive statistics for the expertise and travel frequency questions.

Travel Frequency and Expertise Questions (scale of 1-7)	N	Mean	Median
General Travel Frequency	59	4.49	5
General Expertise	59	5.37	6
Specific Trip Frequency	59	4.60	5
Specific Trip Expertise	45	6.33	7

There are a smaller number of people who answered the question regarding trip-specific expertise (45), as compared to all the other questions (59). This was

accounted for in further analyses conducted. Figures 18-21 depict participant ratings for all four questions.

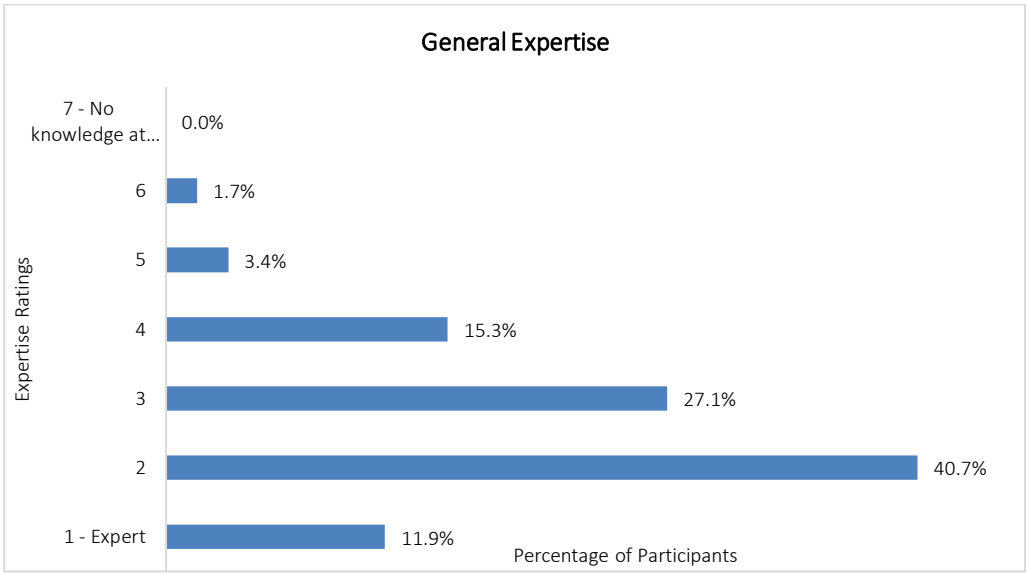


Figure 18. Expertise Ratings: General Expertise (*N* = 59).

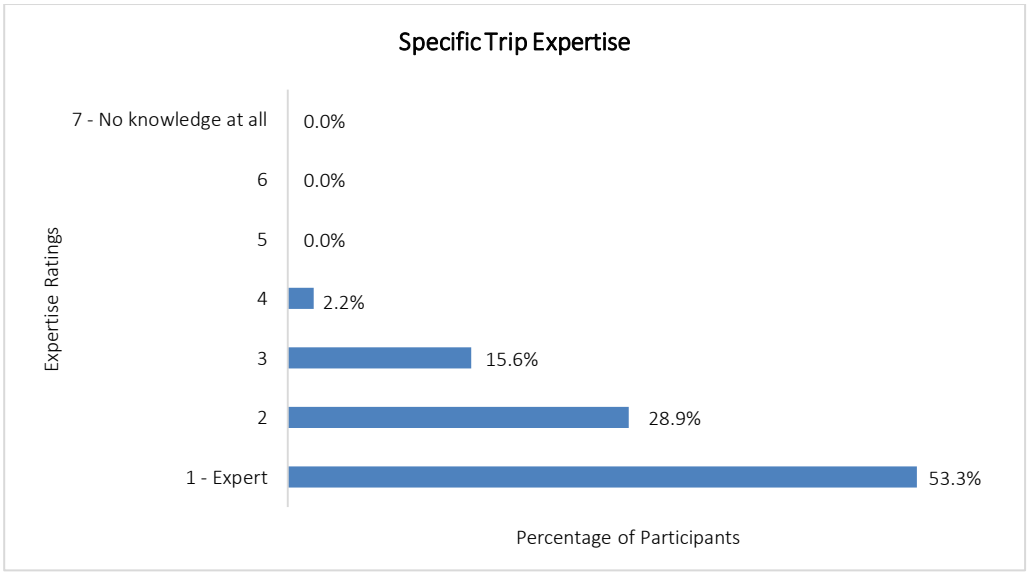


Figure 19. Expertise Ratings: Specific Trip Expertise (*N* = 45).

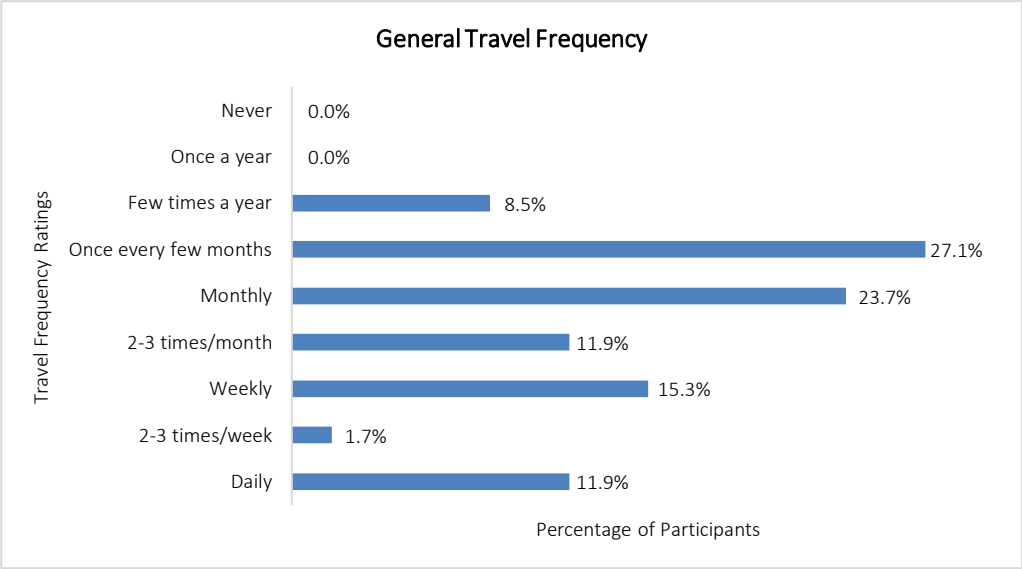


Figure 20. Travel Frequency Ratings: General Travel Frequency (*N* = 59).

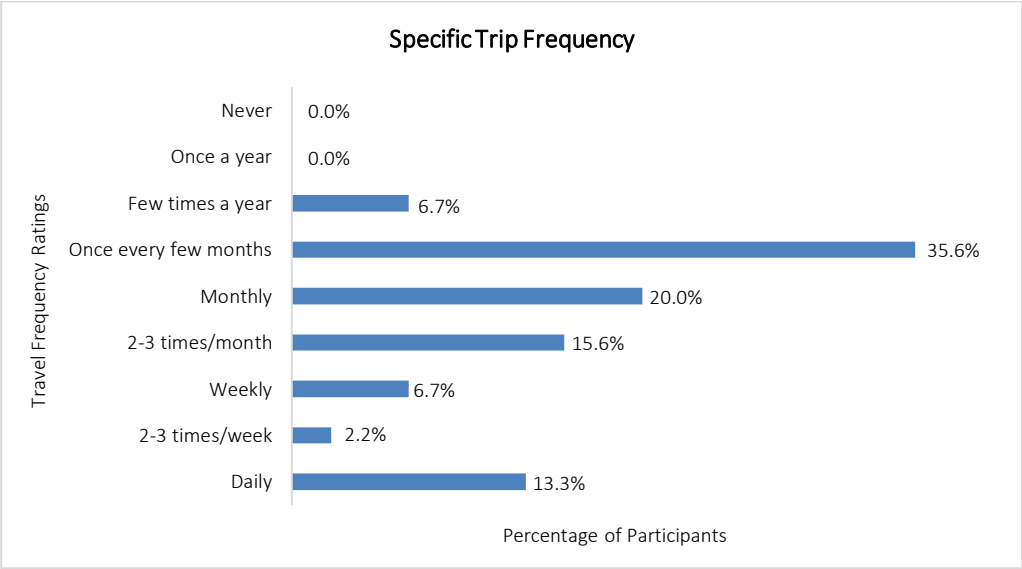


Figure 21. Travel Frequency Ratings: Specific Trip Frequency (*N* = 59).

7.4.3 Expertise and Travel Frequency: Correlations

Table 27 shows the correlations between the different expertise and travel frequency questions. Spearmen's Rho was used to conduct the analyses due to the non-parametric nature of the data.

Table 27. Expertise and travel frequency correlations.

Spearman's Rho		
General Expertise x General Travel Frequency (N = 59)	Coefficient = .269	$p < 0.05$
General Expertise x Specific Trip Frequency (N = 59)	Coefficient = .824	$p < 0.001$
General Expertise x Specific Trip Expertise (N = 45)	Coefficient = .623	$p < 0.001$
Specific Trip Expertise x Specific Trip Frequency (N = 45)	Coefficient = .175	$p > 0.05$

Unlike the previous study, not all correlations were significant. As can be seen, there is no significant correlation between Specific Trip Expertise and Specific Trip Frequency.

7.4.4 Expertise and Travel Frequency: Wilcoxon Signed Rank Test

As in the previous study, a Wilcoxon signed-rank test was conducted on the ratings on general and specific expertise, to examine domain specificity of expertise. The test showed a significant difference between general and specific expertise ($Z = -4.896$, $p < .001$), with the mean rating for Specific Expertise (6.33) higher than that for General Expertise (5.37).

7.4.5 Interim Summary

As in the previous study, results presented so far show significant positive correlations between general expertise and travel frequency, as well as the frequency of travel on, and knowledge regarding, a specific trip. The only difference in this study is the lack of a correlation between specific trip frequency and specific trip expertise.

Again, people tend to rate themselves as being quite high on all the expertise questions, with the lowest mean/median lying at 5 out of 7. Comparatively, the responses for Travel Frequency are more distributed.

The Wilcoxon signed-rank test, again, shows support for the notion of domain specificity of expertise – there is a significant difference between the ratings of specific-trip and general rail travel expertise, with participants seeing themselves as being more knowledgeable regarding the former.

7.4.6 Construct Rankings

Firstly, the rankings of the constructs (based on importance) were examined (Figure 22). These rankings were obtained from 46 of the 59 participants – some of the participant rankings had to be removed from the analysis due to misunderstandings regarding the nature of the ranking task.

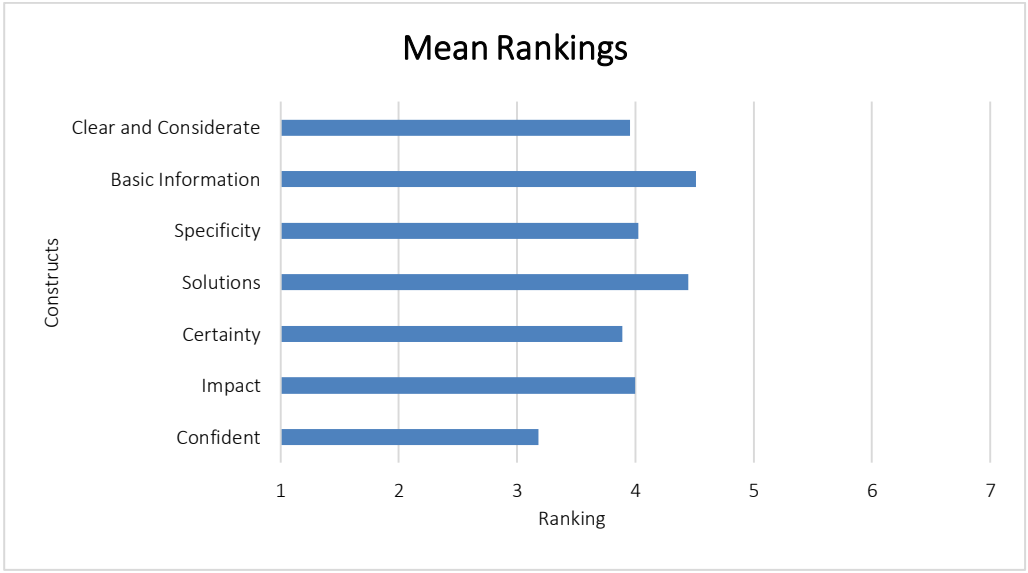


Figure 22. Construct ranks (*N* = 46).

As can be seen, there is a low level of variation across the rankings of the constructs. The provision of basic travel information is the most important,

followed by the presentation of solutions. “Confident” (“This alert makes me feel confident and secure in the situation”) has the lowest rating.

Following this, the grid ratings were studied using a cluster analysis (Ward’s method): first, across all participants, and then within participant groups formed based on high and low travel frequency and expertise. The clusters were constructed by the elements, and then by the constructs, both of which will be reported below.

7.4.7 Cluster Analysis: By Elements

7.4.7.1 All Participants

Firstly, the cluster analysis across all participants depicted the clear clustering of the element ratings into three groups. The main clusters have been circled on the dendogram (Figure 23).

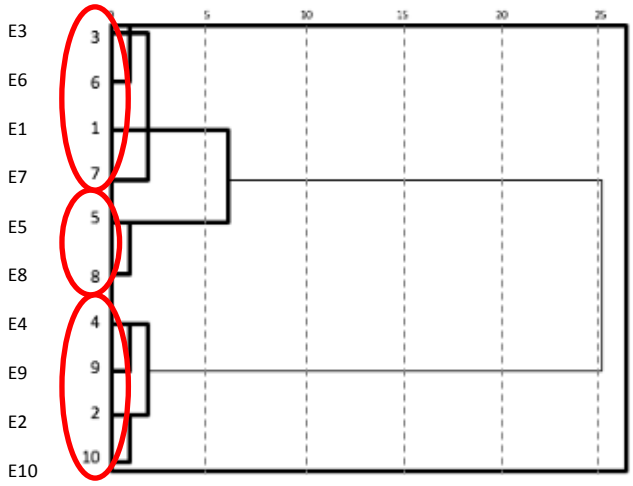


Figure 23. Cluster analysis by elements: all participants (*N* = 59).

These clusters have been presented in Table 28.

Table 28. Element Clusters: All participants.

Cluster	Elements
1	E5: Signalling fault resolved, uncertain outcome E8: Heavy rain, uncertain outcome
2	E2: Broken rail, long delay E4: Signalling fault resolved, uncertain outcome E9: Operational incident, uncertain outcome E10: Track circuit failure, short delay
3	E1: Minor delay E3: Level crossing issue, uncertain outcome E6: Speed restriction, uncertain outcome E7: General uncertainty

Following this, the participants were then split into the following groups based on their expertise and travel frequency ratings:

1. Travel Frequency
    - High: Daily, 2-3 times a week, Weekly, 2-3 times a month
    - Low: Monthly, Once every few months, Few times a year, Once a year, Never
2. Expertise
    - High: 1, 2
    - Low: 3, 4, 5, 6, 7

The results were analysed separately for each group.

7.4.7.2 General Travel Frequency

There is a clear difference in the clustering of the high (four clusters) and low (three clusters) general travel frequency groups, as seen in Figures 24 and 25.

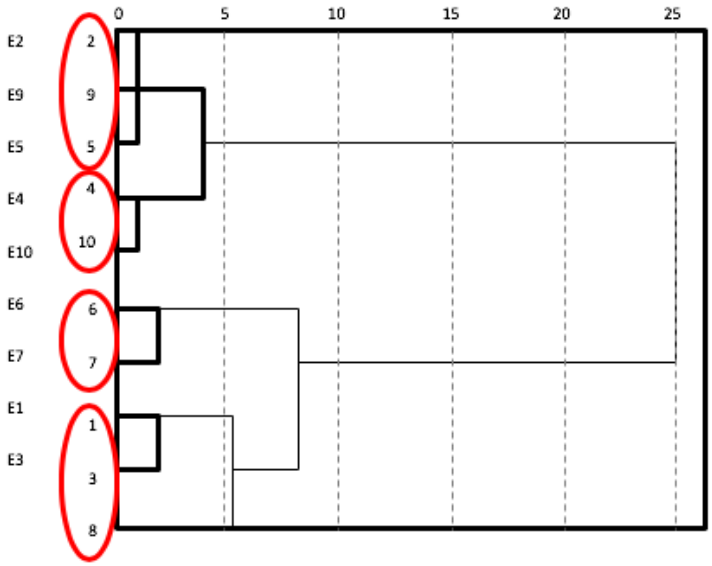


Figure 24. Cluster analysis by elements: high general travel frequency (*N* = 24).

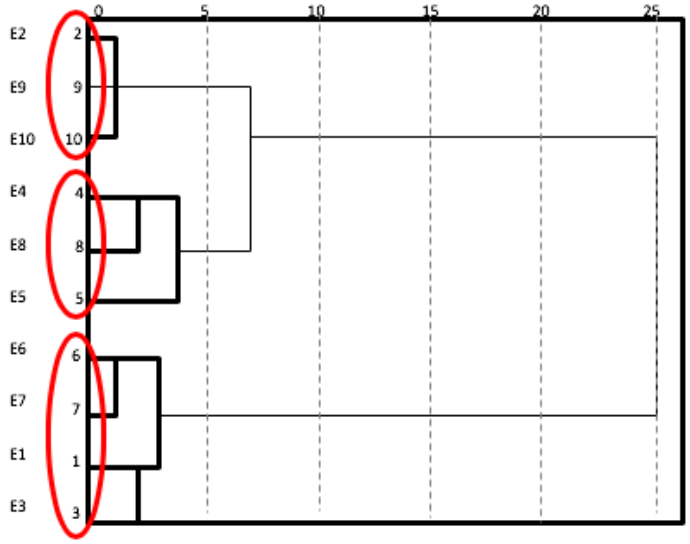


Figure 25. Cluster analysis by elements: low general travel frequency (*N* = 35).

The differences between the number of clusters extracted, and the types of clusters formed between the groups has been presented in Table 29.

Table 29. Element Clusters: General Travel Frequency.

Code	Disruption Alert	High General Travel Frequency	Low General Travel Frequency
E1	Minor delay	Cluster 4	Cluster 3
E2	Broken rail, long delay	Cluster 1	Cluster 1
E3	Level crossing issue, uncertain outcome	Cluster 4	Cluster 3
E4	Signalling fault resolved, uncertain outcome	Cluster 2	Cluster 2
E5	Signalling fault, important connection	Cluster 1	Cluster 2
E6	Speed restriction, uncertain outcome	Cluster 3	Cluster 3
E7	General uncertainty	Cluster 3	Cluster 3
E8	Heavy rain, uncertain outcome	Cluster 4	Cluster 2
E9	Operational incident, uncertain outcome	Cluster 1	Cluster 1
Code	**Disruption Alert**	**High General Travel Frequency**	**Low General Travel Frequency**
E10	Track circuit failure, short delay	Cluster 2	Cluster 1

There are some similarities between the groups – both put E6 and E7 together, and do the same for E1 and E3 and E2 and E9. However, there are more clusters seen for the high frequency travellers, as well as different patterns seen between the clusters formed by both groups.

7.4.7.3 General Expertise

The ratings of the elements result in three distinct clusters for high general expertise (Figure 26) and two clusters for low general expertise (Figure 27).

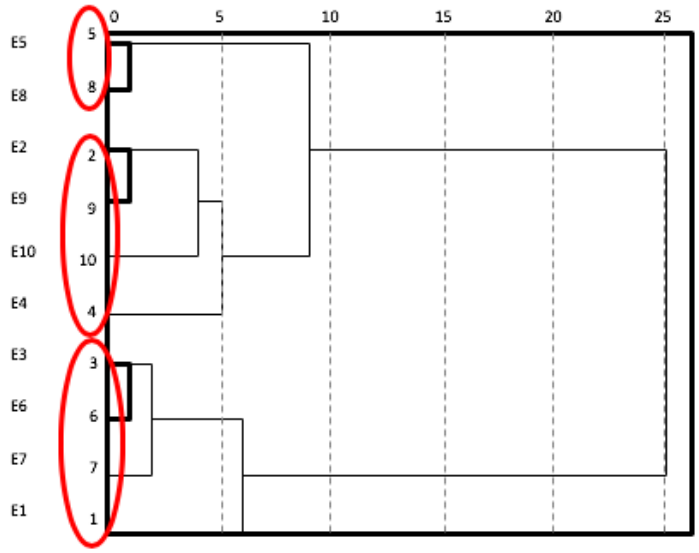


Figure 26. Cluster analysis by elements: high general expertise (N = 31).

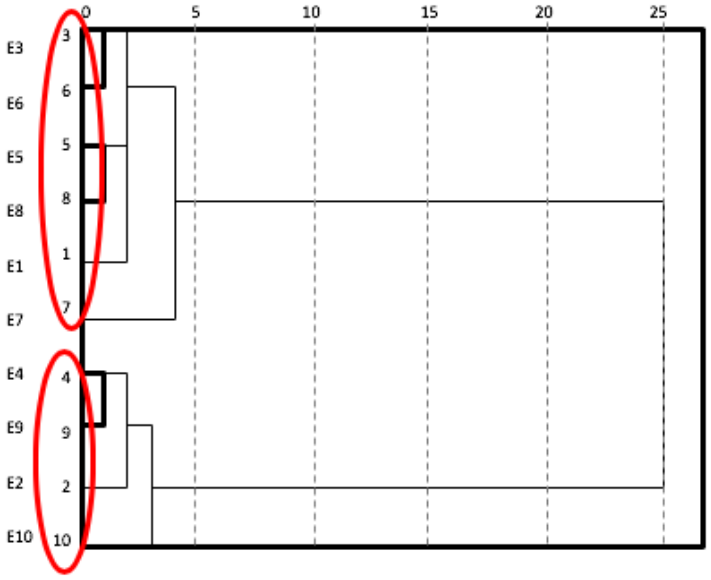


Figure 27. Cluster analysis by elements: low general expertise (*N* = 28).

The clusters formed have been presented in Table 30.

Table 30. Element Clusters: General Expertise.

Code	Disruption Alert	High General Expertise	Low General Expertise
E1	Minor delay	Cluster 3	Cluster 1
E2	Broken rail, long delay	Cluster 2	Cluster 2
E3	Level crossing issue, uncertain outcome	Cluster 3	Cluster 1
E4	Signalling fault resolved, uncertain outcome	Cluster 2	Cluster 2
E5	Signalling fault, important connection	Cluster 1	Cluster 1
E6	Speed restriction, uncertain outcome	Cluster 3	Cluster 1
E7	General uncertainty	Cluster 3	Cluster 1
E8	Heavy rain, uncertain outcome	Cluster 1	Cluster 1
E9	Operational incident, uncertain outcome	Cluster 2	Cluster 2
E10	Track circuit failure, short delay	Cluster 2	Cluster 2

As seen in the table, it is clear that the clusters between the groups are similar. Both groups have the same Cluster 2 (E2, E4, E9, E10). The only difference is that the ratings of the Low General Expertise group for the remaining elements (E1, E3, E5, E6, E7, E8) form a single cluster, while the High General Expertise group divides them into two clusters (E5, E8 and E1, E3, E6, E7).

7.4.7.4 Specific Travel Frequency

These analyses compared the groups that rated themselves as having high specific travel frequency (three clusters) and low/no specific trip frequency (again, three clusters). The different clusters seen between both groups can be seen in Figures 28 and 29.

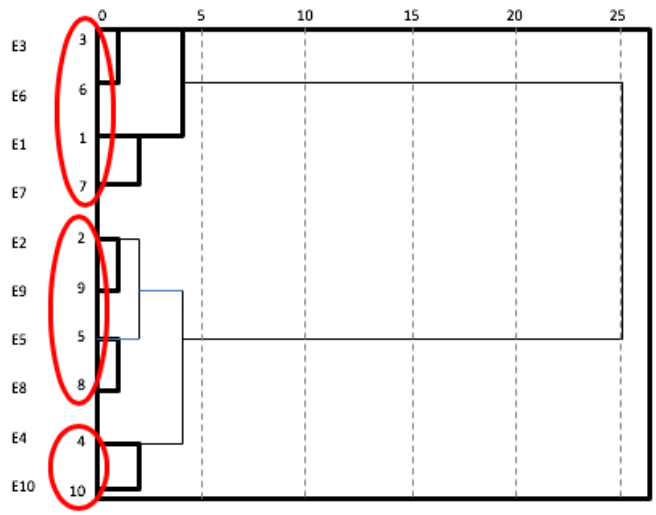


Figure 28. Cluster analysis by elements: high specific travel frequency (N = 17).

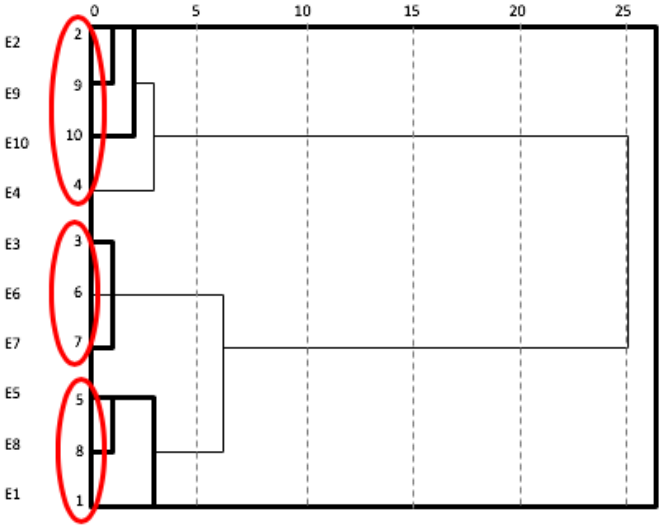


Figure 29. Cluster analysis by elements: low/no specific travel frequency (*N* = 42).

The differences between the number of clusters extracted, and the types of clusters formed between the groups has been presented in Table 31.

Table 31. Element Clusters: Specific Trip Frequency.

Code	Disruption Alert	High Specific Trip Frequency	Low Specific Trip Frequency
E1	Minor delay	Cluster 1	Cluster 3
E2	Broken rail, long delay	Cluster 2	Cluster 1
E3	Level crossing issue, uncertain outcome	Cluster 1	Cluster 2
E4	Signalling fault resolved, uncertain outcome	Cluster 3	Cluster 1
E5	Signalling fault, important connection	Cluster 2	Cluster 3
E6	Speed restriction, uncertain outcome	Cluster 1	Cluster 2
E7	General uncertainty	Cluster 1	Cluster 2
E8	Heavy rain, uncertain outcome	Cluster 2	Cluster 3
Code	Disruption Alert	High Specific Trip Frequency	Low Specific Trip Frequency
E9	Operational incident, uncertain outcome	Cluster 2	Cluster 1
E10	Track circuit failure, short delay	Cluster 3	Cluster 1

The similarity between the groups ends with the existence of three clusters for each group. While there are comparisons that can be made (both groups put E3, E6 and E7 in the same clusters, for example), the clusters formed differ between the two groups.

7.4.7.5 Specific Trip Expertise

The final two groups analysed were those that rated themselves as having high specific travel expertise (two clusters) and low/no specific trip expertise (again, two clusters). The clusters seen in both groups can be seen in Figures 30 and 31.

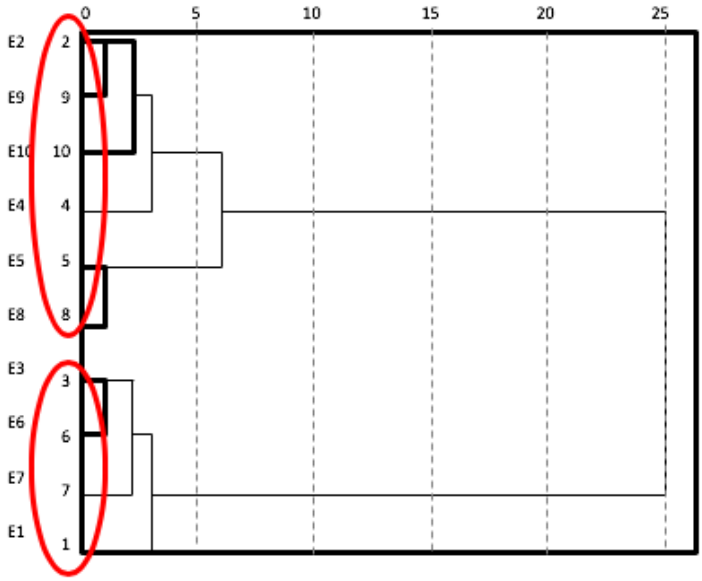


Figure 30. Cluster analysis by elements: high specific trip expertise (*N* = 44).

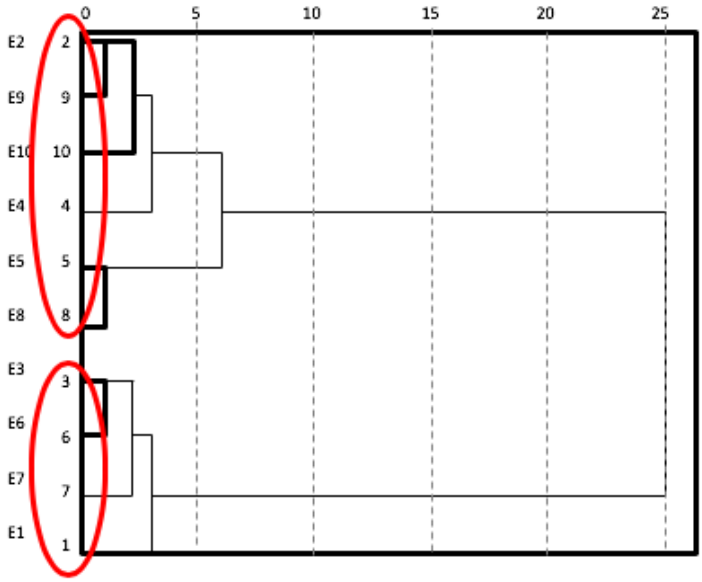


Figure 31. Cluster analysis by elements: low/no specific trip expertise (*N* = 15).

The types of clusters formed between the groups are in Table 32.

Table 32. Element Clusters: Specific Trip Expertise.

Code	Disruption Alert	High Specific Trip Frequency	Low Specific Trip Frequency
E1	Minor delay	Cluster 1	Cluster 1
E2	Broken rail, long delay	Cluster 2	Cluster 2
E3	Level crossing issue, uncertain outcome	Cluster 1	Cluster 1
E4	Signalling fault resolved, uncertain outcome	Cluster 2	Cluster 2
E5	Signalling fault, important connection	Cluster 2	Cluster 2
E6	Speed restriction, uncertain outcome	Cluster 1	Cluster 1
E7	General uncertainty	Cluster 1	Cluster 1
E8	Heavy rain, uncertain outcome	Cluster 2	Cluster 2
E9	Operational incident, uncertain outcome	Cluster 2	Cluster 2
E10	Track circuit failure, short delay	Cluster 2	Cluster 2

In contrast to the findings for Specific Trip Frequency, the clusters found for Specific Trip Expertise were the same across all participants, regardless of their ratings of their own expertise.

7.4.7.6 Clusters by Elements: Collation

The clusters were collated across the different groups, resulting in the identification of 14 clusters after the removal of duplicates. Upon analysis, some of the clusters were quite similar or "smaller versions" of the same cluster type. For example, going back to Figures 21 & 22, Clusters 1 and 3 formed by the High General Expertise group were similar to Cluster 1 (E1, E3, E5, E6, E7, E8) from the Low General Expertise group. Through the de-duplication of similar clusters of this sort, a final list of six high-order clusters were extracted from the analyses. These cluster types can be seen in Table 33, alongside the disruption alerts

linked to each of them, as well as the groups that identified them. There are distinct types of information that have been identified by different groups.

*Table 33.*Higher-order cluster classifications, resulting in a group of 6.

Cluster Type		Disruption Alerts (Elements)	Groups Found In
1	Duration uncertainty	E1, E5, E8	Entire sample Low specific trip frequency High general travel expertise
2	Location uncertainty	E2, E4, E9, E10	Entire sample Low general travel frequency Low specific trip frequency High general travel expertise Low general travel expertise
3	General uncertainty	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10	Entire sample High general travel frequency Low general travel frequency High specific trip frequency High general travel expertise High specific trip expertise Low/no specific trip expertise
4	Technical failures	E2, E4, E5, E8, E9	High general travel frequency Low general travel frequency High specific trip frequency
5	All information given	E4, E10	High general travel frequency High specific trip frequency
6	Only cause provided	E1, E3, E5, E6, E7, E8	High general travel frequency Low specific trip frequency Low general travel expertise

7.4.8 Cluster Analysis: By Constructs

The cluster analysis was then conducted by clustering of the elements (disruption alerts) by the constructs (obtained from the repertory grid). The results across all groups show a basic division into four clusters (Figure 32).

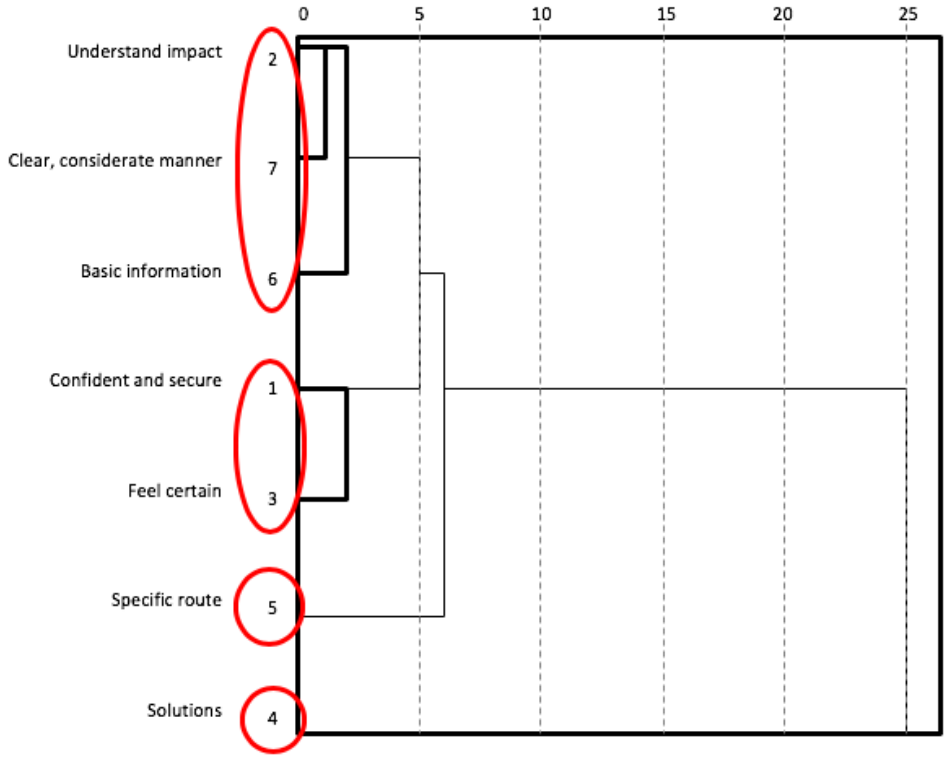


Figure 32. Cluster analysis by constructs: all participants (*N* = 59).

- Cluster 1: Provide Information
    - Understand impact, Clear and considerate, Basic information
- Cluster 2: Instil Confidence
    - Confident and secure, Feel certain
- Cluster 3: Specify Route
    - Specific Route
- Cluster 4: Offer Solutions
    - Solutions

The construct clusters seen across the different groups (high and low frequency travellers, high and low expertise levels) provided similar results, basically boiling it all down to the existence of four main "types" of constructs. All of them have been presented in Appendix D5.

In summary, there were six higher-order clusters found when the ratings were clustered by the elements, and four clusters found when they were grouped by the constructs. These have been presented in Table 34.

*Table 34.*Summary of the final clusters.

Clusters (by Element)
Duration uncertainty
Location uncertainty
General uncertainty
Technical failures
All information given
Only cause provided
Clusters (by Construct)
Provide information
Instil confidence
Specify route
Offer solutions

7.5 DISCUSSION

Following on from the previous chapter, there is continued support for two main hypotheses of this thesis: the link between travel frequency and expertise, as well as the domain specificity of expertise. There are strong correlations

between general rail travel frequency and expertise, as well as a significant difference between self-rated expertise on specific trips and rail travel in general. So how does this link to disruption information?

Firstly, disruption information can be classified based on the following pertinent characteristics: delay duration, location, as well as general uncertainty. Beyond this, clusters seen are also specific to the idea of technical failure, and with a sole focus on the cause of the disruption. Finally, an interesting outcome is the cluster type that identifies the provision of all relevant information – this will be explored further in the following paragraphs, which focus on the comparisons between different groups. To refresh, the main hypotheses regarding traveller differences were:

1. There will be clear differences between participant groups that rate themselves as having higher levels of expertise, and those that have lower levels, in the way that they understand and appreciate disruption information.
2. These differences will also be present between high frequency and low frequency travellers.

Firstly, the exact same cluster types identified by all the participants are also seen in the ratings of travellers that consider themselves as having high levels of expertise. This might point to the idea that all participants, even those with high levels of self-rated expertise, identify the same features of disruption information. Travellers seeing themselves as having high levels of expertise are also probably frequent commuters, based on earlier findings - do these two groups have similar patterns of ratings?

This is the point where the differentiation between the groups begins to get more complicated. The contrasts seen between groups on the basis of both general and specific travel expertise result in the formation of fairly similar clusters. All cluster types seen in these groups are related to uncertainty, with little difference based on high or low expertise. This finding contrasts with the second hypothesis of this study: "there will be clear differences between participant groups that rate themselves as having higher levels of expertise, and those that have lower levels". It is also interesting with regards to the significant difference between participant ratings of their own general and specific travel expertise: participants rate their specific trip expertise as being higher than their general rail travel expertise.

The ratings of travel frequency, however, provide more distinct differences between participant groups, as was expected by the second hypothesis presented in the introduction. While all groups identify the cluster types related to uncertainty, each different travel frequency group identifies additional specific information.

Travellers across the high general travel frequency, high specific trip frequency and low general travel frequency groups exclusively cluster the alerts based on technical failure. However, more importantly, there is a distinct difference seen between high and low frequency travellers - for both general travel and specific trips – based on the identification of situations within which all relevant information has been provided. It is only within high frequency traveller groups that the cluster category of "all information provided" is found. This suggests that frequent travellers specifically identify disruption situations within which

they are equipped with the information necessary to manage them. This might be a result of repeated interaction with the rail system. Frequent commuters have the lowest levels of satisfaction with the rail service (Transportfocus, 2015) due to their relatively high experience of disruption and delays (Transportfocus, 2016a). Also, constant exposure to disruption-related information would result in increased familiarity, and thus knowledge, regarding the successful provision of information within these situations. Frequent travellers are seen as being experts (Grotenhuis et al., 2007). Expertise is a result of extensive learning from one's experiences (Shanteau, 1988), as well as consistent practice within the relevant context (Ericsson et al., 1993). These characteristics match the findings of the current study regarding the ability of frequent travellers to identify nuance. However, the question here is: why is there such a distinct difference seen based on travel frequency, but not expertise? The abstract nature of "expertise" might be the answer here. Is it adequately captured by self-ratings? Beyond this, with regards to the additional hypotheses around stress and control: all participants identify the notion of uncertainty. As mentioned, this idea of uncertainty is crucial to the discussion of rail travel, being highlighted as a downside to the use of public transportation methods due to its tendency to cause cognitive taxation (Grotenhuis et al., 2007). Uncertainty has also been further linked to additional factors like the perception of public transport such as the railways, and the dependence on car usage, for example (Office of Rail Regulation, 2014). Finally, in terms of disruption, the main purpose of the provision of information is to alleviate feelings of uncertainty so that passengers can regain control of their journeys. Control has been highlighted as being the

mediating factor in the experience of stress during the process of rail travel, with a lack of it playing a role in the increase of negativity within the situation (Cox et al., 2006).

Finally, a key point of note is the cluster analysis by constructs. Going back to section 7.4.8, all participants identified the exact same disruption information, regardless of their expertise or travel frequency. This could mean one of two things. The first explanation is that all passengers require the same information when it comes to a disruption situation – good information is good information, regardless of personal context. The second explanation is that the lack of differences seen between groups could simply be attributed to the design and sample of the study. This introduces the possible limitations.

7.5.1 Methodological Learnings

The repertory grid method has limited statistical reliability due to the nature of its design – namely, the use of a small sample. However, it has been noted as eliciting trustworthy data of a high quality. Furthermore, the process of elicitation provides high levels of construct validity, and the fact that the contents of the grid arise from the participants who later rate them ensures great levels of face validity as well (Edwards et al., 2009).

Additionally, the sample size of the present study could be considered as being quite small. However, the repertory grid method, due to the combination of qualitative and quantitative analyses used, does not necessarily warrant a large sample size. Previous studies have successfully conducted repertory grid

methods with 40 (Riemersma, 1988) and 35 (Golightly & Dadashi, 2016), and even 14 (Moynihan, 1996) participants. Thus, the sample size is adequate for the purposes of this study.

Beyond this, self-report data has been known to be problematic in the past due to the reliance on a person's own perceptions of self, as noted in the previous chapter (Edwards, 1953). To adjust for this, however, the expertise questions were split in a manner to ensure that only the top two expertise ratings were considered as being representative of "high expertise".

Here, it is worth considering whether travel frequency is in itself a measure of expertise. The idea of being "an expert" (or not) may be abstract and difficult to conclusively define. The idea of travel frequency, however, might be a way to provide more clarity, at least when using rating-based measures. While an individual might massively over-estimate, under-estimate or even misunderstand their own "expertise", they are considerably more likely to be able to identify something more tangible, such as their own travel patterns. With certain studies equating frequent travel to having "expert knowledge" (Gustafson, 2012), can the former be considered as an adequate measure of higher levels of rail-related knowledge? Is it even necessary to be looking to further identify a more abstract "form" of expertise?

Finally, the main research objective for this chapter was to examine the impact that rail disruption has on expertise and information use, and the additional informational support required based on this. The clustering of the ratings by the constructs provide a template of the manner in which this information should be provided. The clusters provide a checklist regarding all the bases to be

covered during the delivery of disruption information: provide all the important details regarding the impact of the disruption, including length of the delay and its location, aiming to instil confidence in the passenger, whilst also making sure to offer solutions. This basic template can provide a successful strategy across the board due to the its ability alleviate uncertainty, which is the main concern noted by passengers in general.

In summation, the current study provides both a practical framework for the successful provision of information to passengers during disruption, as well as an idea of how current disruption information is viewed by different groups of rail travellers. In addition to this, there are questions raised regarding the study of something as abstract as expertise within the travel context. Travel frequency captures something that measures of expertise may not be able to provide: objectivity. From a theoretical perspective, this study proposes that frequency could be adequate for the purposes of exploring travel habits influenced by individual factors such as experience and personal travel knowledge.

7.6 CONCLUSION

The present chapter presented an argument for the study of information use with a focus on disruption management – a summary of findings in the context of the overall narrative is in Figure 33. As noted by the literature, there is reason to believe that learned patterns of behaviour could be disrupted by exceptional circumstances that the individual traveller is not familiar with. In other words, the nature of expertise might look a bit different within the disruption situation.

The repertory grid study presented in this chapter set out to examine this, using a series of disruption alerts to extract the important factors involved when assessing disruption information. Following the extension of the repertory grid to an online survey, these factors were analysed alongside participants' ratings of their own travel frequency and rail-related expertise. Results, firstly, showed that the key steps to support travellers during disruption were to provide specific information, instil confidence and offer solutions. Upon further analysis, there were differences seen in the information preferences of groups of participants, particularly around the recognition of uncertainty. Looking more specifically at measures surrounding expertise and travel frequency, however, the latter provides more of an insight into understanding passenger behaviour. Expertise seems to provide only a limited explanation for the information preferences of travellers, requiring an investigation of other factors that could be involved. With this in mind, the next chapter will examine possible alternatives to expertise for information personalisation and discuss other factors that could influence passenger behaviour.

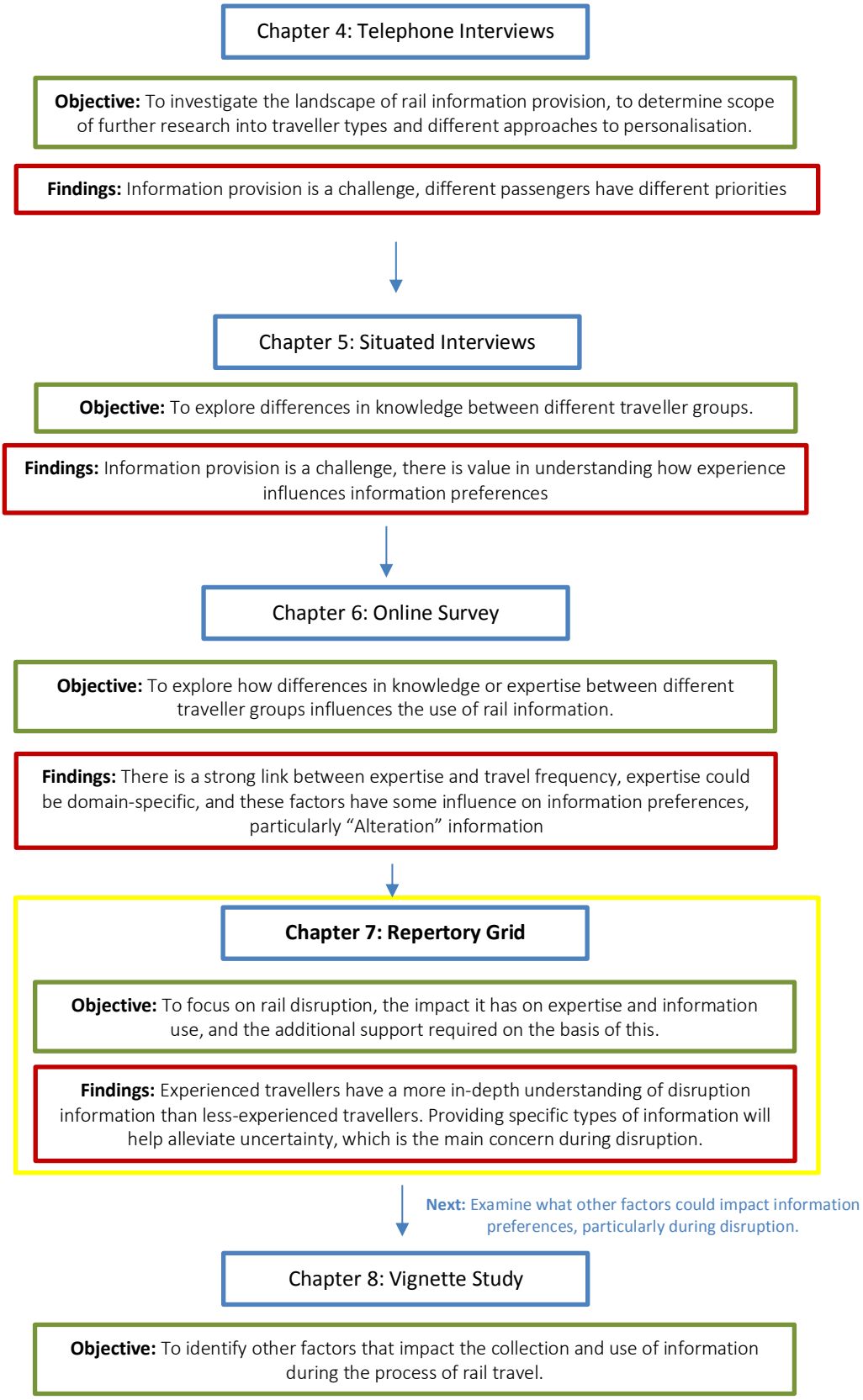


Figure 33. Thesis narrative schematic.

8. Survey Three: Travel Expertise, Travel Frequency and Disruption Information Preferences

8.1 Chapter Summary

The vignette study presented in this chapter explored additional factors that could influence the use of information during rail travel, with a particular focus around the management of disruption. The main aim of was to investigate the fifth research objective of this thesis: to identify other factors that impact the collection and use of information during the process of rail travel. For this, two journey variables were added into the mix – trip purpose and journey familiarity – along with the presentation of a hypothetical travel situation. Participants were asked to rate information features and disruption information characteristics based on their usefulness within the scenario presented. Findings showed a clear preference for specific types of information across all travellers, regardless of their expertise, travel frequency or journey familiarity. While there was an effect of the importance of the trip, this was secondary to the broad preferences for specific types of information.

8.2 Introduction

The story so far has been quite unexpected – expertise and travel frequency do account for some of the decisions made during information selection, as well as in the identification of the relevant characteristics of disruption information.

Travel frequency offers more explanatory power, considering the skewed perception gained by the use of self-rating measures of expertise. However, while expertise and travel frequency contribute to the information use of individual travellers, the results of the last two studies show that they provide limited explanation for the information preferences of travellers. In the first survey, neither travel frequency nor expertise explain a large amount of variance with regards to information grouping and selection. In the second survey, clustering by the information constructs shows a uniform set of preferences across all participants, regardless of their expertise or frequency of travel. These factors do not capture the whole story, and intuitively, there is an argument for this. Travel is a multi-faceted process, influenced by several individual and external variables. While the focus of this thesis has been on the underlying aspects of personal knowledge and experience, there are also external factors that need to be accounted for. The purpose of the present study is to examine possible contextual variables that could explain the information preferences of travellers.

The independent variables were selected based on the existing literature, as well as possible ideas discussed during the course of the present research. The first choice was the notion of journey purpose, which previous research had found to be a key factor in influencing information selection during the use of public transport (Yeboah et al., 2019). Within this thesis itself, both industry stakeholders (Chapter 4) and rail passengers (Chapter 5) mention the impact that journey purpose has on both information delivery and use. One of the major questions that informed the direction of this thesis was the idea of the differing

levels of knowledge between different types of passengers. Previous studies have attributed these differences to the type of traveller themselves. Anable and Gatersleben (2005), for example, discuss the different concerns of commuters and leisure, which influenced the main hypotheses of the present thesis. However, if knowledge and expertise only play a limited role in the information use of passengers, the obvious next step would be to examine the context within which that knowledge is used: the trip itself. It is intuitive to suggest that different trips have different requirements. Passenger needs for a time-bound trip (a business meeting, or a flight, perhaps) would be extremely different to those for a more "leisurely" journey (a vacation, or a direct train with no changes), for example. While a commuter might have more knowledge than a leisure traveller in both those situations, the differing contexts have a crucial role to play in the decisions made, and the amount and type of information required. With this in mind, the first variable selected for manipulation was "Trip Importance", with two levels: high and low importance.

At the beginning of this thesis, it was suggested that expertise was domain-specific. This was investigated by looking at the differences between general rail expertise and specific trip expertise, with the finding that people rate themselves higher on the latter. Due to the stated issues surrounding the use of self-ratings, the choice was made to explore this further, by looking at it from the perspective of the journey, rather than from the perspective of the traveller. Instead of general or specific expertise, the choice was made to focus on whether the journey was an unfamiliar or a familiar one. Going back to the passenger interviews, commuters noted their high levels of knowledge with

regards to their work trip, but the need to plan the journey from scratch if it was an unfamiliar one. To explore this aspect, the second independent variable for this study was "Trip Familiarity". Again, this was at two levels: high and low familiarity.

Finally, previous studies have highlighted the increased requirement for support during disruption - both industry stakeholders and rail passengers comment on this in the interviews, and the repertory grid study outlined distinct concerns that participants had with regards to disruption information. Additionally, one of the main objectives of rail organisations (primarily, Rail Delivery Group) has been to improve their understanding of the best manner in which to improve communication during disruption (Accent & Rail Delivery Group, 2017). A focus on disruption would match that objective, ensuring the delivery of a relevant and usable outcome. Thus, the aim of the present study was to explore the fifth objective of this thesis: to identify other factors that impact the collection and use of information during the process of rail travel.

The main hypotheses of this thesis revolved around the exploration of expertise and travel frequency, and the impact that these factors have on information use during rail travel. The repertory grid study found that there were differences in the way that frequent and infrequent travellers identified the key characteristics of disruption information. Do their preferences regarding disruption information reflect this as well? For this, the travel frequency ratings used in the previous studies were carried onto this one. The expertise questions were also included, in order to re-examine the domain specificity of expertise, particularly among a larger sample of frequent travellers.

The hypotheses for the present study were as follows:

1. There will be significant differences between the information choices of participants based on the different levels of the trip-related variables (high and low Trip Familiarity and Trip Importance).
2. There will be significant differences between the information preferences of high frequency and low frequency travellers.

8.3 METHOD

8.3.1 OVERVIEW OF METHOD

Vignette experiments have been successful applied to the investigation of various topics over the years, from subjective experiences of pain (Chambers & Craig, 1998), referrals for social work (Sheppard & Ryan, 2003) and the gender pay gap (Steiner, Atzmüller & Su, 2016). This method involves the presentation of a hypothetical situation (here, a disrupted travel journey), followed by a selection of relevant questions. In this study, the disruption situation was succeeded by the rating of relevant information functions based on their usefulness within the hypothetical disruption context. Rating measures are recommended for vignette studies, as opposed to open-ended questions, to increase response consistency, and remove between-subjects bias (Steiner, Atzmüller & Su, 2016). These types of factorial surveys are an excellent way to investigate more than one variable, in a multi-dimensional manner. The main advantages of the vignette method include the ability to present realistic situations within an experimental condition, high internal and construct validity,

and flexibility surrounding the manipulation of experimental conditions. All of this contributes to a large amount of reliability when it comes to using this method (Steiner, Atzmüller & Su, 2016).

8.3.2 Design and Materials

8.3.2.1 The Expertise Section

Section one asked participants a series of "expertise-related" questions. This was to ensure consistency across the survey studies, as well as in accordance with the general aim of this thesis to investigate the influence of traveller knowledge on information choice and use. As in the previous studies, the questions were:

1. General Travel Frequency: *"How often do you travel on the railways?"*

   This was a multiple-choice question, with options ranging from daily rail travel to never having travelled by rail.

2. General Rail Travel Expertise: *"What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?"*

   Each participant had to rate the questions on a 7-point rating scale, with "1" meaning no knowledge at all to "7" standing for expertise.

3. Specific Trip: *"Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family""*

   A yes or no question.

4. Specific Trip Frequency: *"How often do you make this trip?"*

   Same multiple-choice options as Q1.

5. Specific Trip Expertise: *"If you answered "Yes" to the previous question, what level of expertise do you think you have regarding that specific journey?"*

   Same rating scale options as Q2.

The rating scale is similar to the online survey, but not the repertory grid study. While the rating scales differed between studies, there was no actual difference to the narrative or the findings of any of the studies based on the direction of the rating scales.

8.3.2.2 The Vignette Experiment

The vignettes presented were designed to reflect the different study variables: high and low "journey familiarity" (2 levels) and high and low "trip importance" (2 levels). The four versions can be seen in Table 35.

*Table 35.*Vignette types.

Vignette Condition	Study Variables	Vignette
Version A	High Familiarity, High Importance	Olivia Pope commutes to work on the train five times a week, and is on her usual journey on a busy Monday morning. She has an important review meeting with her manager at 9 am, and is going over her notes on the platform when it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in her trip, how useful would the following pieces of information be to?
Version B	Low Familiarity, High Importance	Olivia Pope is on her way from Nottingham to Stanstead Airport to catch a flight to Tokyo. She has planned her train journey in a manner that ensures that she reaches the airport 2 hours prior to her flight, giving her enough time to check-in and have a snack before her plane. However, upon arriving at the platform, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in the trip, how useful would the following pieces of information be?

Vignette Condition	Study Variables	Vignette
Version C	High Familiarity, Low Importance	Olivia Pope is used to taking the train from Bristol to London over the weekends, as her partner lives there. She usually leaves work a little bit early on the Friday to avoid the rush, takes the 16.41 train from Temple Meads Station to London Paddington, and then the Tube to her partner's house. When she gets to the platform on this Friday, however, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in the trip, how useful would the following pieces of information be?
Version D	Low Familiarity, Low Importance	Olivia Pope has decided to wind-down after a long week of work by taking a solo trip to York for the weekend. Having never been there before, she decides that the train is the easiest way for her to get there, and decides to take an early train from Sheffield station on the Saturday morning, so she can enjoy the city for a bit before checking into her room later on in the afternoon. As she arrives at the platform, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in her trip, how useful would the following pieces of information be to?

As can be seen, the consistent features of the scenarios across all version were the protagonist, and the disruption faced by her ("when it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident").

An external protagonist was selected in order to limit the influence of social desirability bias (Steiner, Atzmüller & Su, 2016), and provide participants with the opportunity to judge the situation as objectively as possible. As has been seen with the expertise ratings, participants' expectations of their own knowledge and behaviour can be skewed.

8.3.2.3 The Information Functions

Six information functions and four disruption characteristics were used for this study (Table 36). These were derived from the previous survey studies conducted in this thesis. The first six out of the ten were the factors obtained from the exploratory factor analysis conducted on the survey items from Chapter 6. These were used to reflect the types of general travel information that people might require while completing a journey on the railways. The last

few were taken from the cluster analysis conducted on the responses from the repertory grid study (Chapter 7). Out of the six clusters extracted from the repertory grid findings, four were selected to be examined: Duration Uncertainty, Location Uncertainty, All Information Given (or a "Solution"-based alert) and Causal Information (which was merged with the "Technical Failures" cluster). The only cluster excluded was "General Uncertainty", as it did not capture a specific feature of disruption information, like duration or location, for example. The aim of this was to reflect the main types of information that people might require during rail disruption.

Both were combined to ensure that all the important facets of information provision were accounted for, to understand which of them were most appreciated during disruption (Table 36).

Table 36. Information functions and disruption characteristics.

Information Functions	Label	Derived From
1. Basic journey planning information.	Journey Planning	Online Survey (Chapter 6)
2. Information regarding service updates.	Service Updates	
3. FAQs and information about how to provide feedback.	Feedback	
4. Real-time journey updates on a mobile phone.	Phone Notifications	
5. Information about station facilities.	Station Facilities	
6. Information about contacting the TOC.	TOC Details	
Disruption Characteristics	**Label**	**Derived From**
7. Information about the exact duration of the disruption.	Disruption Duration	Repertory Grid Study (Chapter 7)
8. Information about the exact location of the problem.	Disruption Location	
9. Information about possible solutions.	Possible Solutions	
10. Information about the cause of the delay.	Disruption Cause	

As in the two previous studies (Chapters 6 and 7), these functions were rated on a rating scale of 1 ("Completely Useless") to 7 ("Extremely Useful"). After rating all the information functions, the final section to be completed by participants involved the provision of demographic information.

8.3.2.4 Demographics

The following demographic data was collected: age, gender, location, area of residence, education and occupation. Also, questions were asked regarding smartphone use, preferred methods of ticket-booking, and the possession of a social media account. The different versions of the survey have been presented in Appendix E1.

8.3.3 Participants and Procedure

A between-subjects design was selected for the purpose of this study – each participant was presented with a different vignette. Reading every version of the vignette, as well as rating the six information functions on each of them would have been quite a lengthy task for the participants. In order to ensure that the results would not be impacted by fatigue or boredom, a between-subjects method was selected. Additionally, the use of this method ensured that there was no transfer of knowledge or expectancy between conditions, which could have influenced participant ratings.

A power analysis was carried out prior to participant recruitment, which determined that the appropriate number of participants would be between 90 to 160 (for a strong effect). Due to the between-subjects design of the study, along with the presentation of four different versions of the experiment, it was important to ensure that an appropriate group size was selected to account for bias. The aim of the power analysis was to reduce the chance of a Type 2 error

(a false positive) caused by a sample size that is far too small to account for the study design.

In the end, 182 participants were recruited through a variety of formats: in person (with their consent), via email, various forms of social media, and word of mouth. The online versions of the survey required participants to provide their email address to the researcher, and consent to being contacted for the purposes of the study. They were also informed regarding optional entry into a prize draw for a chance to win a £30 Amazon voucher, as well as a donation of 25p to charity for their individual participation.

Four versions of the survey were designed, each using a different combination of high and low "trip familiarity" and "trip importance". Firstly, the experiment was piloted with 10 participants in person, in order to ensure that there were no major issues or possible doubts. It was then distributed in paper format in three offices and two cafes in Nottingham. The physical copies of the survey were thoroughly shuffled prior to distribution, in order to randomise participant allocation.

Participants for the paper-based version were shown an introductory information page, following which, an option to provide their consent towards participating in the study (Appendices E2 and E3). The online version (a Word document) was provided to participants via an email, which they replied to with a statement of consent regarding the use of their responses. An online random number generator was used (www.random.org) to ensure that participants were randomly assigned to the different study conditions. An Excel file was used

to keep track of participants who had been sent the survey (by first name only), alongside their assigned vignette version.

Filling in the survey took approximately 7-10 minutes (based on the pilot study), with participants completing two sides of an A4 sheet (on paper), or two pages (on Microsoft Word). Participants first answered 5 questions related to their own travel frequency and expertise, followed by the presentation of a three-sentence journey scenario (the vignette). After reading the vignette, participants were asked to rate 10 types of information on the basis of their usefulness to the hypothetical situation. The study concluded by asking for basic demographic information, and the participants' email addresses (if they chose to participate in the prize draw for the voucher).

8.3.4 Analysis

The results were anonymised and collated on Microsoft Excel and exported onto a CSV file. The email addresses were only used to contact the winner of the prize draw. Results were analysed using Microsoft Excel and the statistical software SPSS.

8.4 Results

8.4.1 Participant Demographics: Descriptive Statistics

Table 37 features a summary of the participant demographics for the study.

Table 37. Summary of the demographics of the participants.

Demographic Factor	Statistics
Age	The average age of the participants was 32.6, with a median age of 30 years old.
Gender	Apart from 3 people, the rest of the participants identified as male (57.1%) or female (40.7%).
Location	Participants came from 41 different cities and towns across the UK. The highest number of participants were from the Nottingham (32.4%), and then London (19.2%).
Education	The most participants had either a Postgraduate (50%) or an Undergraduate (33.5%) degree.
Occupation	A large proportion of participants were employed (76.4%), followed by 23.6% students.
Smartphone	Most participants had a smartphone (98.9%).
Social media	Most had a social media account (95.1%).

Participants were randomly assigned to each condition. There was a fairly even distribution across conditions, but this could not be further manipulated to ensure an equal number of participant types across all (Table 38).

Table 38. Distribution of frequent and infrequent travellers across different vignette versions.

Traveller	Version A		Version B		Version C		Version D		Traveller
	14		16		8		10		
	11		5		9		2		
Frequent	4	29	5	26	5	22	4	16	Frequent
	5		5		6		10		
	4		6		4		6		
	7		4		5		9		
	4		4		5		3		
	1		0		0		1		
Infrequent	0	21	0	19	0	20	0	29	Infrequent
	Total	50	Total	45	Total	42	Total	45	

8.4.2 Expertise and Travel Frequency: Descriptive Statistics

As with the previous studies, most people rated themselves as having high levels of expertise regarding both rail travel in general (M = 5.45), and especially with regards to their specific journeys (M = 6.38). This can be seen in Table 39.

Table 39. Mean expertise for both general rail travel and specific trips completed.

Travel Frequency and Expertise Questions (scale of 1-7)	N	Mean	Median
General Travel Frequency	182	3.51	3
General Expertise	182	5.45	6
Specific Trip Frequency	131	3.11	2
Specific Trip Expertise	131	6.38	7

The Travel Frequency responses were rated from "Daily" (1) to "Never" (9) - thus, the lower the mean or median, the higher the travel frequency. Accordingly, the results depict that a large proportion of participants for this study make both general and specific rail trips at least "Weekly" on average, with the mean ratings for General Travel Frequency and Specific Trip Frequency at 3.51 and 3.11, respectively. Figures 34-37 depict participant ratings for all four questions.

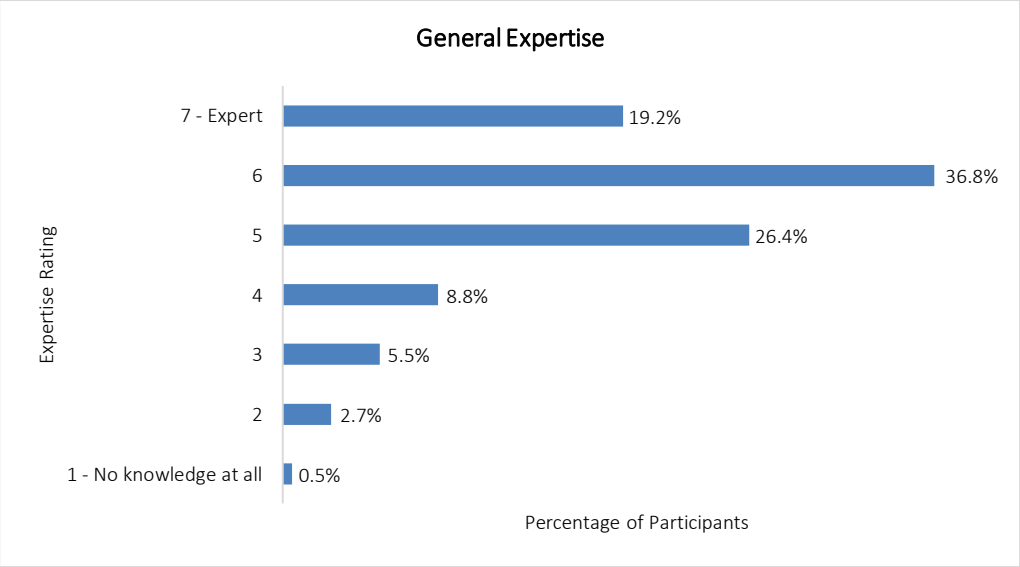


Figure 34. Expertise Ratings: General Expertise (*N* = 182).

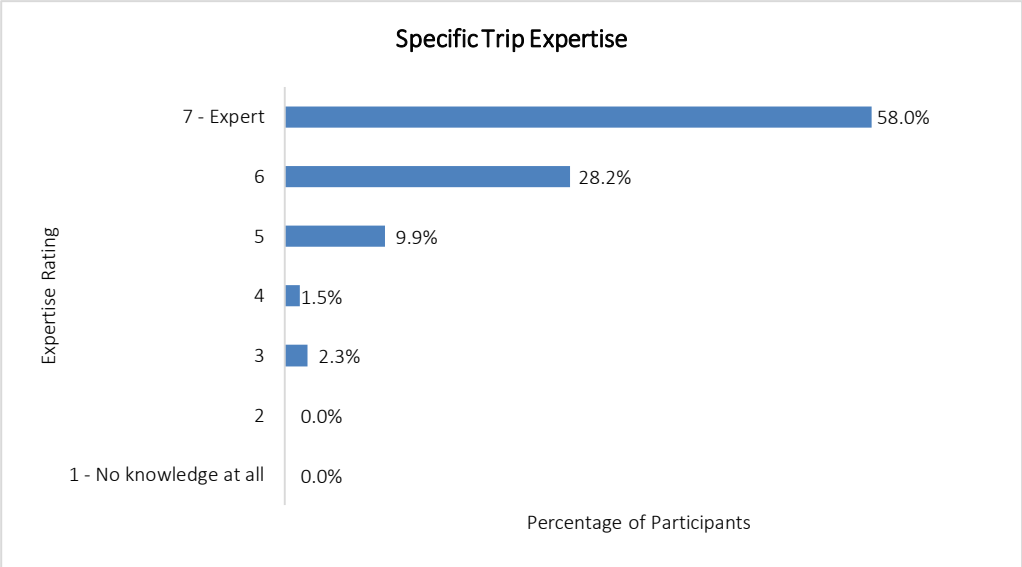


Figure 35. Expertise Ratings: Specific Trip Expertise (*N* = 131).

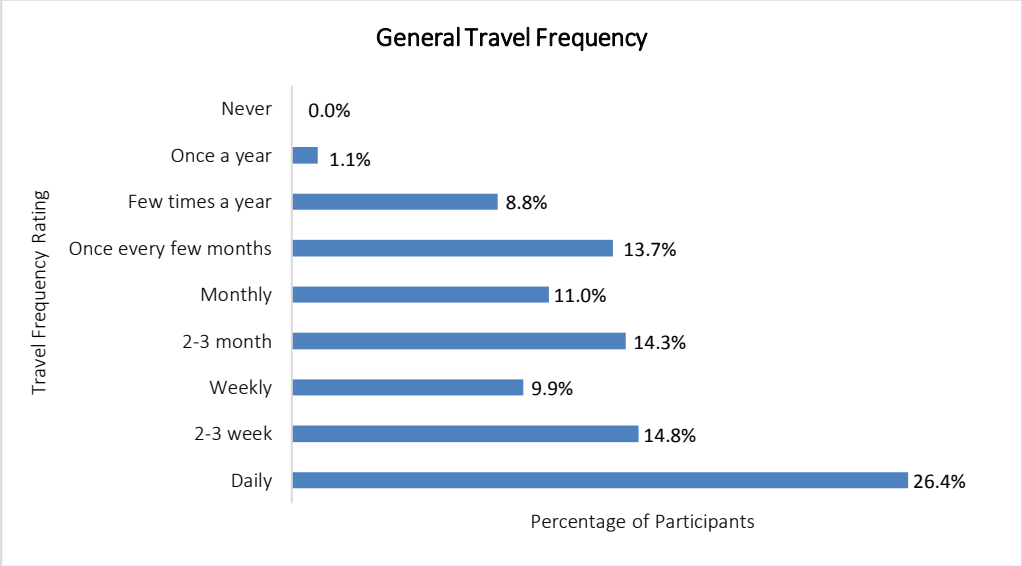


Figure 36. Travel Frequency Ratings: General Travel Frequency (*N* = 182).

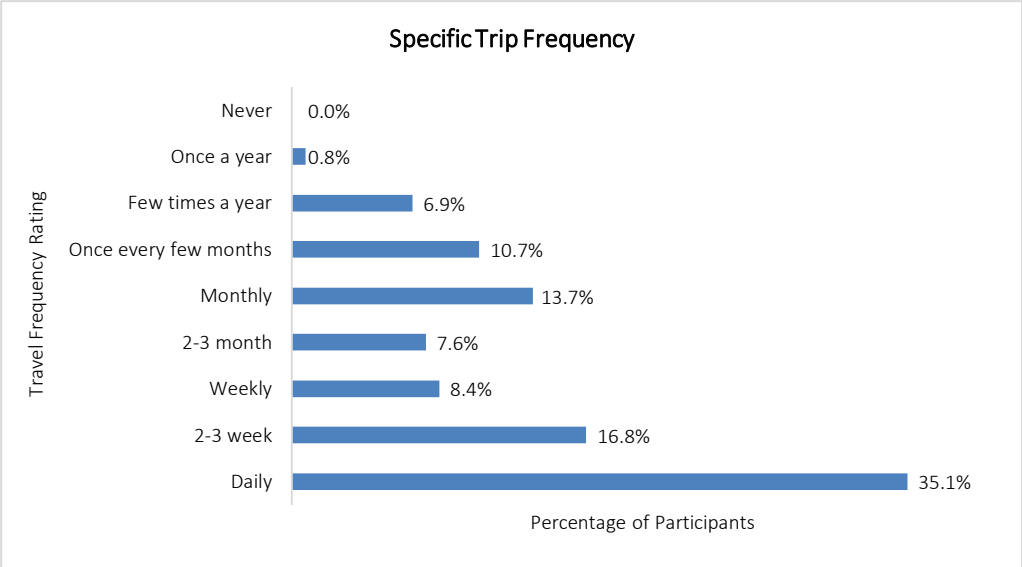


Figure 37. Travel Frequency Ratings: Specific Trip Frequency (*N* = 131).

8.4.3 Expertise and Travel Frequency: Correlations

Correlational analyses were conducted, in order to examine the relationship between travel frequency and expertise. Spearman's Rho was used due to the non-parametric nature of the data. Additionally, the number of participants differ between the groups as fewer participants had answered the questions regarding a specific trip, resulting in a smaller N for those groups. These correlations have been presented in Table 40.

Table 40. Correlational analyses – expertise and travel frequency.

Spearman's Rho		
General Expertise x General Travel Frequency (N = 182)	Coefficient = .323	$p < .01$
General Expertise x Specific Trip Frequency (N = 131)	Coefficient = .950	$p < .01$
General Expertise x Specific Trip Expertise (N = 131)	Coefficient = .524	$p < .01$
Specific Trip Expertise x Specific Trip Frequency (N = 131)	Coefficient = .291	$p < .01$

This was conducted mainly in order to confirm previous findings surrounding the links between expertise and frequent travel. All the correlations were significant

and positive, depicting complementary relationships between travel frequency (both types) and expertise (both forms).

8.4.4 Expertise and Travel Frequency: Wilcoxon Signed Rank Test

As in the previous two studies, a Wilcoxon signed-rank test was conducted in order to examine the difference between ratings on general and specific expertise. The test, again, showed a significant difference between general and specific expertise (Z = -6.778, p < .001), with the mean rating for Specific Expertise (6.38) higher than that for General Expertise (5.69).

8.4.5 Interim Summary

As in the first survey, the results presented show significant positive correlations between both specific and general expertise and travel frequency. People, again, tend to rate themselves as being quite high on all the expertise questions, with the lowest mean/median lying at 6 out of 7, which would be considered as almost "being an expert". This can be seen in Figures 32 and 33. Comparatively, Figures 34 and 35 (Travel Frequency) depict more distributed responses.

Finally, as in the previous two studies, the Wilcoxon signed-rank test shows support for the notion of domain specificity of expertise. There is a significant difference between the ratings of specific-trip and general rail travel expertise, with participants seeing themselves as being more knowledgeable regarding the former.

8.4.6 Information Functions: Analyses

8.4.6.1 Descriptive Statistics

Table 41 provides the means and standard deviations for the ratings of the information functions across participants (from highest to lowest), as well as the median ratings.

Table 41. Mean and median ratings for the information functions across all participants.

Information Item	Mean (N = 182)	Std. Dev	Median
Phone Notifications	6.6	0.82	7
Service Updates	6.6	0.89	7
Journey Planning	4.8	1.76	5
Station Facilities	4.0	1.58	4
TOC Details	3.9	1.67	4
Feedback	3.2	1.53	3

As can be seen in Table 41, the top information functions (Phone Notifications and Service Updates) are very highly rated, all averaging around ratings of 6 out of 7 (with median ratings of 7 for all) on the measure of usefulness. In contrast, the other information functions have much lower ratings, starting at an average of 4.8. There is a clear difference between the "high" and "low" rated types of information, regardless of their individual importance.

All further analyses were conducted only for the travel frequency ratings, and not the expertise ratings. There were two reasons for this. Firstly, the repertory grid study (Chapter 7) had showed differences between participant groups based on travel frequency, not travel expertise. Secondly, as in the last two studies, participant ratings of their own level of expertise was significantly skewed towards the higher end of the spectrum - the median rating for Specific Expertise was "7", or "Expert". Due to the observed bias regarding people's

perceptions of their own expertise, the present study chose to focus on the examination of what could considered as being a more objective measure: travel frequency.

8.4.6.2 Trip Familiarity, Trip Importance, Travel Frequency: 2x2x2 ANOVA

Analyses were conducted following a median split of the data into two groups: frequent travellers and infrequent travellers. The median split simplified the analyses of travel frequency alongside the Trip Familiarity and Trip Importance variables, by forming two distinct levels (high and low travel frequency), as opposed to 9 separate levels of the independent variables ("Daily" – "Never"). This has been presented in Table 42.

Table 42. Median split of the participants on the basis of Travel Frequency

Traveller	Travel Frequency	Participants		Travel Frequency	Traveller
	Daily	48	26	2-3 times a month	
	2-3 times a week	27	20	Monthly	
	Weekly	18	25	Once every few months	
Frequent	Total	93	16	Few times a year	
			2	Once a year	
			0	Never	
			89	Total	Infrequent

For the main analyses, a 2x2x2 ANOVA was selected. The aim was to determine whether the two levels of each independent variable (Trip Familiarity, Trip Importance, Travel Frequency) would influence the dependent variables (the Information Function ratings). In order to ensure the appropriate fit of an ANOVA to the data, the skew and kurtosis of the dependent variables were examined. Guide values are a skew value of less than (±)3.6 and a kurtosis value of less than (±)14.9. All the dependent variables met this criterion, deeming an ANOVA as appropriate.

There were no significant results found for the ANOVAs conducted for most of the information functions, and no interaction effects seen across all of the analyses conducted (Tables 43 and 44). The only significant result found was for the "Feedback" factor, where there was a significant effect of Trip Importance.

Table 43. Results of the 2x2x2 ANOVA for the information functions: Main effects

Information Function	Trip Familiarity	Trip Importance	Travel Frequency
Journey Planning	F(1, 174) = .183, $p > .05$	F(1, 174) = .377, $p > .05$	F(1, 174) = 1.194, $p > .05$
Service Updates	F(1, 174) = .545, $p > .05$	F(1, 174) = .292, $p > .05$	F(1, 174) = 2.316, $p > .05$
Feedback	F(1, 174) = 1.051, $p > .05$	F(1, 174) = 8.097, $p < .01$	F(1, 174) = .062, $p > .05$
Phone Notifications	F(1, 174) = .198, $p > .05$	F(1, 174) = .009, $p > .05$	F(1, 174) = .721, $p > .05$
Station Facilities	F(1, 174) = .040, $p > .05$	F(1, 174) = .2.715, $p > .05$	F(1, 174) = .064, $p > .05$
TOC Details	F(1, 174) = 1.974, $p > .05$	F(1, 174) = .020, $p > .05$	F(1, 174) = .126, $p > .05$

Table 44. Results of the 2x2x2 ANOVA for the information functions: Interactions.

Information Function	Trip Familiarity * Trip Importance	Trip Importance * Travel Frequency	Trip Familiarity * Travel Frequency	Three-Way Interaction
Journey Planning	F(1, 174) = .068 $p > .05$	F(1, 174) = 1.112, $p > .05$	F(1, 174) = .258, $p > .05$	F(1, 174) = .151, $p > .05$
Service Updates	F(1, 174) = 1.517, $p > .05$	F(1, 174) = .848, $p > .05$	F(1, 174) = .352, $p > .05$	F(1, 174) = .003, $p > .05$
Feedback	F(1, 174) = .100, $p > .05$	F(1, 174) = .136, $p > .05$	F(1, 174) = .015, $p > .05$	F(1, 174) = 1.038, $p > .05$
Phone Notifications	F(1, 174) = .190, $p > .05$	F(1, 174) = 1.054, $p > .05$	F(1, 174) = .007, $p > .05$	F(1, 174) = 1.157, $p > .05$
Station Facilities	F(1, 174) = .000, $p > .05$	F(1, 174) = .413, $p > .05$	F(1, 174) = 1.266, $p > .05$	F(1, 174) = .072, $p > .05$
TOC Details	F(1, 174) = 3.806, $p > .05$	F(1, 174) = 1.298, $p > .05$	F(1, 174) = .465, $p > .05$	F(1, 174) = 1.144, $p > .05$

Looking at the mean ratings of the different information functions (Figure 38), there was a clear difference see between the ratings for the "Feedback" factor. An examination of the estimated marginal means showed an increased preference for the ability to provide feedback when the trip was of low

importance (*M* = 3.59, *SE* = .167), as opposed to a high importance trip (*M* = 2.94, *SE* = .158).

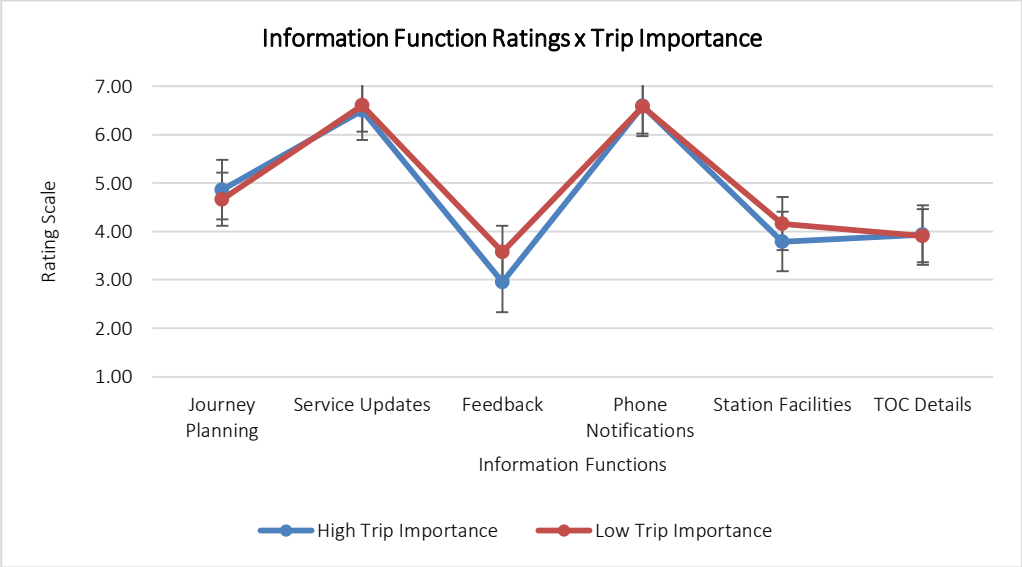


Figure 38. Ratings of information functions for high and low Trip Importance (*N* = 182).

Beyond this, the results show that the ratings of the information functions follow similar patterns across all participants, regardless of high and low Trip Familiarity and Trip Frequency.

8.4.6.3 Trip Familiarity and Trip Importance: 2x2x6 ANOVA

In order to explore this further, a 2x2x6 ANOVA was conducted – two levels of the "Trip Importance", two levels of "Trip Familiarity" and the 6 information functions ratings. There was a significant main effect for the information functions ratings [$F(5, 182) = 226.372$, $p < 0.01$] and for the interaction between the information function ratings and Trip Importance [$F(5, 182) = 2.90$, $p < 0.05$]. Upon examining the pairwise comparisons, most of the comparisons were significant ($p < 0.05$), showing differences between the mean ratings of the information functions. Looking back at Table 41, it is clear that some information functions are rated a lot more highly than others.

There were, however, no significant differences seen between the "Service Updates" and "Phone Notifications" factors, and the "Station Facilities" and "TOC Details" factors. Upon examining the mean ratings of these four factors, the first two ("Service Updates", "Phone Notifications") have the exact same score of 6.6 – both are highly rated and could be considered as being equally important. The mean ratings for the "Station Facilities" (*M* = 4.0) and the "TOC Details" (*M* = 3.9) are quite close as well, with both factors being rated quite low on usefulness.

8.4.6.3.1 Information Functions x Trip Importance: Independent T-Test

In order to further examine the interaction between the Information Function ratings and Trip Importance, an Independent Samples T-test was conducted on the high and low Trip Importance groups separately. There were no significant differences between the groups for high and low Trip Importance, apart from the Feedback factor (Table 45). The differences in the means for the Feedback factor had been noted in earlier analyses.

Table 45. Information Functions x Trip Importance: One-sample t-test.

Information Function	*t*	df	Sig. (2-tailed)
Basic Journey Planning	.752	180	$p > .05$
Service Updates	-.778	180	$p > .05$
Feedback	-2.808	180	$p < .01$
Phone Notifications	.122	180	$p > .05$
Station Facilities	-1.591	180	$p > .05$
TOC Details	.074	180	$p > .05$

The results suggest that there is a cumulative effect of Trip Importance, but it does not carry through to a more detailed examination of the information functions. While this variable matters, the significant differences between the

ratings of the specific information functions are more indicative of passenger preferences.

8.4.7 Disruption Characteristics: Analyses

8.4.7.1 Descriptive Statistics

Table 46 provides the means and standard deviations for the ratings of the four disruption characteristics across participants (from highest to lowest), as well as the median ratings.

Table 46. Means, standard deviations and median ratings for the disruption characteristics

Information Item	Mean	Std. Dev	Median
Disruption Duration	6.7	0.69	7
Possible Solutions	6.2	1.42	7
Disruption Location	4.8	1.60	5
Disruption Cause	4.5	1.60	5

Again, the next stage of the analyses was aimed at linking these ratings to trip familiarity, importance and travel frequency using 2x2x2 ANOVAs.

8.4.7.2 Trip Familiarity, Trip Importance, Travel Frequency: 2x2x2 ANOVA

A 2x2x2 ANOVA was conducted to link travel frequency, and the two additional independent variables of this study, to the ratings of the disruption characteristics. There were no significant results found for all the ANOVAs conducted (Table 47), or any interaction effects (Table 48).

Table 47. Results of the 2x2x2 ANOVA for the disruption characteristics: Main Effects.

Disruption Characteristic	Trip Familiarity	Trip Importance	Travel Frequency
Disruption Duration	F(1, 174) = 1.722, $p > .05$	F(1, 174) = 1.874, $p > .05$	F(1, 174) = .558, $p > .05$
Disruption Location	F(1, 174) = .018, $p > .05$	F(1, 174) = 1.337, $p > .05$	F(1, 174) = 1.653, $p > .05$
Possible Solutions	F(1, 174) = .778, $p > .05$	F(1, 174) = 3.189, $p > .01$	F(1, 174) = .482, $p > .05$
Disruption Cause	F(1, 174) = .027, $p > .05$	F(1, 174) = 3.288, $p > .05$	F(1, 174) = .453, $p > .05$

Table 48. Results of the 2x2x2 ANOVA for the disruption characteristics: Interactions.

Disruption Characteristic	Trip Familiarity * Trip Importance	Trip Importance * Travel Frequency	Travel Frequency * Trip Familiarity	Three-Way Interaction
Disruption Duration	F(1, 174) = .809, $p > .05$	F(1, 174) = .001, $p > .05$	F(1, 174) = .116, $p > .05$	F(1, 174) = .477, $p > .05$
Disruption Location	F(1, 174) = 1.022, $p > .05$	F(1, 174) = 3.519, $p > .05$	F(1, 174) = .359, $p > .05$	F(1, 174) = .505, $p > .05$
Possible Solutions	F(1, 174) = 2.724, $p > .05$	F(1, 174) = .004, $p > .01$	F(1, 174) = .068, $p > .05$	F(1, 174) = 3.021, $p > .05$
Disruption Cause	F(1, 174) = .391, $p > .05$	F(1, 174) = .266, $p > .05$	F(1, 174) = .325, $p > .05$	F(1, 174) = 1.963, $p > .05$

8.4.7.3 Trip Importance and Trip Familiarity: 2x2x4 ANOVA

A 2x2x4 ANOVA was conducted – "Trip Importance" (2 levels), "Trip Familiarity" (2 levels) and the ratings of the 4 disruption characteristics. There was a significant main effect for the disruption information ratings [$F(3, 182) = 168.686$, $p < 0.01$], and for the interaction between all of the disruption characteristics ratings and Trip Importance [$F(3, 182) = 4.14$, $p < 0.01$].

Again, the pairwise comparisons were examined, and all of the comparisons were significant ($p < 0.05$), showing significant differences between the ratings of the disruption characteristics.

8.4.7.3.1 Disruption Characteristics x Trip Importance: Independent T-Test

In order to further examine the interaction between the Disruption Characteristic ratings and Trip Importance, an Independent Samples T-Test was conducted on the high and low Trip Importance groups separately. There were

no significant differences seen between the groups based on their ratings of the disruption characteristics (Table 49). As seen with regards to the information functions, there is a significant effect of Trip Importance across all the disruption characteristics, but not when comparing them to each other based on their usefulness.

Table 49. Information Functions x Trip Importance: Independent Samples T-Test

Disruption Characteristic	*t*	df	Sig. (2-tailed)
Disruption Duration	1.338	180	$p > .05$
Disruption Location	1.133	180	$p > .05$
Possible Solutions	1.845	180	$p > .05$
Disruption Cause	-1.562	180	$p > .05$

Prior to the discussion, a summary of these results can be seen in Table 50.

Table 50. Results summary table.

Information Functions	Travel Frequency		Trip Importance		Trip Familiarity	
Basic Journey Planning	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Alterations	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Help and Feedback	Not significant	Not significant	The less important the trip, the higher the rating	Not significant	Not significant	Not significant
Mobile Device	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Facilities	Not significant	Excluded	Excluded	Not significant	Not significant	Not significant
Contact Details	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Disruption Characteristics	**Travel Frequency**		**Trip Importance**		**Trip Familiarity**	
Basic Journey Planning	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Alterations	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Help and Feedback	Not significant	Not significant		Not significant	Not significant	Not significant
Mobile Device	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant
Facilities	Not significant	Excluded	Excluded	Not significant	Not significant	Not significant
Contact Details	Not significant	Not significant	Not significant	Not significant	Not significant	Not significant

8.5 DISCUSSION

The aim of the present study was to examine alternative possible explanations for the information choices made during rail travel, particularly during disruption. Travel frequency and expertise were measured, along with the addition of two new independent variables: familiarity with rail travel (Trip Familiarity) and the importance of the journey (Trip Importance). This was in order to develop a better idea of the possible external factors that could influence information use during disruption. Looking back at the main hypotheses of this study:

1. There will be significant differences between the information choices of participants based on the different levels of the trip-related variables (high and low Trip Familiarity and Trip Importance).

   This hypothesis will be discussed further on in this section.

2. There will be significant differences between the information preferences of high frequency and low frequency travellers.

   There were no significant differences seen between the preferences of high and low frequency travellers.

8.5.1 EXPERTISE AND TRAVEL FREQUENCY

As in the first survey, there were significant positive correlations between expertise and travel frequency, across both general rail-travel and specific journeys completed. Additionally, there is continued support for the notion of domain specificity within expertise (Shanteau & Stewart, 1992) with participants

rating themselves as having significantly higher trip-specific expertise than general rail-related expertise.

8.5.2 Trip Importance, Trip Familiarity and Travel Frequency

The results of this study showed limited differences between participants assigned to the different vignette conditions/interacting with different levels of each independent variable (Trip Importance, Trip Familiarity, Travel Frequency). There were significant interaction effects of Trip Importance with the information functions and disruption characteristics, providing some support for the first hypothesis of this study. However, when examining the differences in the ratings of the information functions and disruption characteristics, a notable caveat to the findings is the lack of significant differences seen between high and low Trip Importance for almost all the factors. Though there is a cumulative effect of Trip Importance, this effect disappears when looking at the differences between preferences for individual information functions and disruption characteristics. The overarching result is that there are distinct preferences for specific types of information for general rail travel, as well as disrupted rail journeys. Trip Importance should be a secondary consideration. While the purpose of/priority placed on a trip makes a difference to information preferences as a whole, the preliminary emphasis should be on the value that travellers place on different types of information to help them navigate themselves through the rail travel experience.

8.5.3 Information Functions and Disruption Characteristics: Ratings

The top-rated information functions (all with a median rating of 7) are "Phone Notifications" and "Service Updates", and the highest-rated disruption characteristics are "Disruption Duration" and "Possible Solutions", with everything else having much lower ratings. People want to know how long they will be affected for, to have updates delivered to them, and a solution to their problem. Everything else, from journey planning to the cause of the problem to providing feedback fall much lower on the list of priorities when it comes to disruption.

This is, firstly, supported by industry research. Industry data consistently mentions the requirement for timely, accurate, and quick information during disruption, as well as the need for regular updates (National Audit Office, 2008; Southeastern, 2016, for example). The present study elaborates upon this by providing specific types of information as a guideline to fulfil these stated requirements of passengers during disruption. Essentially, it answers the question: what is the exact information that we need to give to people during disruption? While there is no further clarity to offer surrounding the personalisation of information on the basis of individual factors like travel knowledge or trip purpose, the positive result is the increased simplicity of confirming the basic things that people want, regardless of who they are or why they are travelling.

Previous studies in this thesis have found that there are clear types of information that people identify and use when travelling, and when faced with a disruption. They found that more experienced travellers note the nuances of

disruption situations in a way that less experienced travellers did not. However, this study suggests that this does not matter – at the end of the day, some types of information are inherently more useful, and are considered so across the board. This is anything but bad news. Instead of adding layers of complexity, the key might be to focus on the main elements of information that people clearly prefer. The implications for the design of disruption information are clear: deliver relevant information at regular intervals directly to passengers, and tell them how to solve the problem. Anything beyond this is probably a case for individual differences, and individualised journey planning. An excellent example of research that is already being conducted with regards to this is the work of Gould, Mackaness, Bechhofer, Stevens and Cooper (2016) on context-driven data to support individual journey planning during rail travel.

So, with regards to the delivery of the suggested informational support during disruption – how can this be achieved? There are two clear challenges, which were introduced in Chapter 4 (the industry interviews) of this thesis. Firstly, there is the handling of the information in itself, which needs to be in a manner conducive to the successful delivery of regular and accurate updates. Secondly, the implementation of push notifications. The main problem, as mentioned by multiple members of the rail community, is the communication between the different "producers" of information. "The industry is fragmented" was one of the main comments made with regards to this. In order to successfully deliver the information that customers want, the industry needs to invest in improved coordination between the multiple stakeholders involved in gathering and delivering it. Additionally, there needs to be increased investment into the

development and implementation of more sophisticated technologies that will facilitate a quicker, more accurate and coordinated process of information delivery.

Finally, as mentioned by an interviewee in Chapter 4, there is the case of pushing information to customers, as opposed to a manual search on their part. This is, of course, the most ideal situation. The good news is that there is already research being conducted on the different ways in which information can be pushed to customers. One of the main areas of exploration is the idea of a travel buddy that sends suggestions and updates over messages or social media, much like a friend would. Intelligent assistants have been successful in other industries (Plum or Cleo are both financial assistants that work over Facebook Messenger, for example). What would be better news, however, would be increased technological investment on this front as well. Push notification functionality built into the National Rail Enquiries application, for instance, would be an excellent way to achieve the delivery of these updates. The main contribution of the findings of the current study would be to provide an easy template to refer to when navigating through the design of these new systems.

8.5.4 Methodological Learnings

The main advantage of this method was the ability to present study separate independent variables across a large sample of participants, and obtain a clear idea regarding the manner in which they interact with each other, and influence the dependent variables. The use of a between-subjects design allowed for the

presentation of different levels of the variables in an efficient manner, and the vignettes provided an easy way in which to do so. As mentioned, the vignette method allows for the exploration of complex scenarios in a quick and accessible manner, and provides a way in which to study real-world situations in a quantitative manner.

A good guideline for the successful design of vignette experiments is available in the paper written by Steiner, Atzmüller & Su (2016). Generally, some of the important aspects are the ruling out of possible biases based on the sample itself, accounting for potential confounds, using ranking/rating methods to improve response consistency, randomising the sample, and conducting power analyses and a pilot study beforehand. The present study was designed with these recommendations in mind. Beyond this, in accordance with similar studies conducted in the past (Finch, 1987; Lupfer, Doan & Houston, 1998), the study aimed to make the vignette situations as realistic as possible. Additionally, in order to limit the influence of social desirability bias (Steiner, Atzmüller & Su, 2016), the participants were asked to respond from the perspective of the character, as opposed to their own. In this manner, possible confounds were accounted for thoroughly.

Additionally, the sample of this study was balanced in a manner that attempted to address an important source of bias – travel knowledge. When looking at the concepts of familiarity and importance, gathering opinions from travellers with different levels of knowledge helped remove this as being a possible covariant in the findings, making it possible to focus on the independent variables themselves.

This introduces the second question asked earlier on: was it the particular disruption situation presented in the study that resulted in a fairly standard response across the board, or is it disruption itself? The travel situations presented were carefully crafted to be representative of typical types of journeys completed via rail, with an alert that had been used during actual disruptions. The only real argument for an extreme case of disconnect would probably be complete unfamiliarity with the rail system in GB. However, when considering the sample of the study, as mentioned, there were more frequent travellers than the alternative. If anything, there would be the possibility of a bias in the opposite direction, if at all. Thus, it is possible that disruption in itself causes people to require some very specific pieces of information to help them navigate through it, with most people having the same distinct preferences regarding informational support.

8.6 Conclusion

The present chapter examined the role of additional contextual factors, beyond expertise and travel frequency, that could possibly contribute to the information choices of rail travellers. Specifically, these factors were the level of familiarity that the traveller had regarding the journey (Trip Familiarity) and the purpose of the trip (Trip Importance). A vignette experiment was designed in the form of a short survey that consisted of the rating of the usefulness of different information functions in a hypothetical disruption scenario. Following its administration to 182 participants, findings showed a limited influence of the

two independent variables on the information function ratings. In fact, a fairly consistent pattern of informational preferences was seen across the board. Four types of information were rated much higher than the other six: “Disruption Duration”, “Phone Notifications”, “Service Updates” and “Possible Solutions”. While there is some influence of external factors like Trip Importance, the best strategy for disruption management is to focus on providing the key types of information that passengers require to navigate through it. This chapter concludes by considering the possible implications of the findings. Figure 9 presents the contribution of this study to the overall thesis context. Chapter 9 will discuss these findings alongside all the studies conducted for this research project and introduce the main implications of the results.

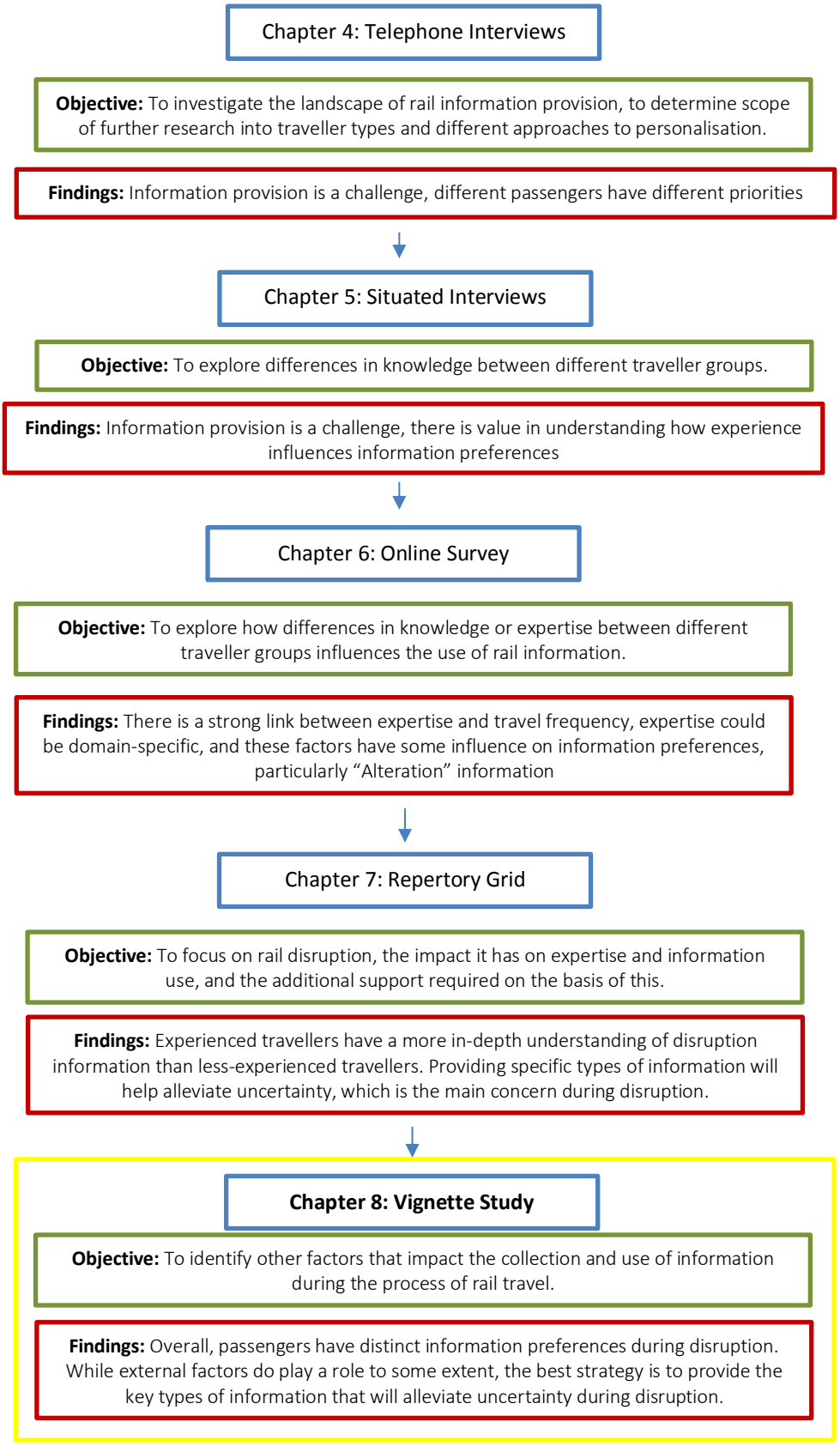


Figure 39. Thesis narrative schematic.

9. DISCUSSION

9.1 CHAPTER SUMMARY

This chapter brings together the findings from the studies conducted for the purpose of this Ph.D thesis. The overarching objectives are discussed in line with each study, following the presentation of the main research objectives. Both the theoretical and practical implications of the research are discussed, as well as the successes and limitations of the methodological approach.

9.2 MOTIVATION

Chapter 1 introduced the context of the thesis, alongside the main objectives of the research, and established the overall aim: to understand how rail passengers collect and use information during rail travel, and the cognitive processes that contribute towards this behaviour. The idea of personal knowledge and expertise was seen as being of particular importance with regards to travel behaviour and information use, and were initially selected as being the main areas of focus for the development of the research objectives for this thesis.

The literature review presented in Chapter 2 introduced the landscape of rail travel in GB, with a focus on the challenges faced by the rail industry. It was followed by the discussion of the keen interest that the rail community has in improving passenger experience, and the key issues surrounding customer satisfaction. The chapter also presented the overarching aim of the thesis, from

both a practical and theoretical standpoint: to examine how psychological theories of expertise and knowledge could be used to deliver targeted information to different groups of travellers. In line with this, six main research objectives were identified:

1. To investigate the landscape of rail information provision, to determine scope of further research into traveller types and different approaches to personalisation.
2. To explore differences in knowledge or expertise between different traveller groups.
3. To explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.
4. To focus on rail disruption, the impact it has on expertise and information use, and the additional support required based on this.
5. To identify other factors that impact the collection and use of information during the process of rail travel.
6. To understand what all of this means for information design and personalisation.

Chapter 3 described the methodological approach that would be used to investigate these objectives. A summary of the different methods used to answer the research objectives of this thesis is in Table 51.

Table 51. Research questions and methods used to investigate them.

Research Question	Method
To investigate the landscape of rail information provision in order to determine scope of further research into traveller types and different approaches to personalisation.	Telephone Interviews
To explore differences in knowledge or expertise between different traveller groups.	Situated Interviews
To explore how differences in knowledge or expertise between different traveller groups influences the use of rail information.	Survey One: Information Preferences
To focus on rail disruption, the impact it has on expertise and information use, and the additional support required on the basis of this.	Survey Two: Disruption Content
To identify other factors that impact the collection and use of information during the process of rail travel.	Survey Three: Disruption Information

The following sections will describe the findings in detail, and how they link to the research objectives, addressing the main aim of this thesis. Following this, the theoretical and practical implications will be discussed, which will be used to answer the final objective: to understand what all of this means for information design and personalisation

9.3 Foundational Research: Objectives 1 & 2

Previous research has explored both the operational (Golightly & Dadashi, 2016) and passenger-focused (Department for Transport et al., 2016; Lyons et al., 2007) aspects of customer experience during the process of rail travel. However, industry perspectives are often overlooked, with a lot of the focus on the opinions and views of the passengers. More crucially, there is a gap in the literature when it comes to the comparison of both sides of the coin. The first objective of this thesis was developed to remedy that, by comparing the perspectives of both industry stakeholders and rail passengers.

Objective 1: To investigate the landscape of rail information provision in order to determine scope of further research into traveller types and different approaches to personalisation.

The exploratory research conducted into the issues surrounding information provision within the rail industry showcased some of the prominent concerns of the community. Based on an initial evaluation of the literature, some of the main passenger-facing areas of interest are the improvement of information delivery, the personalisation of customer data, and the management of disruption. All of these areas feed into the general notion of improving passenger experience, which was one of the high-level aims of the thesis. On the basis of this, six main questions for the rail community were devised, which covered the following themes: information requirements and delivery challenges, passenger behaviour, disruption management, rail research, and future technologies. The main comments of the industry experts are in Table 52.

Table 52. Summary of the main findings of the industry interviews.

Area	Specific Comments
Information Requirements	Information provision is expected by rail passengers. Information aids in journey planning, and improves journey experience. Information provides assistance during delays and disruption.
Information Provision: Challenges	Information delivery should be quick, reliable, maybe even proactive. The rail network is fragmented, causing challenges in the distribution of information. Cost is also a huge barrier to successful information provision. There is a challenge around providing the right kind of information at the right time. There is a lack of dynamic, context-specific information.
Passenger Behaviour	There is a focus on the requirements of different passenger types. Personalisation of customer information is a key area of interest. Different types of travellers require different levels of support, particularly during disruption. There are differences between the behaviour of regular commuters and leisure travellers.
Disruption Management	It is difficult to adapt to last-minute disruption due to a lack of a consistent strategy across the network. There is a need to identify how to best support different types of travellers.
Rail Research	There are diverse forms of rail research, all with the aim to improve the service provided, and passenger experience.
Future Technologies	There is a requirement for increased investment into digital technologies.

9.3.1 A Conceptual Model of Information Delivery

The interviews lead to a more linear conceptual model that places the themes within the context of the provision of rail travel as a service. This has been presented in Figure 40. The framework presented represents a way to communicate an overarching structure of passenger needs. The structure represents the requirements of the passengers, the channels that can be used to reach them, the information that needs to be presented through those channels, and the processes (or back-office support) required to make that

happen. The themes extracted through the analysis can all be divided up based on these elements (Figure 40).

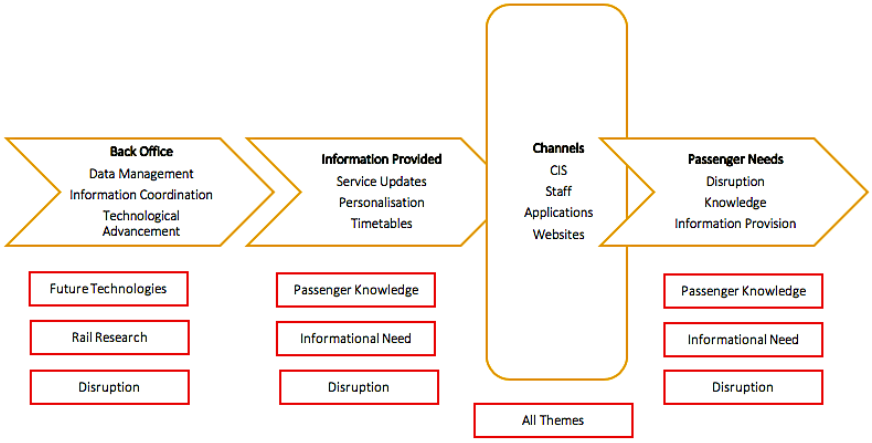


Figure 40. Conceptual model of customer needs and themes.

As seen in this framework, these concerns are high-level descriptions of the issues faced within the linear process of matching information provision to customer needs. Starting at the back office - the foundation of information provision – there is a need for research into advance technologies and the improvement of current systems. The aim here is to improve information quality, with a particular focus on the speed and accuracy of the delivery of information to passengers. There is also the additional challenge of disruption management that runs alongside the general coordination of information systems. The key to improving information provision from the ground up would include the acknowledgement of more general requirements for improvement while also considering the near-consistent influence of disruption situations. The information provided and the needs of the passengers – basically, both sides of the information channels – are to be matched, with the appreciation of passenger knowledge and needs, and the provision of disruption support. From

the opinions expressed, service providers need to consistently consider the information and support being delivered to passengers, as well as the manner and quality of the same. Successful information provision is making sure that information needs of the customer are met, their requirements are understood, and they are supported. This is aided by the use of the appropriate channels, as well as increased investment into the enhancement of these channels. Covering all bases would mean looking at the informational challenges faced, and capabilities of, the service providers at every step in the information provision cycle within the model, from the back office to the retrieval of information from passengers.

As mentioned, the first objective of this thesis was to understand the existing state of the rail industry, and explore the scope for the personalisation of information provided to different types of rail passengers. The industry interviews support the need for improved disruption information and an appreciation of differing traveller requirements. The conceptual model highlights the crucial factors to be appreciated at different stages of the design and delivery of information to passengers.

The industry interviews lead to the identification of three key themes: information provision, passenger behaviour and disruption management. Crucially, both the literature and comments of the industry stakeholders stated that different types of passengers would have differing travel behaviours and informational preferences. This resulted in the second objective of the thesis:

Objective 2: To explore differences in knowledge or expertise between different traveller groups.

The first step was to look at the behaviour of different types of passengers. As discussed, both industry and academic literature feature the segmentation of passengers into three broad types: commuters, leisure travellers, and sometimes, business travellers (Anable & Gatersleben, 2005; Gustafson, 2012; Passengerfocus, 2015). The differences between these groups of travellers have been attributed to factors such as habit (Aarts et al., 1997), practice (Grotenhuis et al., 2007) and expertise (Gustafson, 2012). All three factors are intrinsically linked – it is difficult to disentangle them, as both habit and practice can be considered as being salient contributors to the formation of travel-related expertise. This thesis began the investigation into this expertise in an exploratory fashion, by conducting "go along" (Carpiano, 2009) interviews with the main passenger types mentioned within the literature: commuters and leisure travellers.

The questions asked were based on the themes covered in the industry interviews: journey experience, disruption, information use and suggestions for the improvement of rail services. The main areas of concern for both leisure and frequent travellers surround their rail experiences, the existing infrastructure, crowding and disruption and information use – a lot of these concerns mirror the challenges outlined by members of the rail community. Table 53 provides a comparison between the two.

Table 53. Passenger comments in line with industry perspectives.

Area	Industry Member Comments	Rail Passenger Comments
Information Requirements	Information provision is expected by rail passengers. Information aids in journey planning, and improves journey experience. Information provides assistance during delays and disruption. Personalisation of information is a key area of interest.	Useful information includes: train status, live updates and arrival times. Passengers want detailed disruption information, a better ticket-booking process on the rail applications and personalised information provision.
Information Provision: Challenges	Information delivery should be quick, reliable, maybe even proactive. The rail network is fragmented, causing challenges in the distribution of information. Cost is also a huge barrier to successful information provision. There is a challenge around providing the right kind of information at the right time. There is a lack of dynamic, context-specific information.	Passengers see the presence of staff as being extremely useful. Passengers want timely, reliable and accurate information. Other required information improvements include mobile ticketing, consistent platform information and suggestions regarding alternative routes during disruption. Cost is a major issue for leisure travellers.
Passenger Behaviour	There is a focus on the requirements of different passenger types. Different types of travellers require different levels of support, particularly during disruption. There are differences between the behaviour of regular commuters and leisure travellers.	Leisure travellers wanted more information. Commuters had more confidence in the manner in which they navigated through their journeys. Commuters had more practical suggestions for improvement than leisure travellers. Commuters and leisure travellers have different views on delays. Commuters and leisure travellers had different preferred sources of information. There are differences between how commuters and leisure travellers understand crowding and disruption.
Disruption Management	It is difficult to adapt to last-minute disruption due to a lack of a consistent strategy across the network. There is the need to identify how to best support different types of travellers.	Passengers see disruptive incidents as being memorable but rare. Commuters and leisure travellers have different levels of knowledge regarding disruption management.
Rail Research	There are diverse forms of rail research, all with the aim to improve the service provided, and passenger experience.	Passengers want interactive information boards and more crowdsourced information.
Future Technologies	There is a requirement for increased investment into digital technologies.	Mobile connectivity is an area requiring improvement. Passenger want push notifications for journey updates.

The perspectives gained from the passengers align with the industry literature surrounding the improvement of passenger experience: mainly, passengers want cheaper tickets and more reliable information (Passengerfocus, 2014; Transportfocus, 2017b). Beyond this, when comparing the perspectives of industry stakeholders and passengers, there are some key similarities. Firstly, the industry stakeholders appreciate the main requirements of the customers: timely and reliable information, improved digital technologies, and differing levels of support. However, the members of the rail community also mention the main challenges faced in the delivery of these aspects of passenger experience – the lack of dynamic information, the fragmented nature of rail communications and the requirement for increased investment into digital technologies. In light of this, a key difference between the industry and passenger interviews was with regards to the discussion of cost. Passengers mention their desire for cheaper rail travel, both within this thesis, and in response to surveys conducted by the industry (Passengerfocus, 2014; Transportfocus, 2017d). The discussion of cost by members of the rail community, on the other hand, has to do with the cost of successful information provision. According to their interviews, the successful delivery of a good passenger experience requires increased investment, and higher costs. With rail passengers paying most of the running costs of the railways (Office of Rail and Road, 2017), it is important that there is adequate investment made into the improvement of passenger experience and the support provided to them during the process of rail travel.

Finally, both sets of interviews highlight the differences between leisure travellers and commuters, which surrounded three main areas: information preferences, knowledge of disruption, and general journey experience. The industry members comment on the varying knowledge and support required by different types of travellers, which is matched by the findings of the passenger interviews. Commuters and leisure travellers had contrasting ideas surrounding the improvement of rail information, as well as different levels of understanding when it came to disruption information. This supports the literature on the differences between leisure and frequent travellers, with regards to their contradictory concerns and priorities (Anable & Gatersleben, 2005), and the advanced experience of frequent commuters (Gustafson, 2012). Different groups of travellers have varied levels of knowledge, with some requiring more support than others. This introduces the concept of personalised information provision, which was mentioned by both industry members and rail passengers. There is an alignment between the industry's investment into the personalisation of passenger information and the informational demands of rail customers.

The foundational research conducted for this thesis highlighted the key challenges surrounding information provision for the rail industry, and the main customer priorities for improvement of the rail service. With support seen for the idea of personalising information to different groups of customers, the next step was to investigate the key characteristics of each of these passenger types.

9.4 OBJECTIVE 3: TO EXPLORE HOW DIFFERENCES IN KNOWLEDGE OR EXPERTISE BETWEEN DIFFERENT TRAVELLER GROUPS INFLUENCES THE USE OF RAIL INFORMATION.

The transportation literature proposes that the differences seen between commuters and leisure travellers were based on the extent of the former's experience with the rail system (Dziekan, 2008; Grotenhuis et al., 2007). As mentioned, frequent commuting is seen as being a form of expertise (Gustafson, 2012), developed by consistent practice of the travel routine (Grotenhuis et al., 2007) and the accumulation of advanced trip-specific knowledge (Dziekan, 2008). The discrepancies between the knowledge and travel behaviour of frequent and infrequent travellers was noted in both the industry and passenger interviews. The first survey conducted for this thesis aimed at backing that up with more generalisable quantitative data from a larger sample - the focus was on expertise and information preferences, to link the two.

In addition to this, there was the exploration of the link between expertise and travel frequency. This was added for two reasons. Firstly, some of the literature suggests that expertise is domain-specific (Chase & Simon, 1973; Morris et al., 1981; Glaser & Chi, 1988). As mentioned, experts are seen as having superior domain-specific memory (Glaser & Chi, 1988), resulting in an impressive ability to retain large amounts of information regarding their area of expertise. This level of specificity, however, sometimes results in the lack of their superior level of performance outside of their area of specialisation (Shanteau, 1992). Experts adapt to the characteristics of their domain and become dependent on

information and experience that pertains to it (Slatter, 1987). In line with this, frequent travellers have been referred to as experts within the domain of their specific trip (Gustafson, 2012). This would mean that, in a travel scenario, a frequent traveller is likely to be an expert only on their specific trip, and possibly not with regards to rail travel in general.

This was reflected in the situated interviews, with commuters mentioning their lack of knowledge regarding rail travel in general, but their high level of expertise surrounding their commute to work. The explanation for the formation of expertise within the rail travel scenario would be the consistent experience of the trip. In other words, the idea of practice. As discussed, one of the main psychological theories regarding the development of expertise is practice. For example, Ericsson, Krampe and Tesch-Romer's (1993) describe how 10,000 hours of deliberate practice causes the formation of skilled memory, and thus, expert performance. The literature on frequent commuters also shows support for this with the proposed idea of the practiced trip itinerary (Grotenhuis et al., 2007). Thus, it would be rational to suggest the existence of strong link between expertise and frequency of travel. In order to explore this, the measures employed in all three surveys within this thesis included asking passengers about the regularity of their trips, as well as their ratings of their own expertise. The analyses depicted some interesting findings.

Firstly, results showed that most people think that they are fairly knowledgeable with regards to rail travel, and rate themselves quite highly on the expertise scale. Travel frequency and expertise are linked – the more people travel (both generally, and on specific rail journeys), the higher their self-rated levels of rail

travel expertise are likely to be. This supports the psychological literature on expertise being a product of repeated experience and practice. Additionally, there is support for the idea of expertise being domain-specific (Shanteau, 1992) within all three surveys conducted for this project. Across all the expertise ratings collected, people rated their expertise within their own domain – their specific rail journeys – as being significantly higher than their expertise regarding rail travel in general.

The next step was to look at the information preferences of travellers. Passengers place general rail travel information into six categories: journey planning information, service updates, information about how to get help and provide feedback, mobile phone updates, information about the available facilities and contact details for the service providers. This provides a template of the types of information that passengers identify. Secondly, and more importantly, passengers show clear preferences for the most useful information for their travel. The most valued is information about obtaining the cheapest fare, the ability to book tickets on a website, the provision of live updates and the quickest route, and delay announcements. The "least useful" is Twitter-based information, along with information regarding general facilities, like Wi-Fi, car-parking or providing feedback.

These findings align with the priorities of the passengers from the previous study, whose suggested improvements to the rail service included live journey updates, improved ticket-booking on rail-based mobile applications, and detailed disruption information. Additionally, commuters in particular mention the value that they place on the "quickest route", which is reflected in the

informational priorities seen in the survey, and within the transportation literature (Hine & Scott, 2000). Finally, the passenger interviews highlighted cost as being a particular concern for leisure travellers – this is mirrored in the findings of the survey, with the provision of information regarding the cheapest route being the highest-rated type of information.

Finally, the first survey study aimed to understand the impact that expertise has on the information preferences of rail passengers. The findings showed different relationships between expertise and traveller preferences - there was a negative correlation between expertise and journey planning, and a positive correlation with information about service alterations, for example. Similarly, traveller preferences for information regarding contact details of the service providers, seat reservations, online ticket-booking and information regarding the cheapest fare were all related to frequency of rail travel. However, expertise and travel frequency only explained some of the variance seen in the grouping of information functions. They do not entirely explain the information choices that people make with regards to their rail journeys. Theoretically, this implies that there are other factors that play a role when it comes to travel behaviour.

With this in mind, the next avenue explored was the notion of disruption. Not only is the improvement of disruption information one of the main aims of the rail industry, both industry members and passengers commented on the prominent differences between commuters and leisure travellers with regards to the management of disruption. In the first survey, the most amount of variance explained by expertise and travel frequency was with regards to the "Alterations" factor, which referred to information related to disruption. Those

with higher levels of expertise and travel frequency valued this factor more, showing an appreciation for information relevant to problem-solving within an unexpected situation. This is supported by the psychological literature on expertise and problem-solving. Experts have more advanced problem-solving skills than novices (Anderson & Leinhardt, 2002), and can adapt to novel situations (Shanteau, 1992). Based on this, the next study aimed to examine expertise within this context of problem-solving, by focusing on disruption-specific information.

9.5 Objective 4: To focus on rail disruption, the impact it has on expertise and information use, and the additional support required on the basis of this.

As discussed, the management of disruption is one of the major challenges faced by the rail industry and passengers alike (Accent & Rail Delivery Group, 2017). Disruption goes beyond just being a practical issue – it creates a novel travel context. Passengers need to quickly adapt their information gathering and decision-making processes to the situation, showcasing the extent of their own cognitive flexibility.

Additionally, there are key differences between commuters and leisure travellers in the way in which they manage disruption situations. From a psychological perspective, some studies argue that a key feature of expertise is the ability to adapt quickly to problems that might arise (Ward et al., 2018), with the expert using their experience and knowledge to solve them in a more

effective manner than novices (Shanteau, 1992). If this is the case – and frequent travellers do have some form of expertise – looking at disruption was an ideal way to test these ideas within this thesis. The second survey involved the use of a repertory grid method to elicit the key characteristics of disruption alerts. The aim of the study was to understand how participants with high and low travel frequency and expertise parsed and understood disruption information: was there a difference based on travel experience?

The findings show that the main aspect of disruption noted is the idea of uncertainty. This was seen with regards to the duration of the disruption, the location of the problem, or just uncertainty in general. The alleviation of uncertainty is one of the main reasons for information provision during disruption, and this fits with uncertainty as a key factor for the lack of uptake of public transport (Grotenhuis et al., 2007; Office of Rail Regulation, 2014). To combat this uncertainty, the study uncovered a "best practice" template from the cluster analyses by the elicited constructs, which created for the ideal form of disruption alerts for rail travel. In short: a successful disruption notification should provide information in a manner that instils confidence, while also specifying the location of the problem and a solution. Interestingly, these ideal features of disruption information were seen across all passengers, regardless of their level of expertise or frequency of travel.

In terms of passenger differences, there were no real differences seen between travellers with high and low levels of self-rated expertise regarding general rail travel. There is a simple explanation for this: as mentioned previously, most people consider themselves as having high levels of expertise regarding rail

travel. Expertise regarding a specific rail journey makes also no difference – travellers parse disruption alerts in the same way, regardless of where they fall on the "self-rated specific expertise" spectrum. All in all, expertise has a limited effect on the identification of disruption characteristics. This result was unprecedented, due to the previously mentioned ideas surrounding expertise and problem-solving (Shanteau, 1992; Ward et al., 2018), as well as the findings from both the interviews, and the previous survey. The first survey specifically depicted a relationship between expertise and information regarding service alterations. So, is there a better explanation?

Travel frequency, however, is a different story. People who travel frequently - both generally and on specific journeys – identify the presence of uncertainty, as do all travellers, but are also unique in their appreciation of "perfect" disruption alerts. While infrequent travellers solely noted the causes of their uncertainty, frequent travellers also noticed the opposite situation – the provision of the solution. This suggests an additional layer of nuance in their knowledge. Extensive experience with disruption results in an understanding beyond just the basic detection of uncertainty. Experienced travellers also know what the solution is to this uncertainty, and recognise when it is provided to them. This lends support to the link between expertise and extensive experience (Benner, 1982). High frequency of travel results in increased experience with both disrupted and undisrupted rail travel, resulting in an enhanced ability to adapt to the former (Ward et al., 2018).

So far, the story seemed to be the following: expertise and travel frequency have some effect on information preferences, and travel frequency influences the

identification of the key features of disruption alerts. However, based on the findings so far, it is reasonable to suggest that there are additional external factors at play when examining how passengers use information. This introduces the penultimate research objective, and the final study conducted for this thesis.

9.6 Objective 5: To identify other factors that impact the collection and use of information during the process of rail travel.

Both expertise and travel frequency could be considered to be factors pertaining to the behaviour of the individual, however there are other possible journey factors that are influential as well. Previous research had found trip purpose (Yeboah et al., 2019) to be a key factor influencing information choices, making it the first variable to be selected. The second factor examined was the notion of Trip Familiarity – instead of examining general versus specific expertise, the aim was to look at whether the trip was a routine or a novel one. The purpose of the third survey – the vignette experiment - was to examine these two variables alongside expertise and travel frequency, with a focus on the information and disruption factors examined in the previous studies. Participants were presented with hypothetical journey scenarios that involved the occurrence of a disruption. There were four versions of the vignettes, based on either high or low Trip Importance or Trip Familiarity. They were then asked to rate the six basic information factors extracted from the first survey (Journey Planning, Service Updates, Phone Notifications, Facilities, Help & Feedback and

Contact Details) and four disruption characteristics elicited from the second survey (Disruption Duration, Disruption Location, Disruption Cause and Possible Solutions) on the basis of their usefulness to the presented vignette. These ratings were analysed alongside self-rated expertise and travel frequency.

Results showed that, regardless of their expertise or travel experience, or even trip familiarity, all travellers have clear preferences regarding what they considered to be useful information within a disruption situation. Four types of information were rated much higher than the other six by all participants: "Disruption Duration", "Phone Notifications", "Service Updates" and "Possible Solutions". Passengers have distinct preferences when it comes to disruption support: they want proactive notifications about the duration of the disruption, alongside consistent updates regarding the situation, and a solution to the problem. This is supported by industry research, which states the requirement for timely, accurate, and quick information during disruption, as well as regular updates (National Audit Office, 2008; Southeastern, 2016).

The findings showed that the perceived importance of the trip did impact information choices: the more important the trip, the more that participants valued the specific types of information outlined above. Firstly, this supports the existing literature on the factors that impact how people gather information when using public transport (Yeboah et al., 2019). Additionally, while there were no specific findings of travel frequency in the vignette experiment, previous studies depicted how frequent commuters value disruption information, and understand it better, than infrequent travellers. The explanation here might just be that frequent commuters complete more important trips. The commuters in

the situated interviews mentioned the importance of their trip to work – this importance mediates the value that travellers place on the information provided to them. Trip Importance changes the worth of the information.

9.7 Theoretical Implications of the Findings

The results of the studies conducted for the present thesis have several implications for the study of expertise and traveller behaviour. Beginning with the foundational research conducted, the findings of the industry and passenger interviews highlight the opportunities available to study complex behaviours like expertise within a dynamic context like travel. Studies have highlighted experts as being adaptive and flexible (Shanteau, 1992; Ward et al., 2018). The findings of the situated passenger interviews depict the benefits of studying it in a manner that appreciates these inherent factors, by matching contextualised observations with semi-structured interview data. There are, at least anecdotally, differences in the passenger experience of different types of travellers. The information preferences of frequent/expert travellers also support this. The highest amount of variance explained by these two measures in the first survey was for disruption information, and as per the second survey, frequent travellers were more nuanced in their understanding of disruption information.

Additionally, some of the specific information preferences seen on the basis of expertise and travel frequency support the existing literature on passenger behaviour: expert travellers value the quickest possible route (Hine & Scott,

2000), and pay little attention to information that they do not consider to be instrumental to their journey (Chorus et al., 2006). This provides further evidence for the current division of rail passengers into commuters and leisure travellers for the purposes of understanding passenger experience (Department for Transport et al., 2016).

More crucially, the findings of the three surveys provide support for existing theories regarding the nature of expertise. Firstly, the comparison between the ratings of specific trip and general rail travel expertise support the idea of domain-specificity (Shanteau, 1992). Travellers see themselves as having higher levels of expertise on specific journeys that they complete often, as opposed to rail travel in general. This is in accordance with literature on expertise in general (Chase & Simon, 1973; Glaser & Chi, 1988), as well as research conducted with frequent travellers (Gustafson, 2012).

Secondly, the findings suggest a strong link between expertise and travel frequency. This is important as it provides support for theories that suggest that expertise is a product of extensive experience and practice (Benner, 1982; Charness et al., 2005), as well the transportation literature regarding the repetitive behaviour of frequent travellers (Aarts et al., 1998; Grotenhuis et al., 2007). Additionally, it also provides a form of resolution to the question of whether "expert-like" frequent commuter behaviour is a product of habit (Aarts et al., 1997) or actual expertise (Gustafson, 2012). If expertise is measured by travel frequency, the practiced behaviour of frequent commuters could be attributed to both, with consistent exposure to the travel situation resulting in the formation of a habit that manifests itself as a form of expertise.

An interesting additional finding was with regards to people's perceptions of their own levels of knowledge: people consider themselves as having quite high levels of rail-related expertise. This could either be due to a high level of confidence in their own skills, or due to the nature of rail information itself – both of which would be worth examining further. While this might explain the limited effect of expertise and travel frequency, the findings of this thesis also point to the required exploration of other aspects that impact the process of travel. As discussed, there are several contextual and individual factors that contribute to travel planning and information use: trip importance (Yeboah et al., 2019), habit (Aarts et al., 1998) or even the weather (Gould & Atkin, 2015). The limited explanation for information preferences provided by expertise and travel points to the required investigation of these influential aspects.

Finally, in terms of further exploration of expertise within dynamic environments, the thesis provides an evidence base for the use of travel frequency as a proxy to measure expertise. The findings demonstrate the challenges involved in investigating the abstract concept of expertise, and the way that travel frequency could be considered as being a solution. This will be discussed in further detail later in this chapter.

9.8 Objective 6: To understand the Implications for Information Design and Personalisation.

Alongside contributions to theory, the findings of this project also have crucial implications for the design and personalisation of rail information. The results of

the passenger and industry interviews summarise some of the key concerns of the rail community, and customer priorities for the enhancement of rail travel. While the rail industry has been the focus of research concerning the operational aspects of the service (Golightly & Dadashi, 2016, for example), the perspectives of the community are often overlooked with regards to the enhancement of information. The foundational research for this thesis fills that gap. Additionally, it compares the perspectives of both sides of the coin, allowing for a deeper understanding of the areas of alignment and disconnect between customers and service providers.

With regards to disruption information, the findings outline how passengers read and understand disruption information, and highlight the key role of uncertainty, and the requirement of its alleviation to support passengers during disruption. Not only does this support the existing literature on uncertainty and stress (Cox et al., 2006), it also creates a clear aim for the design of disruption information: to remove any sort of ambiguity within its content.

Finally, the main hypothesis of this thesis was with regards to the impact that expertise and travel frequency had on the information use of rail passengers. The findings do suggest that different groups of travellers have different priorities, thus requiring varied levels of support. This matches the transportation literature, a prominent example being the “instrumental” concerns of commuters versus the “affective” ones of leisure travellers. (Anable & Gatersleben, 2005). This provides evidence for the industry-based segmentation of passengers into commuters and leisure travellers for the examination of journey experience, specifically with regards to factors related

to journey planning and alterations. Importantly, information regarding service updates is seen as being crucial, across all studies. However, the limited explanatory power of expertise and travel frequency regarding information choice suggests that personalisation of information based on these factors is not a straightforward process.

9.8.1 PERSONALISATION

Both industry members and passengers interviewed for this thesis comment on the benefits of information personalisation. The exploration of expertise and information use was motivated by the development of a more theoretical method of personalisation, with the adaptation of information to the existing travel knowledge of passengers. There was some influence of self-rated expertise on the way people grouped information into different categories, their preferences for general rail travel information, and the manner in which they identified the key features of disruption. However, the findings suggest that expertise is quite hard to uncover and examine, particularly within situations like rail travel. A logical alternative would be to look at travel frequency, which correlates quite highly with expertise, and is a straightforward indicator of the amount of travel experience that a passenger has.

Travel frequency predicted some of the variance with regards to information preferences and the parsing of disruption information. However, there are clearly other factors involved. While this thesis did attempt to examine other possible influencers, such as Trip Purpose and Journey Familiarity, the distinct

idea is that all passengers want the same types of information, particularly during disruption. While this does not provide a lot of support for the personalisation of information based on knowledge or specific journey features, it does make the practical delivery of information to rail passengers more straightforward. It is also worth stating that none of these findings have anything to do with personalisation on the basis of machine learning algorithms (think social media advertising) or based on the specific preferences of individual rail travellers. The findings focus on the design of personalised information systems based on expertise or journey characteristics.

9.8.2 General Information Design

This thesis began by exploring the perspectives of industry members and rail passengers on a few key areas of interest to the rail community: information provision, disruption management, traveller behaviour and the enhancement of the service provided to customers. The quantitative analyses lead to the discovery of key information types that could aid passengers in successfully managing their own rail journeys. These categories of information could be separated based on the support that they offer to: a) rail journeys in general, or b) disrupted rail journeys. On the basis of this, an information template was constructed (Figure 41). The purpose of a template of this sort is to provide simple guidelines regarding the main areas that need to be covered in order to successfully deliver information to rail passengers.

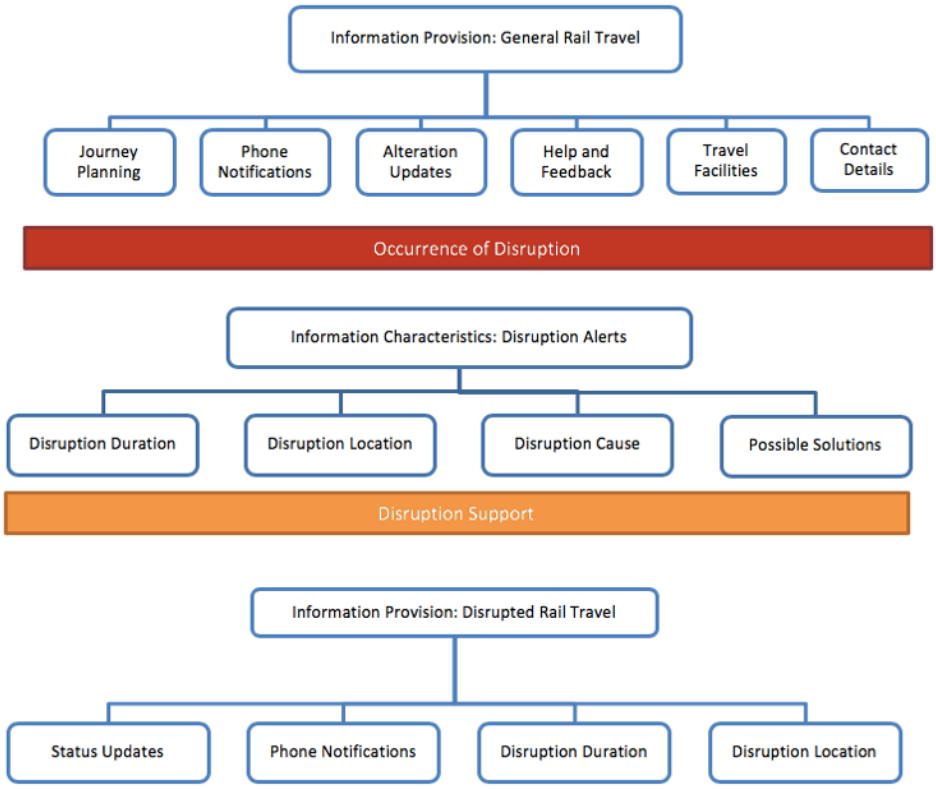


Figure 41. Providing information for both general and disrupted rail travel.

The first level represents the types of information that should be accessible to rail passengers in general. Following the occurrence of a disruptive incident, the next level presents the ideal features of a disruption alert – duration, location, cause and solutions. However, the final level presents the ideal pieces of information that passengers would like to receive to help them navigate through the issue: regular updates, preferably through phone notifications, with an emphasis on information about the duration and location of the problem. While this provides an idea of the best way to support passengers, there are also priority areas of improvement within those information features, elicited from both the qualitative and quantitative data. These have been summarised in Table 54.

Table 54. Key priorities for the improvement of information provision.

Type of Information	Key Priorities
Journey Planning	There is strong demand for tools that help find the cheapest and quickest route. Passengers value being able to book tickets online. Passengers want to know arrival times. Passengers want a more seamless ticket-booking process for rail applications.
Mobile Phone Notifications	Passenger value having live train times available on their mobile phones. Both industry members and passengers mention the importance of push notifications. Mobile connectivity is a key area of concern for passengers.
Service Updates/Alterations	Passengers value delay announcements. Passengers want timely, reliable and accurate information. Passengers want consistent platform information.
Help and Feedback	Passengers value the presence of staff members.
Disruption Management	Passengers want suggestions of alternative routes during disruption. The industry requires a consistent strategy for disruption management across the entire network.
General Information Delivery	There is a need for better collaboration between different organisations within the rail industry. Cost is a major issue, both in terms of information delivery and passenger rail fares. There is a lack of dynamic, context-specific information.

The priorities for improvement broadly match the existing industry literature, with examples of prominent concerns being ticket costs (Passengerfocus, 2014; Transportfocus, 2017b, 2018c), and the reliability of rail information (Transportfocus, 2017c). Additionally, there are mentioned challenges that are already under investigation within the industry, including the aim to make rail travel as seamless as possible (Casey, 2016) and to develop a consistent, network-wide strategy for disruption management (Accent & Rail Delivery Group, 2017).

Going back to the conceptual model, the template in Figure 41 interacts with every step in the process of information delivery (Figure 42).

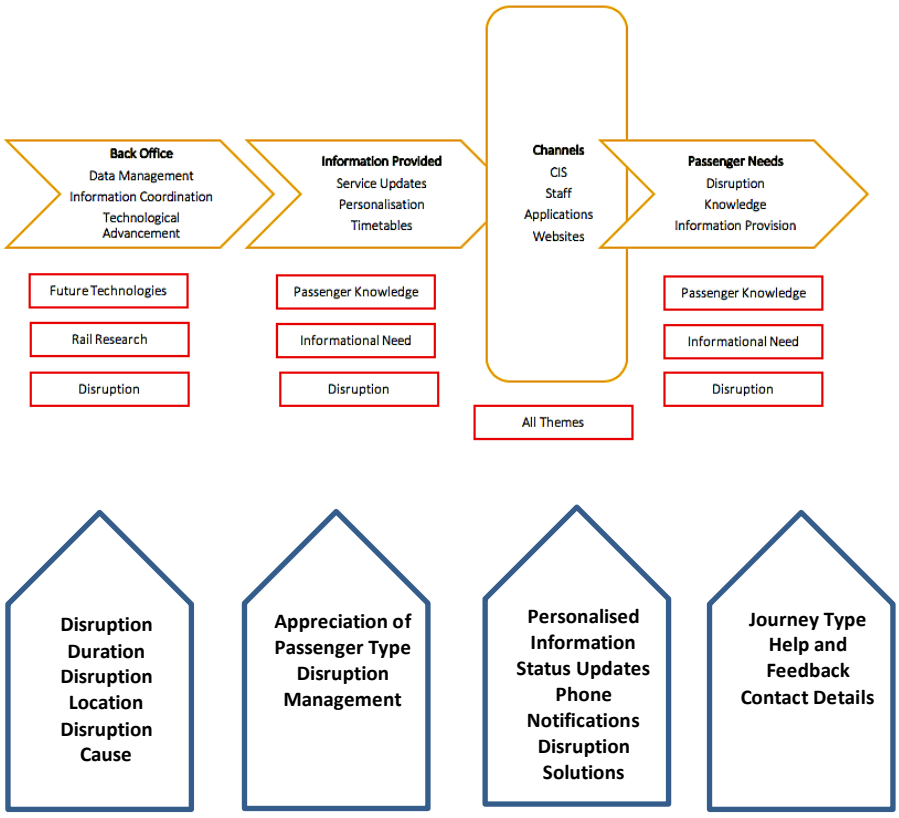


Figure 42. The information process x the conceptual model of information delivery.

Firstly, there are two key factors to appreciate: the model is generally applicable across most passengers, and disruption information is of high priority. As seen in Chapter 8, the provision of disruption information can be standardised across passengers, but journey type might have a slight bearing.

Referring to the "Back Office" again, the additional factors that require consideration, apart from information coordination, are the duration, location and cause of disruption. This data needs to be gathered quickly and efficiently, in order to support passengers. Similarly, with "Information Provided", the

effective management of disruption data is an additional consideration, alongside the general appreciation of passenger type and needs. The “Channels” provide an avenue to personalise information (an opportunity to provide frequent rail travellers with more information regarding service updates and “Alterations”, perhaps), as well as generalised disruption support and solutions. Finally, there is the appreciation of passenger needs – this would be where the impact of Trip Importance (or Journey Type), for example, would be seen the most. This can be anticipated at the “Information Provided” stage, when tailoring the information to be provided through the Channels.

Additionally, the information priorities highlighted in Table 54 also come with the implied importance of the appreciation of the different stages of information provision. A good example would be the improvement of informational accuracy. Starting at the back office, the information collected across Darwin and Knowledgebase should be reliable. The information provided to passengers should cover all the key categories outlined in the template (Figure 41), with the introduction of push notifications and consistent updates, particularly during disruption. Achieving this requires better collaboration between different rail organisations, increased technological investment to enable the acquisition of dynamic data, as well as the capability to provide updates to passengers in a proactive manner. The process of information design for rail passengers requires the appreciation of each stage of the conceptual model, with a focus on a high quality of information throughout. While the priorities for improvement highlight the key areas of concern to passengers and industry members, the

conceptual model details the different facets of information design that require appreciation when investing in the enhancement of rail information.

9.9 Methodological Approach: Learnings

Through the course of this project, the application of each research method has come with its own learnings and discoveries. First and foremost, this thesis successfully exemplifies how mixed-methods research can be a huge asset to the systematic exploration of complex research questions. A major benefit of this method was the ability to design the project with interdisciplinary contributions, and select the best method for every stage of the process, as opposed to a stringent reliance on a specific set of tools or theoretical ideologies. The use of a range of research tools made the outcomes more reliable due to extensive examination.

9.9.1 Qualitative Methods

The selection of the interview method(s) was in order to obtain detailed, anecdotal comments at the beginning of the research process, in order to contextualise and structure the following studies. The main benefit of the use of telephone interviews was the ability to gain access to important stakeholders within the rail community, which would have been a lot harder to do through the organisation of face-to-face or in-person interviews or focus groups, due to their busy schedules. The results of telephone interviews are comparable to those obtained from in-person interviews (Carr & Worth, 2001; Greenfield et al.,

2000), which aim to explore research questions in an in-depth manner, with less concern for generalisation to a large population than quantitative studies (Dworkin, 2012). However, while the method and sample size suited the purposes of the study, there is always an advantage in having a larger, and more diverse sample, covering more members of the rail industry.

This comment holds true for the passenger interviews as well, which also had quite a small sample size. Again, logistically, the sample size was apt for the requirements of the research, especially considering the situated nature of the interviews. A larger sample size would not have been achievable for that format within the timescales allotted for this project. “Go-along” interviews have some of the same benefits as standard “sit-down” interviews, including the procurement of in-depth anecdotal evidence (Carpiano, 2009). However, situating the interview within the lived (travel) experience of the individual came with the added advantages of rich observational data regarding the interaction between the individual and the context, as well as environmental prompts for the individual to recall more pertinent information.

The process has its own drawbacks, which include the complexities involved in ensuring the safety of the researcher, particularly within a lone-working situation, and possible compromises in data quality. One of the main disadvantages of the situated interviews conducted for this project was the inability to record participant responses due to the limitations involved in being in a public space like a train carriage.

9.9.2 Quantitative Methods

The main benefit of using surveys for the quantitative component of the research was the relatively large samples of data, and thus, the generalisability of the results. In addition to this, the repeated use of the survey method allowed for the establishment of a set pattern, with the inclusion of the same expertise, travel frequency and demographic questions across all three studies. The main advantage of the repetition of the expertise and travel frequency questions was the ability to gather strong evidence for the links between the two, as well as domain-specific expertise.

In addition to this, the studies provide an evidence base for the issues related to the use of self-ratings to measure expertise. There were two ways to go about the study of expertise – to allow participants to self-assess, or for the researchers to determine which passengers were experts and which passengers were not. The latter has the obvious issue of researcher bias. The use of self-rating measures was a good way to avoid this, though resulting in a skewed measure of expertise. This is not entirely a surprise, self-report data comes with its own biases, namely with regards to the self-perceptions of the individuals. Individuals have been shown to inaccurately assess themselves with regards to factors like their weight (Flood, Webb, Lazarus & Pang, 2007), or level of physical activity (Haskell, 2012), for example. In order to combat this, the present research could have involved a deeper investigation of traveller expertise, by asking more questions regarding individual travel behaviours or information gathering. However, the questions asked mirror the way personalisation would occur within the rail industry – by asking passengers to provide basic information

regarding their frequency of travel and prioritised journeys. Additionally, the strong correlations between travel frequency and expertise corrected for this, by providing both an objective measure of experience, and a subjective assessment of one's own knowledge. As mentioned, for all intents and purposes, travel frequency seems to be an appropriate proxy for the measure of expertise. Beyond this, the unexpected finding regarding people's perceptions of their own knowledge of rail travel also introduces interesting avenues for research into individual insights into personal knowledge levels, and the perceived characteristics of rail information.

Finally, a caveat to this research is the context within which it lies. All the studies conducted were based around a) the railways, and b) the rail system in Great Britain, specifically, which could limit its generalisability. However, key findings within this research support the results of transportation studies conducted with other populations, or in other countries. The links between travel frequency and expertise, and the expert behaviours identified in this thesis, have been seen in commuters in Sweden (Gustafson, 2012), as well as commuters that take other forms of public transport (Dziekan, 2008). Similarly, the issue surrounding the lack of interest in a modal shift from private vehicles has been seen across different forms of public transport (Kenyon & Lyons, 2003; Kingham, Dickinson, & Copsey, 2001), as well as different countries (De Witte et al., 2008). It is the strong belief of the researcher that the challenges involved in the improvement of passenger experience, as well as recommendations around the design of information are easily transferrable to other rail services, and some other modes of transport. Additionally, the findings surrounding the nature of expertise, as

well as the support for domain specificity, have important theoretical implications for all fields of human-centred research, from psychology to human factors to user experience.

9.10 CONCLUSION

The present chapter collated all of the findings of the Ph.D project, and discussed how each stage of research addressed the objectives. Following this summary, the implications of the results were discussed with regards to information provision, and the enhancement of customer experience on the railways. A template for information delivery for general and disrupted rail travel was presented, as were recommendations for the improvement of the same. This chapter concluded by discussing the methodological approach of this thesis, and the possible limitations of the research conducted.

10. CONCLUSION

10.1 CHAPTER SUMMARY

The final chapter of this thesis summarises the main contributions of the research to existing theories surrounding knowledge and information use, as well as the improvement of information provision and customer experience within the railway service. It concludes with recommendations for future research in these areas, and the successful implementation of the ideas presented within this thesis.

10.2 THESIS SUMMARY

This Ph.D project began with an exploration of the challenges and priority areas with regards to the improvement of passenger experience during rail travel in GB. After narrowing down the key issues regarding information provision and disruption management, it aimed to identify how to best support passengers with differing needs and experiences. The main hypothesis was that expertise and travel frequency would have a significant impact on information preferences, allowing for their use in the development of targeted passenger information. In terms of psychological theory, the findings showed support for the idea of (travel) expertise being a product of extensive experience and practice (Benner, 1982; Grotenhuis et al., 2007), as well as the domain-adapted nature of expertise (Slatter, 1987). In addition to this, travel experience and self-

assessed expertise do have some impact on information preferences during general rail travel, but “expertise” as a concept was difficult to capture. Travel frequency, alternatively, was a key area of interest, particularly with regards to the identification of the significant features of disruption information.

However, the findings suggested that personalisation of information, while being a major priority to the rail industry, is probably not best achieved through the investigation of individualistic factors related to knowledge or travel frequency. While the perceived importance of the trip had an effect on information preferences, at the end of it all, it was found that rail passengers had fairly uniform – and strong - information preferences for the management of disruption, regardless of the individual and contextual variables influencing their journey. This led to the development of a template for the successful delivery of information to support rail passengers during both regular and disrupted rail journeys, as well as a series of recommendations for the improvement of specific areas of the rail service in GB. The project provides an evidence base to support the organisational decision making of rail stakeholders like Rail Delivery Group or the Rail Safety and Standards Board, aligning with existing initiatives related to the improvement of customer experience (Rail Safety and Standards Board, 2012).

10.3 CONTRIBUTIONS

The implications of the findings for academic and industrial research had been discussed separately in the previous chapter – the present section will summarise all of these, and present them as overall contributions.

10.3.1 INDUSTRY PRIORITIES

While there has been previous research into the operational aspects of rail travel (Golightly & Dadashi, 2016, for example), there is little literature surrounding the general views of rail industry members regarding the service it provides. With the existence of organisations like Transportfocus, there is a lot of data around the priorities and opinions of passengers, and rightly so. However, when it comes to understanding how to improve a service, there are two key perspectives to be accounted for: the customers, and the service providers. The industry interviews achieve the latter, examining the perspectives of the rail community, which is often overlooked when studying passenger experience.

The industry interviews outline the key operational challenges involved in creating a successful customer experience, specifically with regards to the acquisition of accurate and reliable information, the management of disruption and the costs involved in the improvement of passenger information. The rail community interviews elicited the key considerations for the improvement of customer experience, allowing for a more detailed understanding of the challenges and opportunities surrounding information provision and passenger experience. Understanding the priorities of the people who work within the

industry helps contextualise the important areas that should be targeted with regards to research and investment.

Furthermore, the comparisons made between the industry and passenger interviews provide an insight into the main areas in which the industry priorities align with customer needs, as well as the crucial contrasts between the two. Both groups, for example, see the importance of personalisation, accurate and reliable information, and the varied levels of support required by different groups of travellers. They, however, have different opinions regarding the costs involved during the process of rail travel: industry members commented on the requirement for increased financial investment and the cost of providing good information, while passengers focused on the high costs of rail travel.

Finally, the interviews resulted in the development of a conceptual model that communicates the overarching structure of passenger needs. The model represents the channels that can be used to meet customer needs, along with the information presented via these channels.

10.3.2 Passenger Behaviour

As mentioned, there is a lot of literature on the priorities of rail passengers, and their experiences surrounding rail travel in GB. This thesis, however, aligns the opinions of passengers with two key aspects that influence their journeys: their travel frequency, and their journey type. The passenger interviews outline how the priorities of travellers could impact their experience with the rail service, by focusing on the differences between passengers who travelled for different

purposes. While there is research conducted on the behaviour of commuters (Lyons & Chatterjee, 2008, for example) and rail passengers in general, this thesis directly compares the two groups, providing a qualitative summary of the behavioural differences between them through the presentation of both interview and observational data.

There are two key contributions of this research to the understanding of passenger behaviour. The first is the presentation of further evidence regarding the differences between commuters' practical needs and leisure travellers' experiential preferences (Anable & Gatersleben, 2005). The second contribution is with regards to methodology: while the "go-along" (Carpiano, 2009) or situated interview method has been used before, this project clearly exemplifies how this process can result in the gathering of rich qualitative data. Beyond just participant responses to questions, there were opinions expressed that were prompted by contextual factors (passengers commenting on the frequency of delays on the service after hearing a delay announcement, for example), as well as opportunities to gather observational data that enhanced the researcher's understanding of the experience of different passengers.

10.3.3 Expertise and Travel Frequency

From an academic perspective, the research conducted makes important contributions to the understanding of expertise, particularly within real-world, dynamic environments. More specifically, it contributes to the transportation literature by forming a link between psychological theories surrounding traveller

behaviour and the practicalities related to navigating around public transportation systems.

The most interesting contribution, however, is with regards to the nature of expertise in itself. Firstly, there is strong support within this thesis for the notion of domain specificity (Shanteau, 1992; Slatter, 1987): across all surveys, all participants rated themselves as having greater expertise regarding specific rail journeys (within their domain) as opposed to general rail travel (general expertise).

Beyond this, the results of this thesis lays emphasis on the subjectivity of personal experience, and the importance of appreciating individual differences when examining seemingly universal concepts like expertise. Expertise, to put it simply, is hard to operationalise and define. With regards to travel, however, there is a solution: travel frequency. This thesis provides a strong argument for the "expertise comes from exposure, experience and extensive practice" (Benner, 1982; Ericsson, Krampe & Tesch-Romer, 1993; Charness, 2005) school of thought by depicting the links between expertise and travel frequency. While capturing underlying expertise might be difficult, looking at the frequency of travel provides a good approximation of the factors that contribute to its development: experience and consistent practice. In summary, the following table (Table 55) provides an overview of the key academic theories that were studied within this body of research, and the contributions that this thesis with regards to them.

Table 55. Summary of key contributions.

Theories Explored	Thesis Contribution
There are key differences between the behaviour of leisure travellers and commmuters (Anable & Gatersleben, 2005; Gustafson, 2012).	This theory was upheld. Both passengers and industry experts commented on the differences between leisure and frequent travellers. In the surveys, there were some differences between the information preferences based on travel expertise, and frequent travellers had a more nuanced understanding of disruption information.
Leisure travellers have more "affective concerns", commuters have more "instrumental" preferences (Anable & Gatersleben, 2005).	The passenger interviews depicted the differences between the concerns of leisure and frequent travellers.
Frequent commuters have higher travel-related expertise (Gustafson, 2012; Dziekan, 2008).	This theory was upheld. There were significant positive correlations between expertise and travel frequency. It was also extended, with the proposition of using travel frequency as a more objective approximation for levels of travel expertise.
Expertise is a product of extensive experience and practice (Benner, 1982; Charness et al., 2005).	There were significant positive correlations between expertise and travel frequency, extending this theory into the domain of passenger experience.
Expertise is domain-specific (Glaser & Chi, 1988; Shanteau, 1992).	This theory was also extended into the domain of passenger experience. In the situated interviews, participants commented on their knowledge being specific to their work commute. In the surveys, people rated their expertise on specific journeys as being higher than their general rail-related expertise.
Experts have superior problem-solving skills within their domain and quickly adapt to changes (Ward et al., 2018; Shanteau, 1992).	This theory was upheld. There were key differences in the manner in which commuters and leisure travellers described their approaches to disruption in the interviews. Additionally, in the repertory grid study, those with higher levels of travel experience had a better understanding of disruption information.
Trip purpose is a key factor that influences information choices when using public transport (Yeboah et al., 2019).	This theory was partially upheld. The final study found that the more important the trip, the more that participants valued the specific types of information outlined above. However, there was no significant evidence found that proved that trip and expertise-related factors significantly impact how information is structured.

10.3.4 Disruption

This thesis provides an idea of how experience contributes to the understanding of disruption information. As seen in the repertory grid survey, frequent travellers had a more nuanced view of information, recognising both the "good" and the "bad", while less-experienced travellers zoned in on the idea of

uncertainty, and solely focused on the information that they were not getting from the situation. This, firstly, supports theories regarding frequent travellers and their expertise. Frequent travellers focus on solution-based, practical information (Anable & Gatersleben, 2005). Additionally, due to their expertise within their domain (Gustafson, 2012), they are able to handle uncertainty (Lipschitz & Strauss, 1997), and thus, quickly solve any problems that they might encounter (Farrington-Darby & Wilson, 2006).

Beyond this, the concept of uncertainty has been a prominent feature with regards to the topics explored in this thesis. As discussed, disruption causes a sense of uncertainty, resulting in stress and a negative passenger experience (Cox et al., 2006). Information provision helps alleviate this uncertainty. The findings show that the focus should be on the features of the information delivered to passengers, rather than individual traveller characteristics. The main underlying factor that should be addressed when managing information provision is the alleviation of uncertainty, especially to support passengers during disruption. This is interesting from a behavioural perspective, contributing to the existing literature on decision making and information use under uncertain circumstances.

10.3.5 The Information Template

The previous chapter summarised the implications of the research findings by presenting a three-stage template that outlines the main facets of information to provide to passengers for both regular and disrupted rail travel. This map is

crucial from a rail industry perspective, as it provides an easy summary of the main priorities of passengers, and the best way in which to adequately support them during their journeys.

Secondly, from a design angle, the template provides a foundation upon which to construct information to support users of all forms of public transport, beyond just the railways. Considering the earlier point made about the alleviation of uncertainty, the map provides an idea of the main factors that achieve this. It provides a starting point for the design of disruption support for other forms of travel, by providing a ready template for this purpose.

10.4 Future Research

The present research aimed to use psychological theories surrounding knowledge and expertise to inform customer insight and information design, introducing research methods from different fields into the investigation. While providing key insights into the improvement of information delivery, this thesis also presents some interesting avenues for future research. Beginning with the industry priorities, as mentioned previously, the sample size for the interviews conducted was small, as well as limited to members from the GB rail industry. The continued collection of the perspectives of industry members from a larger and more diverse sample would complement the data gathered by the rail passenger surveys, determine achievable goals, and provide expert perspectives on the main challenges involved in the delivery of customer information.

The thesis showed how expertise could be studied within dynamic, real-world environments, such as rail travel. While travel frequency is a good approximation for expertise within the travel context, future research should examine dynamic expert behaviour using a range of different measures (interviews, ethnographic research or studies conducted with identified experts), in order to understand the best manner in which to operationalise the concept. As mentioned in the previous chapter, the limitations of the use of self-report measures could be combatted through a more in-depth examination of the behaviour of the individual, through the addition of more questions around their expertise. Additionally, future research could compare the findings of this thesis with the examination of information preferences and disruption characteristics alongside more objective measures of expertise, such as the specific selection of "travel experts".

In the final study, two other external variables were examined alongside expertise and travel frequency: Trip Importance and Trip Familiarity. Though there were limited findings regarding their influence on information use, particularly within disruption situations, there are a number of other contextual and individual factors that influence the use of information during travel. Other studies have argued for the existence of a "travel habit" (Aarts et al., 1998), for example. While research has argued that such habits can be disrupted by contextual change (Wood et al., 2005), this could be investigated with regards to disruption, in order to further understand how psychological facets like habit can influence problem-solving during novel travel circumstances. Beyond this, other factors that impact general travel attitudes are aspects like cost

(Passengerfocus, 2014), modal preferences (Kingham et al., 2001) or travel time (Stanton et al., 2013). The added impact of disruption could be studied with regards to any, or all of these factors.

Finally, the present thesis resulted in the development of a template for the successful provision of rail information to passengers. This should be implemented within an iterative design process. The first step would be to select a specific information system (a journey assistant application, or a departure screen at a station, for example) and examine the manner in which its design could be informed by the template, and adapted to regular and disrupted travel. This system should then be tested, in order to assess its efficiency in supporting passengers within both contexts. Importantly, it is crucial to ensure that the enhancement of the quality of information happens in a bottom-up manner, beginning with the back-office through to the information channels and user interfaces. At the end of the day, while focusing on the passenger-facing channels might result in the development of a quick solution with an attractive user interface, a key learning from this thesis is that any future work with regards to the design of information for rail passengers should begin at the back office, and ensure a high quality of information throughout all channels.

In summary, the key findings of this thesis are as follows:

1. The successful delivery of information to passengers is a major challenge to the rail industry, particularly during the occurrence of disruption.
2. Providing adequate support in the form of consistent service updates is crucial when supporting passengers through disruption.

3. Expertise and travel frequency are strongly correlated: the more someone travels, the more knowledge they have regarding rail travel.
4. There is strong evidence for the proposition that expertise is domain-specific.
5. Expertise and travel frequency do impact the informational preferences of rail passengers, but these effects are quite small.
6. While people seem to consider themselves as having quite high levels of expertise, travel frequency can be considered as being a good, objective proxy to measure the extent of an individual's experience of rail travel.
7. There are differences – at least anecdotally - between the travel behaviour of different groups of passengers, which influence their travel needs.
8. However, when it comes to information preferences, these differences are more likely to be due to the level of importance of the trip, rather than individual characteristics like expertise or travel frequency.
9. At the end of the day, for both general and disrupted rail travel, there are some types of information that are significantly more important than others.

REFERENCES

Aarts, H., Verplanken, B., & van Knippenberg, A. (1997). Habit and information use in travel mode choices. *Acta Psychologica, 96*(1–2), 1–14. http://doi.org/10.1016/S0001-6918(97)00008-5

Aarts, H., Verplanken, B., & Knippenberg, A. (1998). Predicting Behavior From Actions in the Past: Repeated Decision Making or a Matter of Habit? *Journal of Applied Social Psychology 28*(15), 1355–1374. http://doi.org/10.1111/j.1559-1816.1998.tb01681.x

Abernethy, B. (1991). Visual search strategies and decision-making in sport. International *Journal of Sport Psychology, 2*(2), 189–210.

Abernethy, B., & Russell, D. G. (1987). Expert-novice differences in an applied selective attention task. *Journal of Sport and Exercise Psychology, 9*(4), 326-345.

Accent, & Rail Delivery Group. (2017). PIDD-29 Year 1 Report.

Anable, J., & Gatersleben, B. (2005). All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes. *Transportation Research Part A: Policy and Practice, 39(*2–3), 163–181. http://doi.org/10.1016/j.tra.2004.09.008

Anderson, K. C., & Leinhardt, G. (2002). Maps as representations: Expert novice comparison of projection understanding. *Cognition and Instruction, 20*(3), 283-32.

Baber, C. (1996). Repertory grid theory and its application to product evaluation. *Usability evaluation in industry*, 157-165.

Bamberg, S., Ajzen, I., & Schmidt, P. (2003). Choice of travel mode in the theory of planned behavior: The roles of past behavior, habit, and reasoned action. *Basic and applied social psychology, 25*(3), 175-187.

Ben-Elia, E., & Ettema, D. (2009). Carrots versus sticks: Rewarding commuters for avoiding the rush-hour-a study of willingness to participate. *Transport Policy, 1*6(2), 68–76. http://doi.org/10.1016/j.tranpol.2009.03.005

Benner, P. (1982). From novice to expert. *American Journal of Nursing* (Vol. March). http://doi.org/10.1080/0305764910210307

Bissell, D. (2008). Comfortable bodies: Sedentary affects. *Environment and Planning A: Economy and Space, 40*(7), https://doi.org/10.1068/a39380

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(January), 77–101. http://doi.org/10.1191/1478088706qp063oa

Brown, M., Houghton, R., Sharples, S., & Morley, J. (2015). The attribution of success when using navigation aids. *Ergonomics, 58*(3), 426-433.

Bryant, S. (2005). *Rating expertise in collaborative software development*. 19–29.

Camacho, T., Foth, M., Rakotonirainy, A., Rittenbruch, M., & Bunker, J. (2016). The role of passenger-centric innovation in the future of public transport. *Public Transport, 8*(3), 453-475.

Carpiano, R. M. (2009). Health & Place Come take a walk with me : The "' Go-Along '" interview as a novel method for studying the implications of place for health and well-being. *Health & Place, 15*, 263–272. http://doi.org/10.1016/j.healthplace.2008.05.003

Carr, E. C. (1999). Talking on the telephone with people who have experienced pain in hospital: clinical audit or research?. *Journal of advanced nursing, 29*(1), 194-200.

Carr, E. C., & Worth, A. (2001). The use of the telephone interview for research. *NTResearch, 6*(1).

Carter, K., Cushing, K., Sabers, D., Stein, P., & Berliner, D. (1988). Expert-novice differences in perceiving and processing visual classroom information. *Journal of teacher education, 39*(3), 25-31.

Casey, M. (2016). Integrating data sources to enhance the experience for passengers with special needs. Submitted to the Rail Safety & Standards Board. Retrieved from https://rssb.wavecast.io/data-to-improve-the-customer-experience/integrating-data-sources-to-enhance-the-experience-for-passengers-with-special-needs-andor-disabilities-through-privacy-aware-mobile-applications

Cellier, J. M., Eyrolle, H., & Mariné, C. (1997). Expertise in dynamic environments. *Ergonomics, 40*(1), 28-50.

Chambers, C. T., & Craig, K. D. (1998). An intrusive impact of anchors in children's faces pain scales. *Pain, 78*(1), 27-37.
Charness, N., Tuffiash, M., Krampe, R., Reingold, E., & Vasyukova, E. (2005). The role of deliberate practice in chess expertise. *Applied Cognitive Psychology, 19*(2), 151-165.
Chase, W.G. & Ericsson, K. A. (1982). "Skill and working memory" The psychology of learning and motivation. In G. Bower (Ed.) *The psychology of learning and motivation* (Vol. 16, pp. 1-58). New York: Academic.
Chase, W.G. & Simon, H.A. (1973). Perception in chess. *Cognitive Psychology, 4*, 55–81.
Chi, M., Glaser, R., Farr, M. (1988). *The Nature of Expertise*. Lawrence Erlbaum Associates, NJ.
Chorus, C. G., Molin, E. J. E., & van Wee, B. (2006). Travel information as an instrument to change car drivers travel choices : a literature review. *European Journal of Transport and Infrastructure Research,* 6(4), 335–364. Retrieved from http://alexandria.tue.nl/openaccess/Metis213099.pdf
Costal, G., Pickup, L., & Di Martino, V. (1988). Commuting - a further stress factor for working people: evidence from the European Community - I. A review. *International Archives of Occupational and Environmental Health, 60*, 371–376. http://doi.org/10.1007/BF00405673
Cox, T., Houdmont, J., & Griffiths, A. (2006). Rail passenger crowding, stress, health and safety in Britain. *Transportation Research Part A: Policy and Practice, 40*(3), 244–258. http://doi.org/10.1016/j.tra.2005.07.001
de Groot, A. D. (1978). *Thought and choice in chess* (2nd. ed.). Mouton: New York.
De Witte, A., Macharis, C., & Mairesse, O. (2008). How persuasive is "free" public transport?. A survey among commuters in the Brussels Capital Region. *Transport Policy, 15*, 216–224. http://doi.org/10.1016/j.tranpol.2008.05.004
DeltaRail. (2015). A Data Driven Railway.
Department for Transport. (2009). Travel Trends 2009 Edition. Stationery Office: London.
Department for Transport. (2015). Rail passenger numbers and crowding on weekdays in major cities in England and Wales: 2014, (September), 1–25.
Department for Transport. (2017). Rail factsheet: 2017 - GOV.UK. 29 November 2017, 5, 1–6. Retrieved from https://www.gov.uk/government/statistics/rail-factsheet-2017
Department for Transport, Which?, Rail Delivery Group, Transportfocus, Office of Rail and Rail. (2016). Action Plan for Information on Rail Fares & Ticketing.
Department for Transport, Office of Rail and Road, & Transportfocus. (2016). Rail delays and compensation: What passengers want, (November). Retrieved from http://d3cez36w5wymxj.cloudfront.net/wp-content/uploads/2016/06/16155045/Rail-delays-and-compensation-what-passengers-want-November-2016.pdf
DICE: Data to Improve the Customer Experience. (2019, August 22). Retrieved from http://www.dice-project.org.uk/
Dworkin, S. L. (2012). Sample size policy for qualitative studies using in-depth interviews.
Dziekan, K. (2008). What do people know about their public transport options?: Investigating the memory representations of public transport through telephone interviews in a residential area of Stockholm, Sweden. *Transportation, 35*(4), 519–538. http://doi.org/10.1007/s11116-008-9164-x
Edwards, A. L. (1953). The relationship between the judged desirability of a trait and the probability that the trait will be endorsed. *Journal of Applied Psychology, 37*(2), 90.
Edwards, H. M., Mcdonald, S., & Young, S. M. (2009). The repertory grid technique : Its place in empirical software engineering research. *Information and Software Technology, 51*(4), 785–798. http://doi.org/10.1016/j.infsof.2008.08.008
Ericsson, K. A. & Charness, N. (1994). Expert performance: Its structure and acquisition. *Am Psychol 49*(8), 725-747.
Ericsson, K. A., & Harris, M. (1989). Acquiring expert memory performance without expert knowledge: A case study in the domain of chess.
Ericsson, K., Krampe, R., Tesch-Romer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychol. Rev., 100*, 363–406
Ericsson, K. A., & Polson, P. G. (1988). A cognitive analysis of exceptional memory for restaurant orders. *The nature of expertise, 1*, 23-70.

Ettema, D., Friman, M., Gärling, T., Olsson, L. E., & Fujii, S. (2012). How in-vehicle activities affect work commuters' satisfaction with public transport. Journal of Transport Geography, 24, 215–222. http://doi.org/10.1016/j.jtrangeo.2012.02.007
Evans, G. W., & Wener, R. E. (2007). Crowding and personal space invasion on the train: Please don't make me sit in the middle. *Journal of Environmental Psychology, 27*(1), 90–94. http://doi.org/10.1016/j.jenvp.2006.10.002
Evans, G. W., Wener, R. E., & Phillips, D. (2002). The Morning Rush Hour: Predictability and Commuter Stress. *Environment and Behavior, 34*(4), 521–530. http://doi.org/10.1177/00116502034004007
Farrington-Darby, T., & Wilson, J. R. (2006). *The nature of expertise: A review, 37*, 17–32. http://doi.org/10.1016/j.apergo.2005.09.001
Feltovich, P. J., Johnson, P. E, Moller, J. & Swanson, D. (1984). The role and development of medical knowledge in diagnostic reasoning. In W. Clancey & E. 32 Shortliffe (Eds.), *Readings in medical artificial intelligence: The first decade* (pp. 275-319). Reading, MA: Addison Wesley.
Field, A. (2009). *Discovering Statistics Using SPSS: Introducing Statistical Method* (3rd ed.). Thousand Oaks, CA: Sage Publications.
Finch, J. (1987). The vignette technique in survey research. *Sociology, 21*(1), 105-114.
Flood, V., Webb, K., Lazarus, R., & Pang, G. (2000). Use of self-report to monitor overweight and obesity in populations: some issues for consideration. *Australian and New Zealand journal of public health, 24*(1), 96-99.
Fransella, F., Bell, R., & Bannister, D. (2004). *A manual for repertory grid technique*. John Wiley & Sons.
Friman, M., Edvardsson, B., & Gärling, T. (2001). Frequency of negative critical incidents and satisfaction with public transport services. I. *Journal of Retailing and Consumer Services, 8*(2), 95–104. http://doi.org/10.1016/S0969-6989(00)00003-5
Fujiyama, T., & Cao, B. (2016, August). Lengths of time passengers spend at railway termini: An analysis using smart card data. In *2016 IEEE International Conference on Intelligent Rail Transportation* (ICIRT) (pp. 139-144). IEEE.
Garcia, J., & Gustavson, A. R. (1997). The science of self-report. *APS Observer, 10*(1).
Gilmore, D. J. (1990). Expert programming knowledge: a strategic approach. In *Psychology of programming* (pp. 223-234). Academic Press.
Glaser, R. & Chi, M. T. (1988). *The nature of expertise*. Hillsdale, NJ: Erlbaum.
Gobbo, C., & Chi, M. (1986). How knowledge is structured and used by expert and novice children. *Cognitive development, 1*(3), 221-237.
Golightly, D., & Dadashi, N. (2016). The characteristics of railway service disruption: implications for disruption management. *Ergonomics.*
Golightly, D., & Durk, J. (2016). Twitter as part of operational practice and passenger experience on the railways.
Gould, N., & Atkin, D. (2015). Towards a Semantic Layer to Support Road and Public Transport User Decision-making. In *2015 IEEE International Conference on Computer and Information Technology - Ubiquitous Computing and Communications - Dependable, Autonomic and Secure Computing - Pervasive Intelligence and Computing*, 1499–1504. http://doi.org/10.1109/CIT/IUCC/DASC/PICOM.2015.224
Gould, N., Mackaness, W., Bechhofer, S., Stevens, R., & Cooper, L. (2016). "Shortly arriving at…": Development of an Innovative Framework for Customer-centric Rail Passenger Information Applications. Retrieved from http://www.sparkrail.org/Lists/Records/DispForm.aspx?ID=24185
Greenfield, T. K., Midanik, L. T., & Rogers, J. D. (2000). Effects of telephone versus face-to-face interview modes on reports of alcohol consumption.
Grønhaug, K., & Haukedal, W. (1995). Experts and novices in innovative, unstructured tasks: The case of strategy formulation. *Creativity and Innovation management, 4*(1), 4-13.
Grotenhuis, J. W., Wiegmans, B. W., & Rietveld, P. (2007). The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort savings. *Transport Policy, 14*(1), 27–38. http://doi.org/10.1016/j.tranpol.2006.07.001
Rail Delivery Group (2016). Improving rail passenger experience: Submission to House of Commons Transport Select Committee (May).

Gustafson, P. (2012). Travel time and working time: What business travellers do when they travel, and why. *Time & Society, 21*(2), 203–222. http://doi.org/10.1177/0961463X12444057
Harrell, M. C., & Bradley, M. A. (2009). *Data Collection Methods: Semi-Structured Interviews and Focus Groups.*
Harte, J. M., & Koele, P. (1997). Psychometric and methodological aspects of process tracing research. In Crozier, R., Ranyard, R., & Svenson, O. (Eds), *Decision making: Cognitive models and explanations (Vol. 1)*. Psychology Press.
Haskell, W. L. (2012). Physical activity by self-report: a brief history and future issues. *Journal of Physical Activity and Health, 9*(1), 5-10.
Hassenzahl, M., & Wessler, R. (2000). Capturing design space from a user perspective: The repertory grid technique revisited. *International Journal of Human-Computer Interaction, 12*(3-4), 441-459.
Head, M. L., Holman, L., Lanfear, R., Kahn, A. T., & Jennions, M. D. (2015). The extent and consequences of p-hacking in science. *PLoS Biology, 13*(3).
Hernandez, S., Monzon, A., & de Oña, R. (2016). Urban transport interchanges: A methodology for evaluating perceived quality. *Transportation Research Part A: Policy and Practice, 84*, 31–43. http://doi.org/10.1016/j.tra.2015.08.008
Hine, J., & Scott, J. (2000). Seamless, accessible travel: Users' views of the public transport journey and interchange. *Transport Policy, 7*, 217–226. http://doi.org/10.1016/S0967-070X(00)00022-6
Huber, O. (1997). Beyond gambles and lotteries: Naturalistic risky decisions. In Crozier, R., Ranyard, R., & Svenson, O. (Eds), *Decision making: Cognitive models and explanations (Vol. 1)*. Psychology Press.
Intergovernmental Panel on Climate Change. (2007). The IPCC Fourth Assessment Report on Climate Change: Synthesis Report. IPCC: Geneva.
Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.
Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31-36.
Kemdal, A. B., & Montgomery, H. (1997). Perspectives and emotions in personal decision making. In Crozier, R., Ranyard, R., & Svenson, O. (Eds), *Decision making: Cognitive models and explanations (Vol. 1)*. Psychology Press.
Kenyon, S., & Lyons, G. (2003). The value of integrated multimodal traveller information and its potential contribution to modal change. *Transportation Research Part F: Traffic Psychology and Behaviour, 6*(1), 1–21. http://doi.org/10.1016/S1369-8478(02)00035-9
Kingham, S., Dickinson, J., & Copsey, S. (2001). Travelling to work: will people move out of their cars. *Transport policy, 8*(2), 151-160.
Klein, G. A. (1989). "Recognition-primed decisions" Advances in man-machine system research. In W.B. Rouse (Ed.), *Advances in man-machine system research (Vol. 5)*, pp. 47-92. Greenwich, CT: JAI Press.
Kobus, D. A., Proctor, S., Bank, T. E., & Holste, S. T. (2000). *Decision-making in a dynamic environment: The effects of experience and information uncertainty*. San Diego, CA: Pacific Sciences and Engineering Group.
Kollewe, J. (2019, March 14). Govia Thameslink faces £5m fine over 2018 timetable chaos. *The Guardian.*
Larkin, J., McDermott, J., Simon, D. P., & Simon, H. A. (1980). Expert and novice performance in solving physics problems. *Science, 208*(4450), 1335-1342.
Lawrence, J. (1988). Expertise on the bench: modeling magistrates' judicial decision-making. In Chi, M., Glaser, R., Farr, M. (Eds.), *The Nature of Expertise* (pp. 229–259). New Jersey: Lawrence Erlbaum Associates.
Lesgold, A., Rubinson, H., Feltovich, P., Glaser, R., Klopfer, D., & Wang, Y. (1988). Expertise in complex skill: diagnosing X-ray pictures. In: Chi, M., Glaser, R., Farr, M. (Eds.), *The Nature of Expertise.* Lawrence Erlbaum Associates, NJ, pp. 311–342.
Lipshitz, R., & Strauss, O. (1997). Coping with uncertainty: A naturalistic decision-making analysis. *Organizational behavior and human decision processes, 69*(2), 149-163.
Lupfer, M. B., Doan, K., & Houston, D. A. (1998). Explaining unfair and fair outcomes: *The therapeutic value of attributional analysis. British Journal of Social Psychology, 37*(4), 495-511.

Lyons, G., & Chatterjee, K. (2008). A Human Perspective on the Daily Commute: Costs, Benefits and Trade-offs. *Transport Reviews, 28*(2), 181–198. http://doi.org/10.1080/01441640701559484
Lyons, G., Jain, J., & Holley, D. (2007). The use of travel time by rail passengers in Great Britain. *Transportation Research Part A: Policy and Practice, 41*(1), 107–120. http://doi.org/10.1016/j.tra.2006.05.012
Lyons, G., & Urry, J. (2005). Travel time use in the information age. *Transportation Research Part A: Policy and Practice, 39*(2–3), 257–276. http://doi.org/10.1016/j.tra.2004.09.004
Mann, E., & Abraham, C. (2006). The role of affect in UK commuters' travel mode choices: An interpretative phenomenological analysis. *British Journal of Psychology, 97*(2), 155–176. http://doi.org/10.1348/000712605X61723
Middleton, J. (2011). "I'm on Autopilot, I Just Follow the Route": Exploring the Habits, Routines, and Decision-Making Practices of Everyday Urban Mobilities. *Environment and Planning A, 43*(12), 2857-2877.
Morris, P. E., Gruneberg, M. M., Sykes, R. N., & Merrick, A. (1981). Football knowledge and the acquisition of new results. *British Journal of Psychology, 72*(4), 479-483.
Moynihan, T. (1996). An inventory of personal constructs for information systems project risk researchers. *Journal of information technology, 11*(4), 359-371.
MVA Consultancy. (2010). *Passengers' priorities for improvements in rail services.* Passenger Focus: London.
National Audit Office. (2008). Reducing passenger rail delays by better management of incidents: Report. Together with Formal Minutes, Oral and Written Evidence, 655 (November).
Northrup, D. A. (1997). *The problem of the self-report in survey research*. Institute for Social Research, York University.
Office of Rail and Road. (2016). "Measuring up" - Annual Rail Consumer Report, (June), 1–120.
Office of Rail and Road. (2017a). "Measuring up" - Annual Rail Consumer Report, (June), 1–120.
Office of Rail and Road. (2017b). New Performance Measures: 2017-18 Period 4 Factsheet, 2017(August), 1–4.
Office of Rail and Road. (2018). GB passenger rail service complaints: Q3 statistical release, (April), 1–16. Retrieved from http://orr.gov.uk/__data/assets/pdf_file/0017/27152/passenger-rail-usage-2017-18-q3.pdf
Office of Rail and Road. (2019). Passenger Rail Usage 2018-19 Q4 Statistical Release, (June), 1–19. Retrieved from https://dataportal.orr.gov.uk/media/1240/passenger-rail-usage-2018-19-q4.pdf
Office of Rail Regulation. (2012). The impact of publishing more information on seat availability: South West Trains case study, (July). Retrieved from http://orr.gov.uk/__data/assets/pdf_file/0016/4804/swt-crowding-data-research.pdf
Office of Rail Regulation. (2014). Rail passenger experience report, (April), 1–149. Retrieved from http://orr.gov.uk/__data/assets/pdf_file/0003/11748/rail-passenger-experience-report.pdf
Ohayon, M. M., Guilleminault, C., Priest, R. G., & Caulet, M. (1997). Snoring and breathing pauses during sleep: telephone interview survey of a United Kingdom population sample. *BMJ, 23*, 860-863.
Ohmori, N., & Harata, N. (2008). How different are Activities while commuting by train? A case study in Tokyo. *Tijdschrift Voor Economische En Sociale Geografie, 99*(5), 547–561. http://doi.org/10.1111/j.1467-9663.2008.00491.x
ORR. (2018). Passenger Rail Usage 2017-18 Q3 Statistical Release, (March). Retrieved from http://orr.gov.uk/__data/assets/pdf_file/0017/27152/passenger-rail-usage-2017-18-q3.pdf
Passengerfocus. (2009). Employers' business travel needs from rail.
Passengerfocus. (2010). Still waiting for a ticket?: Ticket queuing times at large regional rail stations, (July).
Passengerfocus. (2014). Rail passengers' priorities for improvements, (October), 29. Retrieved from https://www.transportfocus.org.uk/research-publications/publications/rail-passengers-priorities-for-improvements-october-2014/
Passengerfocus. (2015). Buying Advance tickets on the day of travel: what do passengers think?
Petrie, H., & Bevan, N. (2009). The evaluation of accessibility, usability, and user experience. *The Universal Access Handbook*(1), 1-16.

Petrie, H., Hamilton, F., & King, N. (2004, May). Tension, what tension?: Website accessibility and visual design. In *Proceedings of the 2004 international cross-disciplinary workshop on web accessibility* (W4A) (13-18). ACM.
Pietkiewicz, I., & Smith, J. A. (2012). *A practical guide to using Interpretative Phenomenological Analysis in qualitative research psychology*. 361–369.
Potter, J., Hepburn, A., Potter, J., & Hepburn, A. (2008). Qualitative interviews in psychology: problems and possibilities. http://doi.org/10.1191/1478088705qp045oa
Preston, J., Pritchard, J., & Waterson, B. (2017). Train overcrowding: investigation of the provision of better information to mitigate the issues. *Transportation research record, 2649*(1), 1-8.
Pritchard, J. (2016). Use of passenger loading data to influence behaviour , and provide an improved experience for passengers and operators. RSSB Technical Report, 1–23. Retrieved from http://www.sparkrail.org/Lists/Records/DispForm.aspx?ID=22811
Rail Safety and Standards Board. (2012). Rail Technical Strategy, 57–63.
Rail Safety & Standards Board, Rail Delivery Group, Rail Supply Group & Department for Transport. (2017). Rail Technical Strategy.
Riemersma, J. B. J. (1988). An empirical study of subjective road categorization. *Ergonomics, 31*(4), 621-630.
Rossi, P. H., Waite, E., Bose, C. E., & Berk, R. E. (1974). The seriousness of crimes: Normative structures and individual differences. *American Sociological Review, 39*, 224–237.
Schmidt, H. G., & Boshuizen, H. P. (1993). On acquiring expertise in medicine. *Educational psychology review, 5*(3), 205-221.
Seethaler, R., & Rose, G. (2006). Using the six principles of persuasion to promote travel behaviour change: Findings of a TravelSmart pilot test. *Road & Transport Research: A Journal of Australian and New Zealand Research and Practice, 15*(2), 94.
Shannon, T., Giles-Corti, B., Pikora, T., Bulsara, M., Shilton, T., & Bull, F. (2006). Active commuting in a university setting: Assessing commuting habits and potential for modal change. *Transport Policy, 13*(3), 240–253. http://doi.org/10.1016/j.tranpol.2005.11.002
Shanteau, J. (1988). Psychological characteristics and strategies of expert decision makers. *Acta Psychologica, 68*(1–3), 203–215. http://doi.org/10.1016/0001-6918(88)90056-X
Shanteau, J. (1992). Competence in experts: The role of task characteristics. *Organizational Behavior and Human Decision Processes, 53*(2), 252–266. http://doi.org/10.1016/0749-5978(92)90064-E
Shanteau, J., & Stewart, T. R. (1992). Why Study Expert Decision-Making: Some Historical Perspectives and Comments. *Organizational Behavior and Human Decision Processes, 53*(2), 95–106.
Sheppard, M., & Ryan, K. (2003). Practitioners as rule using analysts: A further development of process knowledge in social work. *British Journal of Social Work, 33*(2), 157-176.
Slatter, P. E. (1987). *Building expert systems: Cognitive emulation*. Chichester: Ellis Horwood.
Slovic, P. (1972). Psychological study of human judgment: Implications for investment decision making. *The Journal of Finance, 27*(4), 779-799.
Smith, A. (2018). The Customer Perspective: The GTR Essays, 12–15.
Southeastern. (2016). Customer and stakeholder engagement framework. Retrieved from https://www.ausgrid.com.au/-/media/Files/About-Us/CE-Reports/Customer-and-Stakeholder-Framework.pdf
Stanton, N. a., McIlroy, R. C., Harvey, C., Blainey, S., Hickford, A., Preston, J. M., & Ryan, B. (2013). Following the cognitive work analysis train of thought: exploring the constraints of modal shift to rail transport. *Ergonomics, 56*(3), 1–19. http://doi.org/10.1080/00140139.2012.718366
Starcke, K., & Brand, M. (2012). Decision making under stress: A selective review. *Neuroscience & Biobehavioral Reviews, 36*(4), 1228–1248. http://doi.org/10.1016/j.neubiorev.2012.02.003
Steiner, P. M., Atzmüller, C., & Su, D. (2016). Designing valid and reliable vignette experiments for survey research: A case study on the fair gender income gap. *Journal of Methods and Measurement in the Social Sciences, 7*(2), 52-94.
Tan, F. B., & Hunter, M. G. (2002). The repertory grid technique: A method for the study of cognition in information systems. *MIS Quarterly, 26*(1), 39–57.
Topham, G. (2018, November 30). UK rail fares to rise 3.1% in new year. *The Guardian.*

Transportfocus. (2015). Rail Passenger Satisfaction at a glance: Great Britain - Autumn 2015, 1–4.
Transportfocus. (2016). Passenger attitudes towards rail staff, (February), 1–20. Retrieved from http://www.transportfocus.org.uk/research/publications/passenger-attitudes-towards-rail-staff
Transportfocus. (2016a). Bringing clarity, delivering breakthroughs: Rail delays and compensation – what passengers want, (June), 1–30.
Transportfocus. (2016b). Using smartcards on rail in the south east of England: what do passengers want?
Transportfocus. (2017a). National Rail Passenger Survey: Main Report, (Autumn). Retrieved from http://www.racfoundation.org/assets/rac_foundation/content/downloadables/nrps_analysis-preston_&_jones-dec2012.pdf
Transportfocus. (2017b). Passengers ' Priorities for Improvement. (November).
Transportfocus. (2017c). Routine railway maintenance: passenger perspectives and priorities, (December), 1–8.
Transportfocus. (2017d). The future of the Wales and Borders rail service: What passengers want, (June).
Transportfocus. (2018a). High speed 2. (February).
Transportfocus. (2018b). Railway engineering work: Putting passengers at the heart of the London Waterloo upgrade. (February).
Transportfocus. (2018c). Tomorrow ' s passengers : understanding how to make rail travel more attractive to infrequent and non-users. (April).
Transport Systems Catapult (2015). Traveller Needs and UK Capability Study. (October). Retrieved from https://ts.catapult.org.uk/current-projects/traveller-needs-uk-capability-study/
Treharne, H., & Wesemeyer, S. (2016). RRUKA Project Report, (March).
Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. *Journal of Environmental Psychology, 28*(2), 121–127. http://doi.org/10.1016/j.jenvp.2007.10.005
Ward, P., Gore, J., Hutton, R., Conway, G. E., & Hoffman, R. R. (2018). Adaptive Skill as the Conditio Sine Qua Non of Expertise. *Journal of Applied Research in Memory and Cognition, 7*(1), 35–50. http://doi.org/10.1016/j.jarmac.2018.01.009
Wardman, M., Hine, J., & Stradling, S. (2001). *Interchange and Travel Choice Volume 2.* Scottish Executive Central Research Unit.
Wisdom, J., & Creswell, J. W. (2013). *Mixed methods: integrating quantitative and qualitative data collection and analysis while studying patient-centered medical home models.* Rockville: Agency for Healthcare Research and Quality.
Wood, W., Witt, M. G., & Tam, L. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology, 88*(6), 918–933. http://doi.org/10.1037/0022-3514.88.6.918
Yeboah, G., Cottrill, C. D., Nelson, J. D., Corsar, D., Markovic, M., & Edwards, P. (2019). Understanding factors influencing public transport passengers' pre-travel information-seeking behaviour. *Public Transport, 11*(1), 135-158.
Zhang, Q., Xiaoxiao, L., & Spurgeon, S. (2016). Technical Report: Development of Intelligent Predictive Models for Crowding on Trains using Data-driven Methodologies. Retrieved from http://www.sparkrail.org/Lists/Records/DispForm.aspx?ID=24298
Zimmerman, B. J., & Schunk, D. H. (Eds.). (2001). *Self-regulated learning and academic achievement: Theoretical perspectives*. Routledge.

APPENDIX A: TELEPHONE INTERVIEWS

A1. LIST OF QUESTIONS

1. Why is there a need for passenger information provision?
2. What are the barriers and enablers to successful information provision?
3. What are the particular challenges surrounding the provision of information during disruption?
4. What research is being conducted surrounding the improvement of information provision, and/or can you describe an incident that resulted in an improved understanding of how to successfully manage the information needs of customers?
5. How do you think a passenger's existing levels of knowledge and/or travel expertise could contribute to their attitude towards information provided to them?
6. What do you think the future of passenger information looks like?

A2. CALL FOR PARTICIPANTS

Hello,

Hope you're well!

My name is Shalaka Kurup and I am a PhD. student with the Human Factors group at the University Of Nottingham, looking into customer experience on the railways.

I'm looking into developing a better understanding of the rail industry in general, and getting a few opinions and perspectives from members of the rail community. It would mean a lot to me if it would be possible to interview at some point regarding this? The entire process should take no more than 30 minutes at the very most, as I will have only 4-5 questions to ask. This could happen over the phone, or in person – entirely dependent on your preferences, and only if you are available, of course!

Would this be okay?

Looking forward to hearing from you,

Thanks a lot,

Regards,

A3. Information Sheet and Consent Form

Dear participant,

My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training. I am interviewing rail stakeholders as part of my PhD, which is sponsored by RSSB, ATOC and Network Rail. My PhD aims to explore frequent travel habits are formed, and their susceptibility to change. The output of this work will be a report to the sponsors, and potentially a research publication.
I would like to interview you about customer experience, everyday impediments to the creation of the perfect commute and other operational aspects regarding everyday travel This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.
Please read the following points carefully

- All information will be treated anonymously. You and your organisation will not be named unless it is with your explicit approval.
- Notes will be taken. Audio may also be recorded, and photographs taken only with your explicit approval.
- All data will be stored electronically (written notes will be transcribed) and securely, and can only be accessed by the researcher. Data is typically stored for 7 years. This is in line with University of Nottingham Faculty of Engineering ethics procedure.
- You will be sent a copy of the outputs, which you are free to comment on.
- You are entitled to have any comment in the interview excluded from the transcript, now or in the future.
- You are entitled to decline to answer a question.
- You are entitled to withdraw from the interview now, or withdraw your consent for your data to be used in the future.

Please sign below to confirm you have read and are happy to give consent

Name_____

Signature_____

Date_____

Signature of researcher_____

Appendix B: Situated Interviews

B1. Call for Participants: Frequent Travellers

Hello,
My name is Shalaka and I am a PhD. student, studying with the Horizon CDT and the Human Factors Research Group. Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel.
To better understand passenger experience, I'm looking to accompany a frequent rail traveler (travels on the train - preferably for work - on at least two-three days/week) on a single journey. This will involve a semi-structured interview, which will last only for the duration of that journey, and compensation in the form of a £15 Amazon voucher.
If interested – or if you know someone who might be – please send over an email: shalaka.kurup@nottingham.ac.uk.
Alternatively, if you have any questions/would like to discuss this further in person, feel free to find me at the Human Factors Research Group office in the ITRC building on the University of Nottingham's University Park campus.
Thanks,
Shalaka

B2. Call for Participants: Leisure Travellers

Hello,
My name is Shalaka and I am a PhD. student, studying with the Horizon CDT and the Human Factors Research Group. Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel.
For my next PhD study, I'm looking to interview a few people during their rail journeys – if you are travelling via rail over the next few weeks/have someone visiting who would be happy for me to interview them on their journey back, I would be extremely grateful! The process will involve a semi-structured interview, which will last only for the duration of that journey, and compensation in the form of a £15 Amazon voucher!
If you/someone you know might be interested, please send over an email: shalaka.kurup@nottingham.ac.uk
Thanks,
Shalaka

B3. Information Sheet

Information Sheet

Introduction
Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel. In order to better understand rail passenger experience, my aim will be to look into the process of frequent travel, while conducting an in-situ interview that will involve questions related to the nature of your daily commute, and possible disruption situations. The output of this work will be a report to the sponsors, and my PhD.

Procedure
The study will involve a verbal, semi-structured interview, consisting of six questions and possible further discussion. This interview will last for the duration of this single journey. No personal questions will be asked, and any further information that you wish to withdraw will be deleted immediately upon request. Following the completion of the interview, you will be given a £15 Amazon voucher via email.

Data Storage
Data will be collected in the form of written notes – a complete transcript will be provided to you following the interview. This data will be completely anonymised, and you will only be known in relation to your participant number. Only the researchers will see the raw data, which will be stored on a password-protected server.

Contact Details
In the case of questions, concerns, or the withdrawal of data, here are my contact details:
Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)
Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

B4. CONSENT FORM

Dear participant
My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training, as well as a consortium consisting of RSSB, RDG and Network Rail. My PhD aims to understand customer decision making in the face of disruption during the process of rail travel.
I would like to interview you about your current rail journey, particularly with regards to your experience(s) of disruption. This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.
Please read the following points carefully

- All information will be treated anonymously. You and your organisation will not be named unless it is with your explicit approval.
- Notes will be taken.
- All data will be stored electronically (written notes will be transcribed) and securely, and can only be accessed by the researcher. Data is typically stored for 7 years. This is in line with University of Nottingham Faculty of Engineering ethics procedure.
- You will be sent a copy of the outputs, which you are free to comment on.
- You are entitled to have any comment in the interview excluded from the transcript, now or in the future.
- You are entitled to decline to answer a question.
- I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided unless this information has already been published in academic and research outlets (e.g. journals, conferences).

Please sign below to confirm you have read and are happy to give consent

Name_____

Signature_____

Date_____

Signature of researcher_____

Date_____

B5. LIST OF QUESTIONS

1. What are the possible obstacles that could prevent customers – like you - from having a perfect commute?
2. In the face of disruption on your journey, what would your options be?
3. What are the typical disruptions that you have faced/would face on a standard journey of this type?
    a. How do those experiences compare to a standard journey?
    b. How often have experiences of this sort happened?
4. What type of information do you use when making this type of trip?
    a. What sources do you refer to?
    b. What sources do you trust? Why?
5. If you had a mobile app for travel information for this type of journey, what features would be useful?

APPENDIX C: SURVEY ONE

C1. ONLINE SURVEY

Rail Travel and Information Use

Page 1: Page 1

Introduction

My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training, as well as a consortium consisting of RSSB, RDG and Network Rail.

My PhD aims to understand customer decision making in the face of disruption during the process of rail travel. The output of this work will be a report to the sponsors, and potentially a research publication.

As a part of my PhD, I'm conducted an online survey on people's self-rated rail expertise and how they use information during the process of rail travel. This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.

This online survey will consist of three sections, each asking:

1. Your own ratings of your own rail travel expertise

2. Your ratings of types of information that could be provided to you during your journey

3. Basic demographic information about yourself

All information recorded will be linked to your participant ID, not your name. You will also have the chance to win a £40 Amazon voucher!

The final page will ask for your email address – this will only be in order for us to be able to contact you if you have won the prize draw.

Data Storage

The data will be completely anonymised, and you will only be known in relation to your participant number. Only the researchers will see the raw data (your answers and demographic information), which will be stored on a password-protected server.

Contact Details

In the case of questions, concerns, or should you wish to withdraw your data, here are my contact details:

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Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)

Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

1. After having read the information, do you consent to participating in this study? * *Required*

- ○ Yes
- ○ No

Page 2: Travel Expertise

2. How often do you travel on the railways?

- Daily
- 2-3 times a week
- Weekly
- 2-3 times a month
- Monthly
- Once every few months
- Few times a year
- Once a year
- Never

3. What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?

- 1 - No knowledge at all ("I have no idea of how to travel on the rail network in the UK")
- 2
- 3
- 4
- 5
- 6
- 7 - Expert ("I would consider myself as an expert regarding rail travel in the UK")

4. Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"

- Yes
- No

4.a. How often do you make this trip?

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- Daily
- 2-3 times a week
- Weekly
- 2-3 times a month
- Monthly
- Once every few months
- Few times a year
- Once a year
- Never

5. If you answered "Yes" to the previous question, what level of expertise do you think you have regarding that specific journey?

- 1 - No knowledge at all ("I have no idea of how I would make this trip")
- 2
- 3
- 4
- 5
- 6
- 7 - Expert ("I would consider myself an expert when it comes to making this trip")

Page 3: Information Functions

6. Here is a list of information functions provided by train operating companies in the UK. On a scale of 1-7, please rate how useless (1) or useful (7) to your train journeys you'd consider these functions to be.

Please don't select more than 1 answer(s) per row.

	1 (Completely useless)	2	3	4	5	6	7 (Extremely useful)
The ability to reserve a seat	☐	☐	☐	☐	☐	☐	☐
A tool that lets you find the quickest route possible for your journey	☐	☐	☐	☐	☐	☐	☐
The ability to purchase a flexible ticket for your journey	☐	☐	☐	☐	☐	☐	☐
Information regarding alternative routes you can take if there is a disruption	☐	☐	☐	☐	☐	☐	☐
Information about how to contact the train company/a helpline	☐	☐	☐	☐	☐	☐	☐
A guide to different ticket types and what they mean	☐	☐	☐	☐	☐	☐	☐
The ability to provide feedback about your journey	☐	☐	☐	☐	☐	☐	☐
The provision of announcements if there's a delay	☐	☐	☐	☐	☐	☐	☐

The ability to speak to station/onboard staff if you have any questions/concerns or for updates regarding your journey	☐	☐	☐	☐	☐	☐	☐
A tool that allows you to plan your journey from door to door	☐	☐	☐	☐	☐	☐	☐
Information about Oyster cards or other local travelcards	☐	☐	☐	☐	☐	☐	☐
A tool that lets you find the cheapest fare for your journey	☐	☐	☐	☐	☐	☐	☐
Information about refunds	☐	☐	☐	☐	☐	☐	☐
Information about the platform that the train will be arriving at	☐	☐	☐	☐	☐	☐	☐
The provision of a route map for your journey on your phone	☐	☐	☐	☐	☐	☐	☐
The provision of a guide to navigating around the station on your phone	☐	☐	☐	☐	☐	☐	☐
The ability to book tickets on a website	☐	☐	☐	☐	☐	☐	☐
The ability to book tickets on your mobile phone	☐	☐	☐	☐	☐	☐	☐

The provision of live train times on your mobile phone	☐	☐	☐	☐	☐	☐	☐
Real-time updates regarding the progress of your journey	☐	☐	☐	☐	☐	☐	☐
Push notifications to your phone with information about your journey as you approach the station	☐	☐	☐	☐	☐	☐	☐
The ability to get travel updates from Twitter for your journey	☐	☐	☐	☐	☐	☐	☐
The provision of push notifications to your phone with information about delays or disruptions during your journey	☐	☐	☐	☐	☐	☐	☐
Information surrounding crowding (how busy the train is)	☐	☐	☐	☐	☐	☐	☐
The provision of reasons for a delay or disruption, if there is one on your journey	☐	☐	☐	☐	☐	☐	☐
Car parking information at stations	☐	☐	☐	☐	☐	☐	☐

Information about train and/or station facilities (toilets or catering, for example)	☐	☐	☐	☐	☐	☐	☐
Information at the station regarding the availability of wifi on the train/at the station	☐	☐	☐	☐	☐	☐	☐
Information surrounding delay repay schemes	☐	☐	☐	☐	☐	☐	☐
The ability to contact train operating companies on Twitter	☐	☐	☐	☐	☐	☐	☐
Information about local travel options for your onward journey	☐	☐	☐	☐	☐	☐	☐
Push notifications to your phone regarding the status of your connections	☐	☐	☐	☐	☐	☐	☐
Information regarding how to get to and from stations	☐	☐	☐	☐	☐	☐	☐
The provision of updates surrounding timetable changes (for example, the change to the winter timetable)	☐	☐	☐	☐	☐	☐	☐

Information about local travel or connections to be made during or after your trip	☐	☐	☐	☐	☐	☐	☐
Information about service alterations or engineering works	☐	☐	☐	☐	☐	☐	☐

6.a. Are there any other information functions that you think might be useful to your rail travel, which haven't been mentioned in this list?

Page 4: Demographics

7. What is your age?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

8. What is your gender? * *Required*

- Male
- Female
- Non-binary
- Prefer not to say
- Other

9. Where do you live?

- East of England
- East Midlands
- London
- North East and Cumbria
- Northern Ireland
- North West
- Scotland
- South East
- South West
- Cymru Wales

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- West Midlands
- Yorkshire & the Humber

10. Which best describes the area that you live in?

- Urban
- Suburban
- Rural

11. What is the highest degree or level of school you have completed?

- No schooling completed
- Some schooling, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor's degree
- Master's degree
- Professional degree
- Doctorate degree

12. What is your occupation?

- Employed for wages
- Self-employed
- Unemployed
- Student
- Retired
- Unable to work

- Other

12.a. If you selected "Other", please specify:

13. How are you most likely to book your tickets for a rail journey?

- At the station
- Through the website of a specific train operating company
- Through the National Rail Enquiries website
- Through a ticketing website (Trainline, for example)
- Through the mobile application of a train operating company
- Through a ticketing mobile application
- Through the National Rail Enquiries mobile application
- Through a third party (for example, a travel agent)

14. Do you own a smartphone?

- Yes
- No

15. Do you have a social media account?

- Yes
- No

Page 5: Prize Draw

16. If you would like to enter the prize draw, please enter your email address:

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Page 6: Thanks!

Thank you for your answers!

In the case of questions, concerns, or should you wish to withdraw your data, here are my contact details:

Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)

Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

APPENDIX D: SURVEY TWO

D1. CALL FOR PARTICIPANTS

Hello,
My name is Shalaka and I am a PhD. student, studying with the Horizon CDT and the Human Factors Research Group. Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel.
I'll be conducting a 30 minute exercise, which will involve a rating of one-sentence disruption scenarios based on rail-related experiences. To thank you for your participation, I will be offering compensation in the form of a £10 Amazon voucher!
If you/someone you know might be interested, please do get in touch with me: shalaka.kurup@nottingham.ac.uk. Alternatively, if you have any questions/would like to discuss this further in person, feel free to find me at the Human Factors Research Group office in the ITRC building on the University of Nottingham's University Park campus.
Thanks,
Shalaka

D2. INFORMATION SHEET

Introduction
Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel. In order to better understand rail passenger experience, my aim will be to understand the information preferences of passengers during disruption on the railways.
Procedure
The study will involve rating disruption alerts on the basis of different rail experiences – the process will be explained in detail during the upcoming presentation. The study will conclude with the recording of basic demographic information (age, gender, occupation) which will be linked to your participant ID, not your name. During this process, your answers will be recorded – the transcripts will be anonymised, and the recordings deleted following the transcription process. Finally, I'll be handing over a £10 Amazon voucher to thank you for your participation!
Data Storage
The data will be completely anonymised, and you will only be known in relation to your participant number. Only the researchers will see the raw data (your answers and demographic information), which will be stored on a password-protected server.
Contact Details
In the case of questions, concerns, or the withdrawal of data, here are my contact details:
Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)
Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

D3. CONSENT FORM

Dear participant
My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training, as well as a consortium consisting of RSSB, RDG and Network Rail.
My PhD aims to understand customer decision making in the face of disruption during the process of rail travel. The output of this work will be a report to the sponsors, and potentially a research publication.
I would like to interview you using a repertory grid approach, which will involve the rating of rail disruption alerts on the basis of rail-related experiences. This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.
Please read the following points carefully

- All information will be treated anonymously. You and your organisation will not be named unless it is with your explicit approval.
- Notes will be taken and your responses will be recorded.
- All data will be stored electronically (written notes will be transcribed) and securely, and can only be accessed by the researcher. Data is typically stored for 7 years. This is in line with University of Nottingham Faculty of Engineering ethics procedure.
- You are entitled to have any comment in the interview excluded from the transcript, now or in the future.
- You are entitled to decline to answer a question.
- You are entitled to withdraw from the interview now, or withdraw your consent for your data to be used in the future.

Please sign below to confirm you have read and are happy to give consent

Name_____

Signature_____

Age_____

Occupation_____

Date_____

Signature of researcher_____

Date_____

D4. ONLINE SURVEY

Disruption During Rail Travel and Information Use

Page 1: Introduction

My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training, as well as a consortium consisting of RSSB, RDG and Network Rail.

My PhD aims to understand customer decision making in the face of disruption during the process of rail travel. The output of this work will be a report to the sponsors, and potentially a research publication.

As a part of my PhD, I'm conducted an online survey on people's self-rated rail expertise and how they use information during the process of rail travel. This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.

This online survey will consist of three sections, each asking:

1. Your own ratings of your own rail travel expertise

2. Your ratings of types of information that could support you during the described disruption experience when travelling on the railways

3. Basic demographic information about yourself

All information recorded will be linked to your participant ID, not your name. You will also have the chance to win one of three £10 Amazon vouchers!

The final page will ask for your email address – this will only be in order for us to be able to contact you if you have won the prize draw.

Data Storage

The data will be completely anonymised, and you will only be known in relation to your participant number. Only the researchers will see the raw data (your answers and demographic information), which will be stored on a password-protected server.

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Contact Details

In the case of questions, concerns, or should you wish to withdraw your data, here are my contact details:

Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)

Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

1. After having read the information, do you consent to participating in this study?

- ○ Yes
- ○ No

Page 2: Travel Expertise

2. How often do you travel on the railways?

- Daily
- 2-3 times a week
- Weekly
- 2-3 times a month
- Monthly
- Once every few months
- Few times a year
- Once a year
- Never

3. What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?

- 1 - Expert ("I would consider myself as an expert regarding rail travel in the UK")
- 2
- 3
- 4
- 5
- 6
- 7 - No knowledge at all ("I have no idea of how to travel on the rail network in the UK")

4. Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"

- Yes

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- No

4.a. How often do you make this trip?

- Daily
- 2-3 times a week
- Weekly
- 2-3 times a month
- Monthly
- Once every few months
- Few times a year
- Once a year
- Never

5. If you answered "Yes" to the previous question, what level of expertise do you think you have regarding that specific journey?

- 1 - Expert ("I would consider myself an expert when it comes to making this trip")
- 2
- 3
- 4
- 5
- 6
- 7 - No knowledge at all ("I have no idea of how I would make this trip")

Page 3: Disruption Alerts

Imagine a rail journey - this could either be a journey you complete often, or a journey that you are fairly comfortable with.

Keeping this in mind, the following page contains a grid of possible disruption alerts that you could recieve during the journey. Some of them (for example, an alert about travelling to the airport) may require you to change your mental image of your journey slightly.

6. The tables show 7 different characteristics of disruption information (in the columns). On a scale of 1 (completely irrelevant) to 7 (extremely relevant), consider how relevant these characteristic statements are to the disruption alerts presented (rows). Please enter your answers in the boxes provided.

	This alert makes me feel confident and secure in this situation * *Required*	This alert helps me understand the impact of the disruption	This alert makes me feel certain about the status of the situation	This alert provides me with solutions	This alert makes it clear that the disruption is for a specific route	This alert provides me with basic information required during a disruption	This alert delivers the information in a clear, considerate manner
There will be minor delays on your route today	☐	☐	☐	☐	☐	☐	☐

A broken rail is causing disruption to trains on your route. Please allow for delays of up to 60 minutes to your journey.	☐	☐	☐	☐	☐	☐	☐

6.a.

	This alert makes me feel confident and secure in this situation * *Required*	This alert helps me understand the impact of the disruption	This alert makes me feel certain about the status of the situation	This alert provides me with solutions	This alert makes it clear that the disruption is for a specific route	This alert provides me with basic information required during a disruption	This alert delivers the information in a clear, considerate manner

A problem at a level crossing is causing disruption to trains. Trains may be cancelled, delayed by up to 5 minutes or revised.	☐	☐	☐	☐	☐	☐	☐
The fault with the signalling system has been resolved, and trains in the area are starting to return to normal. Until then, trains may be delayed by up to 15 minutes or cancelled until 11:00.	☐	☐	☐	☐	☐	☐	☐

6.b.

	This alert makes me feel confident and secure in this situation * *Required*	This alert helps me understand the impact of the disruption	This alert makes me feel certain about the status of the situation	This alert provides me with solutions	This alert makes it clear that the disruption is for a specific route	This alert provides me with basic information required during a disruption	This alert delivers the information in a clear, considerate manner
A fault with the signalling system is disrupting trains. Heathrow connect services are suspended.	☐	☐	☐	☐	☐	☐	☐

A speed restriction is in place over a defective track, causing disruption to journeys. As trains are required to run at a reduced speed, congestion may build up quickly causing services to be delayed, revised, or cancelled at very short notice.	☐	☐	☐	☐	☐	☐	☐

6.c.

	This alert makes me feel confident and secure in this situation * *Required*	This alert helps me understand the impact of the disruption	This alert makes me feel certain about the status of the situation	This alert provides me with solutions	This alert makes it clear that the disruption is for a specific route	This alert provides me with basic information required during a disruption	This alert delivers the information in a clear, considerate manner

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A number of incidents have occurred today on your rail network. These have ranged from train faults to passengers being taken ill on trains. They are working hard to restore train services to a normal working timetable however as a result of these incidents, they are still experiencing delays and services may still be subject cancellations and short notice alterations.	☐	☐	☐	☐	☐	☐	☐

Heavy rain has flooded the railway line. This means that trains between these stations may be cancelled or delayed by up to 15 minutes or more	☐	☐	☐	☐	☐	☐	☐

6.d.

	This alert makes me feel confident and secure in this situation * *Required*	This alert helps me understand the impact of the disruption	This alert makes me feel certain about the status of the situation	This alert provides me with solutions	This alert makes it clear that the disruption is for a specific route	This alert provides me with basic information required during a disruption	This alert delivers the information in a clear, considerate manner

The train which was involved in an operational incident has now moved, allowing the line to reopen. Whilst services recover, train services running through this station may be cancelled or delayed by up to 20 minutes. Disruption is expected until 12:00	☐	☐	☐	☐	☐	☐	☐

A track circuit failure means that trains have to run at reduced speed. This will cause delays of up to 10 minutes until 13:00.	☐	☐	☐	☐	☐	☐	☐

7. How important are the following constructs to you when you recieve disruption information? Could you rank them from 1 (least important) to 7 (most important)?

	Ranking (1 = least important to 7 = most important)
The alert makes me feel confident and secure in this situation	☐
The alert helps me understand the impact of the disruption	☐
The alert makes me feel certain about the status of the situation	☐
The alert provides me with solutions	☐
The alert makes it clear that the disruption is for a specific route	☐
The alert provides me with basic information required during a disruption	☐
The alert delivers the information in a clear, considerate manner	☐

Page 4: Demographics

8. What is your age?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

9. What is your gender?

- Male
- Female
- Non-binary
- Prefer not to say
- Other

9.a. If you selected Other, please specify:

10. Where do you live?

- East of England
- East Midlands
- London

- North East and Cumbria
- Northern Ireland
- North West
- Scotland
- South East
- South West
- Cymru Wales
- West Midlands
- Yorkshire & the Humber

11. Which best describes the area that you live in?

- Urban
- Suburban
- Rural

12. What is the highest degree or level of school you have completed?

- No schooling completed
- Some schooling, no diploma
- High school graduate, diploma or the equivalent (for example: GED)
- Some college credit, no degree
- Trade/technical/vocational training
- Associate degree
- Bachelor's degree
- Master's degree
- Professional degree
- Doctorate degree

13. What is your occupation?

- Employed for wages
- Self-employed
- Unemployed
- Student
- Retired
- Unable to work
- Other

13.a. If you selected Other, please specify:

14. How are you most likely to book your tickets for a rail journey?

- At the station
- Through the website of a specific train operating company
- Through the National Rail Enquiries website
- Through a ticketing website (Trainline, for example)
- Through the mobile application of a train operating company
- Through a ticketing mobile application
- Through the National Rail Enquiries mobile application
- Through a third party (for example, a travel agent)

15. Do you own a smartphone?

- Yes
- No

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16. Do you have a social media account?

- Yes
- No

Page 5: Prize Draw

17. If you would like to enter the prize draw, please enter your email address:

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Page 6: Final page

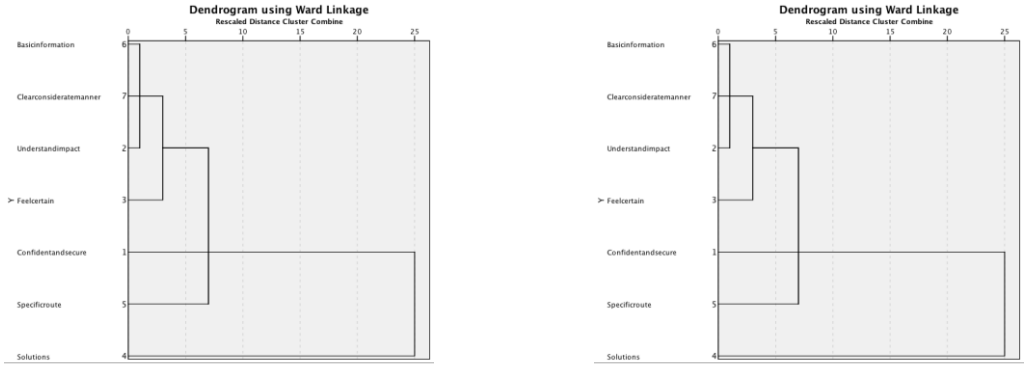
Thank you for your answers!

In the case of questions, concerns, or should you wish to withdraw your data, here are my contact details:

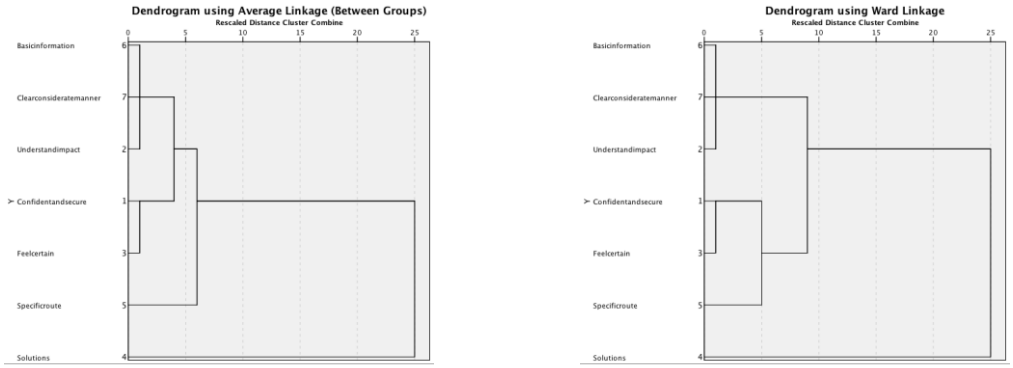
Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)

Primary Supervisor: Dr. David Golightly (david.golightly@nottingham.ac.uk)

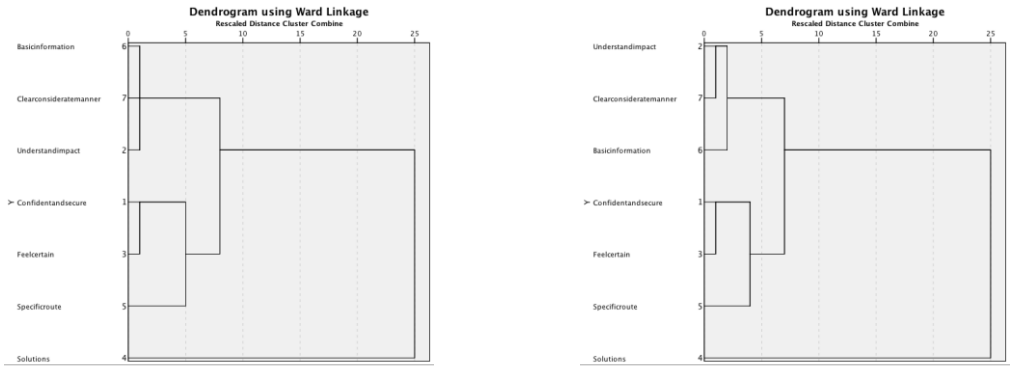
D5. CLUSTER ANALYSIS BY CONSTRUCTS



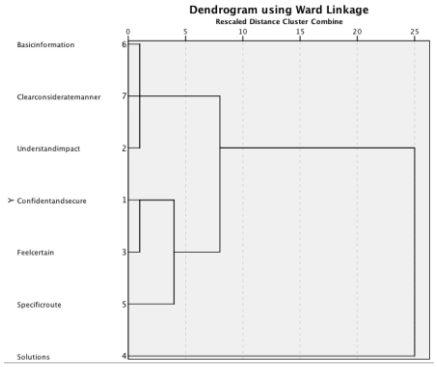
D5.1. High and low general travel frequency, respectively.

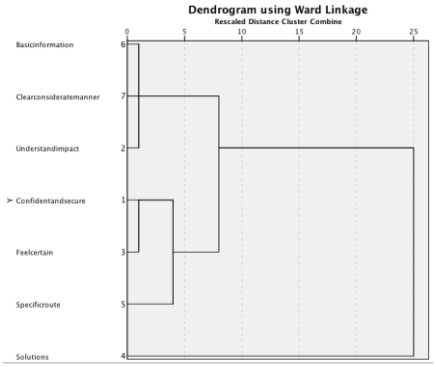


D5.2. High and low general expertise, respectively.



D5.3. High and low specific travel frequency, respectively.





D5.4. High and low/no specific expertise, respectively.

APPENDIX E: SURVEY THREE

E1. DIFFERENT SURVEY VERSIONS

Version 1

1. **How often do you travel on the railways?**

   Daily
   2-3 times a week
   Weekly
   2-3 times a month
   Monthly
   Once every few months
   Few times a year
   Once a year
   Never

2. **What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?**

   1 – No knowledge ("I have no idea of how to travel on the rail network in the UK")
   2
   3
   4
   5
   6
   7 - Expert ("I would consider myself as an expert regarding rail travel in the UK")

3. **Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"**

   Yes No

   a. **How often do you make this trip?**

      Daily
      2-3 times a week
      Weekly
      2-3 times a month
      Monthly
      Once every few months
      Few times a year
      Once a year

Never

4. **If you answered "Yes" to Question 3, what level of expertise do you think you have regarding that specific journey?**

   1 – No knowledge ("I have no idea of how I would make this trip")

   2

   3

   4

   5

   6

   7 - Expert ("I would consider myself an expert regarding this trip")

5. **The following paragraph talks about Olivia's train journey. After reading it, please answer the questions**

Olivia Pope commutes to work on the train five times a week, and is on her usual journey on a busy Monday morning. She has an important review meeting with her manager at 9 am, and is going over her notes on the platform when it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in her trip, how useful would the following pieces of information be? ***Rate them on a scale of 1 ("completely useless") to 7 ("extremely useful").***

1. Basic journey planning information – train times, ticket-booking services, for example.

   1 2 3 4 5 6 7

2. Information regarding service updates or journey alterations – modified services, delay times, for example.

   1 2 3 4 5 6 7

3. FAQs and information that tells her how to give feedback regarding the service.

   1 2 3 4 5 6 7

4. Real-time updates on her mobile phone that give her journey details and service updates.

   1 2 3 4 5 6 7

5. Information about station facilities – toilets, cafes, wifi, for example.

   1 2 3 4 5 6 7

6. Information about how to contact the train operating company.

   1 2 3 4 5 6 7

7. Information about the exact duration of the delay.

1 2 3 4 5 6 7

8. Information about the exact location of the problem

1 2 3 4 5 6 7

9. Information about possible solutions.

1 2 3 4 5 6 7

10. Information about the cause of the delay.

1 2 3 4 5 6 7

6. Please fill in the following pieces of information about yourself:

1. What is your age?
2. What is your occupation?
3. What is your highest completed level of education
4. Where do you live?
5. How do you identify, in terms of gender?
6. How do you book your train tickets?
7. Do you own a smartphone?
8. Do you have a social media account?

7. Would you like to participate in the prize draw for a £30 Amazon voucher? If so, what is your email address?

Version 2

1. **How often do you travel on the railways?**

   Daily

   2-3 times a week

   Weekly

   2-3 times a month

   Monthly

   Once every few months

   Few times a year

   Once a year

   Never

2. **What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?**

   1 – No knowledge ("I have no idea of how to travel on the rail network in the UK")

   2

   3

   4

   5

   6

   7 - Expert ("I would consider myself as an expert regarding rail travel in the UK")

3. **Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"**

   Yes No

   a. **How often do you make this trip?**

      Daily

      2-3 times a week

      Weekly

      2-3 times a month

      Monthly

      Once every few months

      Few times a year

      Once a year

Never

4. **If you answered "Yes" to Question 3, what level of expertise do you think you have regarding that specific journey?**

   1 – No knowledge ("I have no idea of how I would make this trip")

   2

   3

   4

   5

   6

   7 - Expert ("I would consider myself an expert regarding this trip")

5. **The following paragraph talks about Olivia's train journey. After reading it, please answer the questions**

Olivia Pope is on her way from Nottingham to Stanstead Airport to catch a flight to Tokyo. She has planned her train journey in a manner that ensures that she reaches the airport 2 hours prior to her flight, giving her enough time to check-in and have a snack before her plane. However, upon arriving at the platform, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in the trip, how useful would the following pieces of information be? ***Rate them on a scale of 1 ("completely useless") to 7 ("extremely useful").***

1. Basic journey planning information – train times, ticket-booking services, for example.

   1 2 3 4 5 6 7

2. Information regarding service updates or journey alterations – modified services, delay times, for example.

   1 2 3 4 5 6 7

3. FAQs and information that tells her how to give feedback regarding the service.

   1 2 3 4 5 6 7

4. Real-time updates on her mobile phone that give her journey details and service updates.

   1 2 3 4 5 6 7

5. Information about station facilities – toilets, cafes, wifi, for example.

   1 2 3 4 5 6 7

6. Information about how to contact the train operating company.

   1 2 3 4 5 6 7

7. Information about the exact duration of the delay.

1 2 3 4 5 6 7

8. Information about the exact location of the problem

1 2 3 4 5 6 7

9. Information about possible solutions.

1 2 3 4 5 6 7

10. Information about the cause of the delay.

1 2 3 4 5 6 7

6. Please fill in the following pieces of information about yourself:

1. What is your age?
2. What is your occupation?
3. What is your highest completed level of education
4. Where do you live?
5. How do you identify, in terms of gender?
6. How do you book your train tickets?
7. Do you own a smartphone?
8. Do you have a social media account?

7. Would you like to participate in the prize draw for a £30 Amazon voucher? If so, what is your email address?

Version 3

1. **How often do you travel on the railways?**

   Daily

   2-3 times a week

   Weekly

   2-3 times a month

   Monthly

   Once every few months

   Few times a year

   Once a year

   Never

2. **What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?**

   1 – No knowledge ("I have no idea of how to travel on the rail network in the UK")

   2

   3

   4

   5

   6

   7 - Expert ("I would consider myself as an expert regarding rail travel in the UK")

3. **Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"**

   Yes No

   a. **How often do you make this trip?**

      Daily

      2-3 times a week

      Weekly

      2-3 times a month

      Monthly

      Once every few months

      Few times a year

      Once a year

Never

4. **If you answered "Yes" to Question 3, what level of expertise do you think you have regarding that specific journey?**

1 – No knowledge ("I have no idea of how I would make this trip")

2

3

4

5

6

7 - Expert ("I would consider myself an expert regarding this trip")

5. **The following paragraph talks about Olivia's train journey. After reading it, please answer the questions**

Olivia Pope is used to taking the train from Bristol to London over the weekends, as her partner lives there. She usually leaves work a little bit early on the Friday to avoid the rush, takes the 16.41 train from Temple Meads Station to London Paddington, and then the Tube to her partner's house. When she gets to the platform on this Friday, however, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in the trip, how useful would the following pieces of information be? ***Rate them on a scale of 1 ("completely useless") to 7 ("extremely useful").***

1. Basic journey planning information – train times, ticket-booking services, for example.

1 2 3 4 5 6 7

2. Information regarding service updates or journey alterations – modified services, delay times, for example.

1 2 3 4 5 6 7

3. FAQs and information that tells her how to give feedback regarding the service.

1 2 3 4 5 6 7

4. Real-time updates on her mobile phone that give her journey details and service updates.

1 2 3 4 5 6 7

5. Information about station facilities – toilets, cafes, wifi, for example.

1 2 3 4 5 6 7

6. Information about how to contact the train operating company.

1 2 3 4 5 6 7

7. Information about the exact duration of the delay.

1 2 3 4 5 6 7

8. Information about the exact location of the problem

1 2 3 4 5 6 7

9. Information about possible solutions.

1 2 3 4 5 6 7

10. Information about the cause of the delay.

1 2 3 4 5 6 7

6. Please fill in the following pieces of information about yourself:

1. What is your age?
2. What is your occupation?
3. What is your highest completed level of education
4. Where do you live?
5. How do you identify, in terms of gender?
6. How do you book your train tickets?
7. Do you own a smartphone?
8. Do you have a social media account?

7. Would you like to participate in the prize draw for a £30 Amazon voucher? If so, what is your email address?

Version 4

1. **How often do you travel on the railways?**

   Daily

   2-3 times a week

   Weekly

   2-3 times a month

   Monthly

   Once every few months

   Few times a year

   Once a year

   Never

2. **What level of expertise do you think you have surrounding rail travel in the UK, in general (how comfortable are you whilst using the rail network)?**

   1 – No knowledge ("I have no idea of how to travel on the rail network in the UK")

   2

   3

   4

   5

   6

   7 - Expert ("I would consider myself as an expert regarding rail travel in the UK")

3. **Is there a rail journey that you complete often? For example: "I travel to work 2-3 times a week" or "I go to London once a month to visit my family"**

   Yes No

   a. **How often do you make this trip?**

      Daily

      2-3 times a week

      Weekly

      2-3 times a month

      Monthly

      Once every few months

      Few times a year

      Once a year

Never

4. **If you answered "Yes" to Question 3, what level of expertise do you think you have regarding that specific journey?**

1 – No knowledge ("I have no idea of how I would make this trip")

2

3

4

5

6

7 - Expert ("I would consider myself an expert regarding this trip")

5. **The following paragraph talks about Olivia's train journey. After reading it, please answer the questions**

Olivia Pope has decided to wind-down after a long week of work by taking a solo trip to York for the weekend. Having never been there before, she decides that the train is the easiest way for her to get there, and decides to take an early train from Sheffield station on the Saturday morning, so she can enjoy the city for a bit before checking into her room later on in the afternoon. As she arrives at the platform, it is announced that the train may be delayed by 15 minutes, or cancelled due to an earlier incident. At this point in her trip, how useful would the following pieces of information be? ***Rate them on a scale of 1 ("completely useless") to 7 ("extremely useful").***

1. Basic journey planning information – train times, ticket-booking services, for example.

1 2 3 4 5 6 7

2. Information regarding service updates or journey alterations – modified services, delay times, for example.

1 2 3 4 5 6 7

3. FAQs and information that tells her how to give feedback regarding the service.

1 2 3 4 5 6 7

4. Real-time updates on her mobile phone that give her journey details and service updates.

1 2 3 4 5 6 7

5. Information about station facilities – toilets, cafes, wifi, for example.

1 2 3 4 5 6 7

6. Information about how to contact the train operating company.

1 2 3 4 5 6 7

7. Information about the exact duration of the delay.

1	2	3	4	5	6	7

8. Information about the exact location of the problem

1	2	3	4	5	6	7

9. Information about possible solutions.

1	2	3	4	5	6	7

10. Information about the cause of the delay.

1	2	3	4	5	6	7

6. Please fill in the following pieces of information about yourself:

1. What is your age?
2. What is your occupation?
3. What is your highest completed level of education
4. Where do you live?
5. How do you identify, in terms of gender?
6. How do you book your train tickets?
7. Do you own a smartphone?
8. Do you have a social media account?

7. Would you like to participate in the prize draw for a £30 Amazon voucher? If so, what is your email address?

E2. INFORMATION SHEET

Information Sheet

Introduction
Sponsored by a consortium consisting of RDG/RSSB/Network Rail, my PhD aims to examine customer decision making in the face of disruption during the process of rail travel. In order to better understand rail passenger experience, my aim will be to understand the information preferences of passengers during disruption on the railways.

Procedure
The study will have three sections. The first section will ask you to rate your own travel frequency and rail-related expertise, and the second will ask you to read a short description of a trip, followed by the rating of some types of information. The study will conclude by asking you for basic information (age, gender, occupation) about yourself, which will be linked to your participant ID, not your name. Finally, there will be an option to enter your email address for a shot at a £30 Amazon voucher!

Data Storage
The data will be completely anonymised, and you will only be known in relation to your participant number. Only the researchers will see the raw data (your answers and demographic information), which will be stored on a password-protected server.

Contact Details
In the case of questions, concerns, or the withdrawal of data, here are my contact details:
Researcher: Shalaka Kurup (shalaka.kurup@nottingham.ac.uk, +447544831486)
Primary Supervisor: Prof. Sarah Sharples (sarah.sharples@nottingham.ac.uk)

E3. CONSENT FORM

Consent Form

Dear participant
My name is Shalaka Kurup. I am a PhD student at the University of Nottingham, currently working with the Horizon Centre for Doctoral Training, as well as a consortium consisting of RSSB, RDG and Network Rail.
My PhD aims to understand customer decision making in the face of disruption during the process of rail travel. The output of this work will be a report to the sponsors, and potentially a research publication.
The current survey will ask you to read a travel scenario and select the most useful information for the person in the situation. This study has been approved by the University of Nottingham Faculty of Engineering Ethics panel. This is to ensure you and your data is treated with anonymity and fairness.
Please read the following points carefully

- All information will be treated anonymously. You and your organisation will not be named unless it is with your explicit approval.
- All data will be stored electronically and securely, and can only be accessed by the researcher. Data is typically stored for 7 years. This is in line with University of Nottingham Faculty of Engineering ethics procedure.
- You are entitled to withdraw your consent for your data to be used in the future.

Please sign below to confirm you have read and are happy to give consent

Name_____

Signature_____

Age_____

Occupation_____

Date_____

Signature of researcher_____

Date_____