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Improving the clarity of travel information for familiar and unfamiliar travellers in public transport travel information systems

by

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Thesis for the degree of Doctor of Engineering

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ABSTRACT

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IMPROVING THE CLARITY OF TRAVEL INFORMATION FOR FAMILIAR AND UNFAMILIAR TRAVELLERS IN PUBLIC TRANSPORT TRAVEL INFORMATION SYSTEMS

By Amanda Jane Haylett

Every day, UK towns and cities are full of different traveller types, each with a different level of exposure to the environment around them, which is made up of the local landscape and transport system operations. For example, the travellers that are most comfortable with the information around them and can respond accurately to it are those who travel regularly and are familiar with the environment. However, other travellers unfamiliar with these things will need a little more help in understanding it and the available information relating to it.

In some cases, service providers and key stakeholders turn to external information systems to resolve pressure points caused by a lack of local familiarity. These include journey planners used to help travellers gain an understanding of day-to-day operations within that landscape. These external systems focus on distributing the available travel information and not on the user's primary travel information needs relating to their journey. Little research has addressed how travel information should be presented to travellers to inform effective action. In essence, giving an individual access to relevant information and advice means the production of accurate travel plans that correctly match the local landscape and transport operations in a clear and understandable way.

This thesis established a broad view of the different traveller type personas based on their level of familiarity and the stages of information use. That knowledge was captured in a Traveller Planning Types (TPT) framework conceptualised through a triangulation study comprised of a contextual review, focus groups and a literature review collated using thematic analysis. The TPT framework was confirmed as an appropriate framework using a Delphi study of these key stakeholders of external information provision systems. The TPT framework was then used to establish a new method of measuring pre-trip travel information needs for familiar or unfamiliar journey planning situations using probing and process observation techniques using a screen monitoring system.

The results show that there is a statistically significant difference in how travellers feel when pre-planning a familiar or unfamiliar journey, especially with regards to translating that information into accurate travel plans and the confidence to conduct the pre-planned journey. The research has identified that pre-planning travel information has yet to meet the standards set by the fourth rule of citizenship. Specific strategic guidelines were developed to guide future development of such external information systems to take into account user's travel information needs.

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Declaration of authorship

I, Amanda Jane Haylett declare that this thesis entitled 'Improving the clarity of travel information for familiar and unfamiliar travellers in public transport travel information systems' and the work presented in it are my own and has been generated by me as the result of my own original research. I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;

2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

3. Where I have consulted the published work of others, this is always clearly attributed;

4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;

5. I have acknowledged all main sources of help; including information provided with permission from TfL regarding the Customer Touchpoints Typology and other attributing material.

6. Where the thesis is based on work done by me jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

7. Parts of this work have been published as: Haylett et al. (2015)

Signed: .....

Date: .....

Acknowledgements

I want to thank a treasured father, brother and friend for never leaving me nor forsaking me through the trials of this thesis. I leant on you for wisdom against hard words and grace for my many weaknesses. If I had never known you, I would not have produced this thesis. If you had not shown me how you make life precious, neither would I have survived it. Thank you for making me your 'eternally beloved'.

In all I do, lead me to you

I wish to thank my supervisors for their patience while trying to convey the point of this thesis. I am grateful for their encouragement, even if seeing the wood for the trees was a big ask. I wish to thank Karen Ghali for being a shining light in the chaos of survey work and always knowing what to do next. I am sorry that I am not the best at understanding how to build relationships with others, but you helped me passed some key challenges, and I will be forever grateful for your guidance and support.

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My final thanks go to my literary predecessors who have gone before me and laid trails of wisdom to find that could weave this thesis together.

Chapter 1. Introduction

1.1 Introduction

This chapter sets out the framework of the research by exploring the context of what public transport travel information systems should provide the pre-trip planning traveller. The research problem is outlined along with the core aim and objectives informing the structure of the overall thesis.

1.2 Context and Guidelines

This research is primarily concerned with the delivery of clear and understandable public transport travel information, which enables a traveller to plan their journey successfully. It uses the fourth rule of citizenship, as defined by the National Consumer Council, which still states the expectations for information accessibility in today's society to evaluate the sufficiency of travel information systems (National Consumer Council, 1977). Information accessibility is the equal and unbiased opportunity for an individual to easily find relevant information (European Agency For Special Needs and Inclusive Education, 2015). The travel information system in this case will be a journey planner, a multi-source and often multi-modal travel planning service that enables a traveller to query a journey at any time or place (pre-trip and in-trip) and become aware of all the relevant solutions for that journey (Spitadakis and Fostieri, 2012).

This thesis will provide a structured investigation of journey planners and their present usability and information accessibility, and will attract attention and advice to key areas that the findings reveal. It is primarily concerned with the traveller's ability to plan a journey using present-day travel information systems, and not with the wider debate about how this information influences the traveller's success when conducting the trip. However, this will be discussed throughout the thesis to emphasise the wider implications of the subject. This research is also part of a wider debate about the structure and design of public transport information systems that enable the traveller to consume and use travel information to form trip plans.

1.3 Background

Information Technology (IT), the ability to store, retrieve, transmit and manipulate data for a purpose using hardware and software systems, is an expanding and ubiquitous commodity in modern day society (Daintith, 2009, European Agency For Special Needs and Inclusive Education, 2015). A part of that growth is the desire to leverage available information about a subject or industry to share knowledge, extend the reach of that industry to a wider audience and have the ability to produce smarter solutions because of new insights formed from access to previously

unobtainable information (Céspedes-Lorente et al., 2018). According to Mark Weiser, who coined the term Ubiquitous Computing (UBICOMP) and was instrumental in the initial development of tablet-style technology, the goal of IT is to disappear: 'They weave themselves into the fabric of everyday life until they are indistinguishable from it' (Weiser, 1991); in effect, seamlessly providing the users of IT with what they need to satisfy personal, industry or business objectives.

There are many areas in society on which an individual might want to obtain information to survive and thrive, and one such subject area is information related to daily travel planning, which might be in the form of business, leisure or medical trips using public transport services (Transport for London, 2009). In literature, there are few examples that draw out the types of areas in which a society would require information. However, some do indicate through the use of cognitive probing techniques that individuals will spontaneously mention transport information as one such area (Naumer, 2006, Warner et al., 1973). According to Warner et al. (1973) 545 of 1000 participants spontaneously identified the need for information relating to public transport-related issues, and that those individuals felt that the providers of that information did not understand their needs. Insufficiency or poor quality of information can also communicate a general lack of support from those responsible for providing clear, definable information. This is supported by Donald and Pickup (1991) who found that participants in a travel diary study continually raised the issue of a lack of relevant information, the unreliability of provided information and a general sense of confusion over how the services operate when multiple service providers operate independently from one another. Munyama et al. (2015) support this concern with their findings from focus group workshops that travellers saw it as the service provider's responsibility to provide relevant travel information, and that the providers have a duty to give the traveller the relevant information they need to use it. A failure to do so is a failure to meet the traveller's basic needs from the service.

With travel information, there are two subjects to consider. Firstly, the availability of information to address the travellers' identified concerns, which require the provision of information. In some cases that information might not be available, and one such example is the provision of accurate travel-time based information. Chorus et al. (2007) argued that travel information is 'reliably unreliable' because it is based on estimated times and lacks real-time accuracy, which is often only identified in-trip. This suggests that there are certain weaknesses or limitations in the ability to provide travel information and although this is not the subject of this thesis, it is a barrier to the successful provision of travel information. The second issue is the accessibility of that information and the ability to present travel information clearly so that it provides clarity about the trip being

planned. This also includes an awareness of how to build a seamless connection to that information, which provides an equal and unbiased opportunity to plan that trip, regardless of traveller ability.

The focus on information accessibility raises questions regarding what this travel-related information offers a traveller and how they can be given a sense of seamless and unbiased access to that information. However, few places in the transport-related literature address these fundamental questions. More of it gives an insight into the use of IT to leverage its ubiquitous nature and reach a wider audience by personalising travel information to make it more relatable (The Parliamentary Office of Science and Technology, 2014, Department for Transport, 2011, Papangelis et al., 2016, Everitt and Dixon, 2016). In broadening the scope of the literature search to identify what IT should do to address these questions, accessibility for the more vulnerable or disadvantaged users was also included (Simpkins, 1994). This consideration, the fourth rule of citizenship stated below, was used to explain an individual's rights to information as a consumer of any form of information-based service.

> 'People will not be able to get their due as citizens of present-day society unless they have continuous access to the information that will guide them through it and, where necessary, the advice to help them translate that information into effective action'. The fourth rule of citizenship (National Consumer Council, 1977).

This rule suggests that what a person needs from any source providing information is to be given 'continuous access' to relevant information along with the 'support to translate' and understand it so that they can use it. For the traveller, this entails the ability, at any time or place, to access trip options that can be applied to a journey and successfully understand, navigate and complete that trip (Transport for London, 2009, Spitadakis and Fostieri, 2012).

With this access, there is a fundamental concept to establish – the value of being given access to information in a general sense. Palmour and King (1981) believe that the factor that has enabled medicine, science, technology, education and other industry sectors to thrive is understanding and intensively using information to influence the decisions and direction. Nkiko (2007) suggests that information is the resource that increases an individual's capacity to participate in any given policy and make effective, informed decisions about that policy. Harande (2009) argues that information-led services such as a library serve as a means of addressing barriers in understanding a service and provides an avenue to build that knowledge. Together, these views show that access to information is an important way to increase an individual's capacity to respond to a policy or subject and to make clear, informed decisions. Providing this information continuously is

something that a modern technology-driven society is capable of doing through the existence of IT-enabled 'open data' distribution (The Parliamentary Office of Science and Technology, 2014), including information for the traveller.

In support to translate the information, understanding the nature of that trip and the ability to use this knowledge to navigate and complete that trip successfully are key. This covers the individual's specific information literacy skill and is the ability to identify, access, assess, adopt and apply information to solve specific problems, and is developed through continued exposure to information to build understanding (Nkiko, 2007). Although the fourth rule was predominantly taken up by literature targeting disadvantaged members of society, this was not its original motivation. The rule was produced at the request of the government of the day to aid their understanding of the value of information-led services and take into consideration how individuals came to understand existing government support initiatives. In regards to evidence in the literature of traveller specific comprehension, little is known. However, some articles have described the negative consequences that a lack of understanding produces, such as having a limited grasp of structural identification (local landmarks, street names and general structural hierarchy), an inability to absorb environmental information, a failure to ask for help and difficulty finding external information sources that offer relevant travel information. The positive consequences that comprehension offers, often linked to frequent travellers with a commute pattern, gives them less need for the structural route-based information and instead a need for more transient time-based information for flexible planning.

1.4 Addressing the gap

Given the concerns in the body of transport-related literature regarding information accessibility in relation to traveller comprehension, it is unsurprising that this also evidences little design-based guidance for travel IT systems. This thesis intends to address this gap. The general aim that directed this research was to examine travellers' comprehension and how this influences or alters the term 'effective action', understood as: enabling the traveller to, at any time or place, access the relevant trip options that can be applied to a specific journey and successfully understand, navigate and complete that trip, including the IT designed to facilitate this. It thus included addressing the present usability of travel IT systems to benchmark present IT usability and make recommendations to improve them. The objectives for this thesis thus became:

- To conduct a review of the literature on information comprehension and case-based reasoning (CBR) to structure the traveller's ability towards travel information.

- To obtain qualitative and quantitative data on travel information use and the dependencies and opportunities that a strong or weak information recall ability (CBR) produce.
- To identify and catalogue the elements of data that form 'travel information' to determine its structure and intent in the process of forming an effective action.
- To conduct a usability study with travellers as the evaluator of current journey planners' functional usability.
- To collate the findings into clear recommendations to improve the quality and efficiency of existing travel IT systems.

1.5 Structure

Following this introductory chapter, Chapter two presents the literature review and catalogues present day travel information systems and how these have developed over time to enable continuous access to travel information. It draws out the weaknesses in design-based guidance for each type and uses journey planners as its focus. Chapter three then discusses and describes the methodology, the research process and evolving objectives. Chapter four presents a discussion about the traveller's comprehension.

Chapter five consolidates the findings from Chapter four into a framework that addresses the aim of this thesis. This framework shows how effective action is inhibited or supported by the traveller's compression of travel information. Chapter six then catalogues the elements that constitute 'travel information' in terms of specific travel related data that a traveller would require. Chapter seven presents the first part of the usability study which outlines the traveller's ability to use a journey planner successfully.

Chapter eight presents the second part of the usability study and the observation heuristics that the evaluators encountered during the planning process. This draws out the specific design-based guidance.

Chapter nine then draws the thesis to a close, presenting its conclusions.

Chapter 2. Literature review

2.1 Opening travel information to rapid development.

Information-led technology offers alternative ways of accessing travel information. Although this initially began with travel information websites offering the same type of information obtained from printed formats, it soon evolved into more advanced methods of obtaining and distributing travel information (Ferris et al., 2010). This transformed the traveller's digital information landscape, and enabled them to access travel information and at any time they needed it (Jennings and Khadar, 2015). Large travel information datasets were easily collected and distributed, benefiting both the traveller and the provider, doubtless due to the proliferation of smartphones offering a step change in travel information distribution (The Parliamentary Office of Science and Technology, 2014). The collection of data has grown in complexity and quantity over time as other information needs have emerged and other travel information has become available through sensory monitoring and by tracking movement in the network. This has allowed the transport industry to consider introducing targeted travel information systems that work with the traveller to help them access travel information and consider more frequent use of public transport.

2.1.1 Using open data channels to gather travel information

In 2012, a publication setting out the Department for Transport's (DfT) open data policy expressed an interest in linking transport data with data from other sectors to improve and encourage growth in the UK's data infrastructure. This direct focus on open data channels arose from an earlier Transport White Paper published in 1998, stating the DfT's intent to improve the efficiency of traveller information systems (Lyons et al., 2007), alongside the desire to encourage use of public transport through better service information and nudging consumer behaviour (Department for Transport, 2011). The UK government has continued to explore ways to improve and increase the information provided and to increase the travelling population's use of public transport use over private transport (POST, 2014). The DfT's strategy revealed the existence of 14 datasets corresponding to public and private transport use. These datasets covered the three specified domains of interest: overall network structure; movement in the network; and passenger and goods tracking (see Table 2-1).

Table 2-1: Department for Transport (2012) dataset listings[1]

Dataset	Description	Active From	Update frequency	Licensing
Rail real-time	Network Rail TD.net dataset of train running	June 2012	Real-time	Network Rail Open Licence
Rail Performance	ORR to start publishing more detailed information about rail performance below Train Operating Company level. This change will be rolled out gradually as new franchises are issued	May 2012	Monthly	OGL
Bus Timetables	Traveline National Dataset of Great Britain Bus Timetables	April 2012	Weekly	OGL
Bus Stop Times	Traveline Next Buses API covering 350,000 bus stops showing next three planned or real-time departures	April 2012	Real-time	OGL
Rail Network	Network Rail's geographical description of the Great Britain rail network	June 2012	Every six months	OGL
Road Network	The Highway Agency's geographical description of the English Strategic Road network	June 2012	Monthly	OGL
Roadwork's [ELGIN]	Access to data via the ELGIN roadwork's partnership API covering over 65% of local authorities	March 2012	Weekly	OGL
Roadwork's	Data about accessing roadwork's data from each English local authorities	December 2012	Quarterly	OGL
Road Condition	Data about the condition of the English road network	December 2012	Annual	OGL
Rail Fares	Consultation on providing more open access to rail fares data (as part of the Government's review of rail fares and ticketing)	End 2012	TBA	TBA

Analysis of Table 2-1 showed that individual datasets focused on geographic representation, service provision and transition travel information subjects (see Table 2-2). These datasets demonstrate the existence of growing travel information, but they exclude the bespoke datasets held by the individual operators who track and collect their own data. Although there is an increased desire for data sharing and open-data, operators share only a portion of travel information data as they view certain aspects as proprietary information.

[1] The remaining four datasets relate only to private transport data collection, and are thus not relevant to this study.

Table 2-2: Analysis of Table 2.1 – Open dataset list by domain categories

Structural identification	Service provision	Wayfinding transition
Rail Network	Bus Timetables	Rail Performance
Road Network	Bus Stop Times	Rail real-time
Road Condition	Rail Fares	Roadwork's [ELGIN] Roadwork's
Each dataset is about the geographical layout and condition of the network. This includes characteristics like composition and conditions of the geography.	Each dataset is about the delivery of public transport services in the structural layout, covering things such as time, cost, stop locations etc.	Each dataset is about to real-time conditions or difficulties in the environment that will enable the successful transition through the network.

2.1.1.1 Barriers to open data channels in a multi-operator market

The landscape of public transport provision changed significantly between 1953 and 1968. Expectations such as operating standards and the set fare scale dictated as part of the pre-deregulation licensing terms were no longer maintainable. As a result, private investment was brought in to promote healthy competition and provide better operating standards without the requirement for central funding subsidiaries (Butcher, 2012). The process of deregulating local bus services took effect outside London, allowing operators to set themselves up in an area freely and setting their operating standards, while London opted to contract out the routes rather than to have direct roadside competition. This resulted in 661 regionally operating service providers.[2]

Table 2-3: Number of service providers by Traveline region

Area	Bus	Coach	Community Transport
East Anglia	58	0	7
East Midlands	63	0	2
North East	21	1	0
North West	47		1
Scotland	41	1	0
South East	110	2	9
South West	76	3	10
Wales	75	1	3
West Midlands	93	0	3
Yorkshire	32	1	1
Grand Total	616	9	36

[2] Services providers can be broken into parent and sub-companies, i.e. 'First' is a parent company of 'First Hampshire'. Fares and timetables are regionally managed and therefore, sub companies are counted as a single service provider, due to the complexities in service provision. http://www.travelinedata.org.uk/traveline-open-data/traveline-national-dataset/.

Although central government introduced deregulation for financial reasons, it affected the freedom of information sharing and information provision declined significantly. Donald and Pickup (1991) conducted a travel diary survey (n=127 participants) to investigate the overall effects felt by travellers, finding that a majority pointed to a lack of information or the unreliability of information. There was also a general sense of confusion over service operations. For example, one participant commented:

> 'Well, they're very erratic. You used to know the times of the buses but when they changed you just had to go and hope you'd get one and even now they all come together so if you miss one you've missed the lot'.

Around the same time, a consultation in 1993 by the Office of Fair Trading and the Monopolies and Mergers Commission found that there was an escalation in conflicts between rival operators, and the general decline of service provision stability. The Competition Act prevented the sharing of information because of its proprietary nature, thus conforming to legislation targeted at private organisation standards. Although the Act incorporated a minor rule change, it left the sharing of proprietary data at the operator's discretion. Seeking a more direct approach to support multi-operator operations, the government applied funded initiatives that would encourage operators to offer multi-modal ticketing and better passenger information (Butcher et al., 2015). This turbulent environment, despite the steps taken by the government, has left a barrier as to what information is available to the traveller due to the discretion that is still exercised by the operator.

2.1.1.2 Gathering open data travel insights directly from travellers

A phenomenon that has emerged in recent years is co-created data from social media in which travellers with access to smartphone technology can access and contribute insights about the current status of the network. In some cases, these travellers may even offer their expertise to other less confident travellers (Filippi et al., 2013, Nunes et al., 2014). This co-created form has attracted the attention of service providers as a means of addressing enquiries as they arise. They have social media policies that define the format, style and type of information offered to travellers, especially at the point where enquiries relate to service disruption difficulties (Bregman, 2012). The traveller's enquiry (co-created information point) acts as information that other travellers can use.

Other researchers suggest that co-created information provision can be solely traveller driven. For example, the UbiBus project from 2012 is a tool that collects social media posts from travellers about specific routes. This opened channels for travellers to recommend routes to other travellers (Vieira et al., 2012). It enabled travellers to trade and discuss their knowledge, and was only made

possible through the increase in technology and the presence of social media as a platform to gather and exchange information almost in real-time (Filippi et al., 2013). This project demonstrates that travellers can be used to fill the gap when information clarity is lacking.

2.1.2 Using rapid technology growth to gather real-time travel information

The traveller's portable devices can support them in-trip and do so passively and unobtrusively, and can also promote greater yields in real-time data collection (Duncan et al., 2009), but it favours those that are tech-savvy or willing to use technology (Chorus et al., 2007). Those that opt in to accessing travel information via these portable devices have access to more information, ranging from standard estimates to personalised journey plans, and at any point in the journey providing there is a connection to the internet.

2.1.2.1 Gathering location-specific traveller and vehicle information

One advantage that the increase in portable devices provides is a growth in advanced traveller information systems designed to resolve specific challenges that travellers face. One such pressure point is the traveller's concerns regarding late services or even missing services altogether (Transport for London, 2009). This concern was to be resolved using QR codes that could be scanned at a location (e.g. bus calling point) by travellers using enabled portable devices to retrieve information such as current travel times and maps for that calling point (QRDecoder, 2014, Gammer et al., 2014).

In some instances, these QR codes can retrieve real-time transport information using Global Positioning Systems (GPS) tracking data. GPS captures location-specific data by tower triangulations which then can be used to map the location of vehicles geographically. In addition to this, the travellers own personal device can be enabled with GPS features to support geo-location information that is converted into realistic travel information in-trip. Some researchers have tried to incorporate real-time GPS tracking into their travel research, but have found that these techniques are still underdeveloped. This is due to the way that GPS data is stored when coming into contact with individual cell towers operated by different mobile phone operators (Järv et al. (2014); Schönfelder and Axhausen (2010); González et al. (2008); Ahas et al. (2010)). Despite this, geo-location can tailor travel information accurately to the traveller and their journey needs and can benefit the traveller that has spatial wayfinding difficulties. However, the delivery and interpretability of that information must take priority as its benefit is to occasional travellers who will naturally struggle to process incoming geo-location travel information (Lane et al., 2010, Duncan et al., 2009, Witte and Wilson, 2004). There is little evidence as to how these methods were designed to support the needs of the traveller. This suggests that these mediums have

developed as a result of technology advancement and expressed issues rather than being designed for specific needs (Dziekan and Kottenhoff, 2007, Hsieh et al., 2012).

2.1.2.2 The proliferation of data collection through integrated personal devices

Due to the presence of portable devices and their presence in the transport network at the same time as the traveller, they have been targeted for information delivery (GSMA, 2014, GSMA Press Office, 2014). Operators recognise the possibilities that these devices can offer in terms of personalising travel information to meet the travellers' needs (Munyama et al., 2015). These possibilities target both smartphone and smartwatch devices for their booming app market and ability to notify travellers of travelling difficulties (Everitt and Dixon, 2016), and because it offloads costs for expensive infrastructure such as real-time enabled display boards (Barnett, 2014). The increase in open data channels and sharing of travel data, at least to the extent that operators permit, allows independent developers to make use of that information. These developers present travel information in novel and innovative ways at little cost to the operator (Filippi et al., 2013). The presence of these devices and the supporting technology and the geolocating of both vehicle and traveller starts to address one of the most crucial information requirements, accurate travel information. For example, travel information about journey times is often proved to be unreliable (Chorus et al., 2007).

These apps also provide a means of personalised pre-trip planning or assistance to in-trip decision making (Transport for London, 2009). The advantages gained through technology naturally benefit those travellers that have access to and are willing to use technology. As is often the case with technology, some individuals lose this level of support because of their low level of technical ability (Transport for London, 2009) or a direct preference diverting their decision-making to other sources (Chorus et al., 2006c, Chorus et al., 2006d). Those sources could be reliance on another traveller's personal knowledge, a belief that the transit system is simpler than it appears, or that other sources of information meet the need without requiring mobile phones (Schmitt et al., 2015). As an alternative to portable device support, technology embedded in the transit environment provides travel information for those that have opted out of personal device usage, such as departure boards, enabling wider access to dynamic travel information. These act as information radiators, passively offering information to travellers as they pass by, and allowing technology to benefit the wider community of travellers. They present information in a place where a passer-by can see it and are a valuable asset to the in-trip travellers because 'the passer-by does not need to ask questions; the information simply hits them as they pass' (Cockburn, 2006). This method has been shown to be particularly useful in development teams adopting agile

software development methods. Travellers value their presence in the network, but seek higher accuracy in the information that is distributed (Munyama et al., 2015).

2.1.2.3 Gathering proactive travel information form sensory-enabled environments

It is possible to collect a significant amount of relevant data; share it more openly; monitor, tailor, alter and use data in real-time; and distribute it in many ways via portable and embedded devices. This has enabled the travellers to demand more personalised information from the service providers (The Parliamentary Office of Science and Technology, 2014). Therefore, more reliance on sensitive and responsive environments is likely to be the future direction of travel information provision (Munyama et al., 2015, Filippi et al., 2013). To date, the emphasis has been on the introduction of near field communication (NFC) systems and RFID sensors that allow portable devices to communicate with other enabled devices. This allows travellers to tap in and out of sensory boundaries or synchronise with other devices; this approach is part of the Ambient Intelligence (AmI) methodology (Hsieh et al., 2012). Weiser (1991) initially presented the idea of advanced sensory tracking as part of his foundational work regarding ubiquitous computing and the potential for sensory devices and tracking techniques, so the technology for this sensitive and responsive tracking has existed for some time. For example, the foundations of portable devices can be traced back to the development of in-house tablets, pads and boards used by staff at Xerox Parc, of which Mark Weiser had first-hand exposure. He stated that: 'the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it' (Weiser, 1991).

It thus appears that technology is more than capable of offering the desired travel information support, especially the sensory, reactive technology that can be found in RFIDs, QR Codes and GPS (Weiser, 1993, Cook et al., 2009). Although AmI has begun to make progress into the travel information landscape, there is evidence of a general debate regarding its future use there. Most of these debate originated in connection with EU policies that attempted to address existing environmental concerns, for example by the Information Society and Technologies Advisory Group (2001), Information Society and Technologies Advisory Group (2012). Three out of the four proposals suggested by the ISTAG targeted car hire, public transport and car sharing. These ideas included a simplistic understanding of sensory technology and envisioned intrusive sensors placed either inside a person's own body, which was apparently considered in the review to be a controversial topic. Alternatively, and perhaps slightly more appropriate views, included sensors in watches or articles of clothing that communicated with other sensory devices, which are now available to the traveller. In 2001, when ISTAG conducted its first review, there were concerns

that the technology would lead to information overload and create social division between those that owned these sensory devices and those that did not. The conclusion of this review initially rejected the possibility of exploring AmI despite the perceived benefits. These included: the ability to increase the quality of life and fulfilment of personal needs; improved quality services; future innovation; and better applications to improve public services. In 2012, ISTAG concluded that the means to deliver on the ideals of AmI and the benefits highlighted by earlier reviews had yet to be realised, suggesting that more research and funding are required to understand the practical and ethical applications (Information Society and Technologies Advisory Group, 2012).

There are other successful sensory systems at historical sites enabling users to interact with local heritage information and aiding successful transportation of historical artefacts (Costantini et al., 2008). Parcel tracking using context-aware systems to find parcels travelling through the system is another example of a sensory system (Gupta et al., 2014). What is common to both these examples is that they conjoin surrounding technical devices for the purposes described, joining the sensors, PDAs and other devices to work and interact together to achieve the core objectives. The local heritage example is a good representation of what future public transport systems could be like. In this example, the use of AmI enables tourists visiting heritage sites to obtain facts and details about points of interest as they travel around the site. In practical terms, as the visitor enters the site, their devices begin to communicate with the other sensory devices and the information for points of interest is tailored and sent to the visitors based on: where the visitor has been before (pre-existing knowledge); where the visitor intends to go (current intentions); and what information the visitor has been shown before (catering to knowledge growth).

It also monitors the traveller's journey through the site, their progress and various sources of wayfinding support such as maps to assist the traveller's movement and corrects them if they stray from their intended plan. It also had the flexibility to readjust all these sources of information if that traveller intentionally strayed off the path because of a new emerging interest (Sadri, 2011).

2.2 Present-day filtration of travel information to travellers

The delivery of travel information is dependent on its nature (either estimated or real time), the traveller's desire to use specific delivery methods and the stage of journey planning that they are at. These can cover a wide range of travel circumstances, and Southampton City Council (2008) defines the stages as: pre-journey; arrival; getting around; interchange; and finding a destination. Other research has split the stages of a journey based on the environment in which it occurs, e.g. pre-trip, wayside and on-board (Grotenhuis et al., 2007). The most precise way to understand the distinction between the stages of information use would be to consider the temporal boundary

between pre-trip considerations and in-trip dependency. The delivery of travel information will come from these two stages of information use.

2.2.1 Targeting the provision of travel Information: pre-trip

In literature, most of the information distribution techniques are described in the context of pre-trip journey planning and take into account the types of pre-trip considerations that a traveller would make (Kent (2010); Salehian (2014). Keywords such as 'evaluate' or 'compare' are often used to imply that travellers want the means to judge the information they are offered for its sufficiency to their personal and journey needs, regardless of which information distribution method they use. The reason these keywords are particularly prevalent is that travellers often approach journey planning with their set of personal preferences which drive what any travel information must conform to, such as the reduction of interchanges in a journey (see Järv et al. (2014), Filippi et al. (2013), Spitadakis and Fostieri (2012), Dewi (2010), Chorus et al. (2006c), Chorus et al. (2006d)). Therefore, the traveller's preferences drive the type of information they seek, which also implies that they are a 'seeker' of that information. There is limited information in the literature as to what information provision methods do to satisfy the traveller's information needs, and there is not enough evidence to suggest that this could be defined with the needed clarity to understand the use of specific information points in the context of pre-trip planning.

Typically, literature points to journey planners regardless of its method of distribution (e.g. web or mobile) as the primary information distribution method for pre-trip journey planning (Spitadakis and Fostieri (2012)). It is likely that journey planners are the primary method for distributing travel information because they are capable of providing it with more relevance to the traveller's specific travel enquiry, and offer the traveller the ability to compare available travel options (Schmitt et al., 2015, Schmitt et al., 2013). Munyama et al. (2015) found that travellers in London particularly valued the TfL's journey planner because the information is managed and presented by the originating operator, whereas other similar planners such as Traveline are developed by third-party distributors with access to open data channels. This may indicate a concern that the quality and level of travel information offered is inferior to that provided from the originating source (The Parliamentary Office of Science and Technology, 2014).

Some of the travel information that journey planners offer consists of pre-drafted estimated or scheduled data, known as 'static' data. The literature regarding pre-trip planners eludes to the requirement for basic support if they have significant wayfinding ability, or access to decision

support systems.[3] A decision support system is a computer-based system that can help decision-makers confront ill-structured problems through direct interaction with data and analysis models (Sprague and Carlson, 1982). The definition of these types of systems can be described as any system that supports the decision making process in any way (Sprague and Watson, 1989). Local and central government portray journey planners as a means of bridging the gap between the traveller and the intended logical choice process, enabling appropriate choice by offering suggestive recommendations or nudges to assist the decision-making process (Southampton City Council, 2008, Department for Transport, 2011). They also believe that decision support systems empower travellers to make informed decisions about factors that relate to the how, when, where and if it is possible to travel successfully (Lyons et al., 2007).

2.2.1.1 Assisting choice: recommender systems

Personalised travel information is of increasing interest given the availability and growth of technology (Munyama et al., 2015, Everitt and Dixon, 2016). In the example relating to the exploration of heritage sites, the system recommends locations to the visitors and offers relevant information. There are other examples of recommender systems that modify their output based on the traveller, and the possible routing recommendations which are found within the tourism sector (Mahmood and Abdul-Salam, 2013). The tourism industry is known for its strong emphasis on personalisation and the production of travel options that meet the needs of the traveller through profiling. This allows specific values such as cost to be targeted and information organised to offer relevant suggestions to the traveller. There are various types of recommender systems within the tourism sector that focus on traveller-specific needs, traveller profiles or the journey enquiry settings:

- Knowledge-based filtering (Trewin, 2000);
- Collaborative-base (Gavalas et al., 2014); and
- Demographic-based filtering (Pazzani, 1999).

Mahmood and Abdul-Salam (2013) suggest that recommender systems use advanced hybrid filtering techniques that analyse the traveller's personal and journey needs based on set values such as cost, along with the use of prior traveller feedback (collaborative-base filtering) as an additional means of satisfying the need. This form of collaborative recommendation filtering is reliant on having sufficient collaborative resource that can provide accurate feedback (Lops et al., 2011). In some cases, the level of information that is presented from a recommender system or

[3] See **Chapter 4** for a broader discussion about the specific implications of journey planning with a strong or weak wayfinding ability.

journey planner can overwhelm travellers if they cannot judge which option to choose. Some travellers may require a means of controlling the information overload, enabling them to identify journeys that are good enough over optimal. Todd (2007) refers to this as modelling for human rationality and defines it as filtering based on unbounded, bounded or ecological rationalities (see Table 2-4).

Table 2-4: Analysis of the three forms of rationality (Todd, 2007)

Unfiltered	Filtered	
Unbounded	**Bounded**	**Ecological**
Based on the premise of gathering and analysing all available information, without constraints regarding human or technology-based limitations. Providing the recipient with all possible avenues of information that could have even a small relevance towards making a decision whether requested or not.	Based on the premise that the recipients are exposed to constraints such as limited time, limited knowledge and cognitive abilities. Methods or strategies are incorporated to guide the search and obviate the need for follow-up information.	Exploiting the problem domain by understanding the factors and thought processes that lead to right decisions. This is also combined with supportive techniques such as the adaptive toolbox that modify the decision logic relevant to the problem domain and profiling.

In consideration of Table 2-4 and the issues surrounding a traveller's ability to process travel information; a recommender system with unbounded rationality would present the traveller with all the available travel information related to a specific journey enquiry which could result in a plethora of routes, providers and associated costs. This approach of applying unbounded rationality naturally favours the traveller with the necessary exposure to travel-related information and can determine what information is directly relevant to the journey enquiry and journey needs. Consequently, unbounded recommender systems would exclude travellers with reduced wayfinding ability or who approach the public transport environment with a fresh perspective due to changes in personal circumstances (Schmitt et al., 2015). These travellers require more restrictive measures such as bounded and ecological rationality that provide shortcuts to the information that will be of most relevance to them (Transport for London, 2009, Walker, 2010) (see Chapter 4).

Mahmood and Abdul-Salam (2013) argued that TripAdvisor's geo-location services and traveller-provided journey details enable personalisation – a traveller requirement – by adapting a form of rationality to meet the type of journey enquiry. It is possible to control the type of rationality that a recommender system uses to provide well defined, better-targeted solutions that can work with the individual's ability and their information needs using robust algorithms (Janev and Vraneš, 2011). TripAdvisor (2014) demonstrates what recommender systems are capable of providing by how it supports its users through a complicated decision-making process (Gavalas et al., 2014).

2.2.1.2 Assisting choice: Journey planners

Due to the increase of responsive websites, the production of a web-based journey planner became possible. They are designed to support the travellers using embedded filtering techniques similar to recommender systems to filter and convert travel information into understandable journey plans (Spitadakis and Fostieri, 2012, Solar and Marqués, 2012) allowing the traveller to use their knowledge. In 2000, the UK government made a concerted effort to support a national multi-modal and web-based journey planner that could assist the traveller with door-to-door journey planning decisions because of the existence of such responsive website technology (Lyons et al., 2007). For example, WISETRIP and Traveline are present-day responsive website journey planners that are provided by third-party providers (WISETRIP Consortium, 2008, Lyons et al., 2007). The ability to consolidate wayfinding support into a single system by accounting for trip chaining and multi-modal variances is an advantage to travellers with limited knowledge of the overall public transport network.

Despite this perceived advantage, the open source information needed to build this is often restricted due to the data's proprietary nature and the operator's freedom to disclose. Some journey planners also try to consolidate disparate systems and other proprietary journey planners that can address problems but remain restricted to some extent (The Parliamentary Office of Science and Technology, 2014, Farag and Lyons, 2012). Based on surveys around journey planning systems such as WISETRIP, researchers can identify stated preferences and how a traveller feels towards the use of a journey planner. Spitadakis and Fostieri (2012) found that travellers were willing to pay for better information provision. However, Fu et al. (2013) found that the rise in mobile applications had led to travellers not wanting to pay for information that they expect the service to provide. Current research from TfL also supports this conclusion, finding that travellers have a higher expectation and reliance on the provision of information because of it being the operator's responsibility to provide (see Figure 2-1). These differences may be due to the research methods that were employed: one focusing on stated preference, the other using revealed preference. The revealed preference demonstrated the traveller's information needs better than the stated preferences found by Spitadakis and Fostieri (2012).

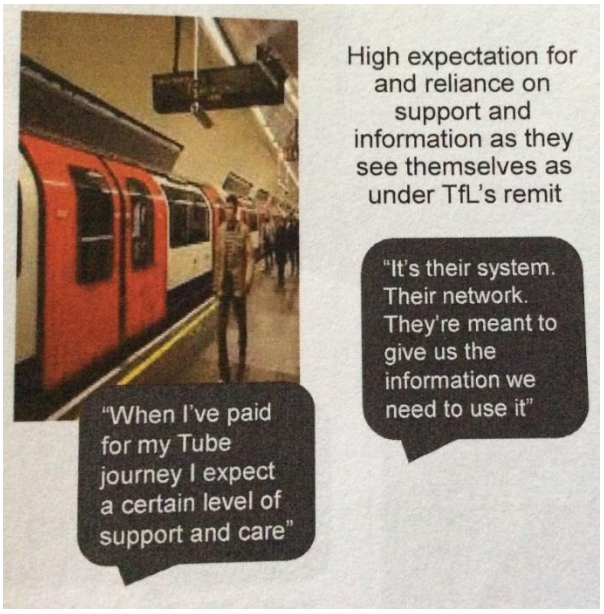


Figure 2-1: Traveller sentiments towards the provision of travel information (Munyama et al., 2015)

Any research focusing on personal behaviour and intentions of the community always has to contend with preferences, both stated and revealed, where the stated preference findings often represent the traveller's idealised opinions towards the subject matter. It is when preferences are revealed that they demonstrate true intentions and beliefs towards the subject matter (Kothari, 2004). In this instance, the travellers' opinions demonstrate that they value having access to advanced features and information, but not to the exclusion of information such as journey costs. This suggests that there is a scale regarding the approach to travel information and its relevance in planning a journey (Bellman et al., 2011).[4] Ignoring the financial findings from Spitadakis and Fostieri (2012), they did confirm the need to fulfil traveller's information needs, basic and wayfinding needs.

Over time, the WISETRIP journey planner evolved and incorporated additional features to satisfy certain traveller requirements, such as:

- Turn-point[5] information before and during the whole trip;
- Appropriate management of the travellers observed and stated preferences by ensuring their preferences for the journey were displayed;
- Contingency plans to pre-empt and manage in-trip difficulties; and
- Co-created information from social media

(Forthnet et al., 2012, Solar and Marqués, 2012)

[4] See Chapter 6 for a more detailed discussion of the specific types of information needs.
[5] Refers to directional navigation, e.g. 'turn left onto the Avenue' or 'in 50 yards, turn right'.

Despite the potential that journey planners offer, their longevity seems to be doubtful according to some observers. Firstly, after ten years of use, the Transport Direct journey planner developed by government to meet the traveller's information needs was decommissioned because of the growing competition among journey planner systems and the difficulty of keeping up with traveller information needs (Department for Transport, 2014c). Secondly, Skoglund and Karlsson (2012) investigated journey planner life-span using a two-stage online survey, and their findings demonstrated a reduction of use over time. The first round of their survey polled a sample of 277 unfamiliar travellers who were either new users of journey planners or had recently moved into the area. The second round was nine months later with 71 of the previous 277 participants. The results demonstrated that the desire to continue using a journey planner waned over time, as did the traveller's initial positive attitude towards the journey planner. Finally, Schmitt et al. looked at the suitability of journey planners and suggested that the reason that these tools have yet to reach their potential is the way in which they are designed for both reduced and significant wayfinding ability travellers (Schmitt et al., 2015, Schmitt et al., 2013). This may explain why information provision is prevalent, but sustainable interest is weak.

2.2.1 Targeting the provision of travel Information: in-trip

The stage of information use most often discussed in the literature is pre-trip journey planning (Esztergár-Kiss and Csiszár, 2015, Grotenhuis et al., 2007, Lyons et al., 2007). However, there is reference to alternative stages of information use such as in-trip journey planning, journey re-planning due to emerging difficulties, and the need to address the traveller's wayfinding needs as they transition from information evaluation (pre-trip) to information dependence (in-trip) (Caiafa, 2010, Transport for London, 2009). For example, Southampton City Council (2008) identified that travellers need clear and understandable information both pre-trip and in-trip to manage their journey, get around the public transport network, navigate interchanges and find their final destination. It is clear that regardless of the stage of information use, a traveller's focus will be on their navigation through that transit environment; in essence, they are journey driven (Jennings and Khadar, 2015, Munyama et al., 2015, Transport for London, 2009). Looking at in-trip journey planning, the traveller will have access to real-time, dynamic information whether or not they are a user of portable devices due to its prevalence in the travel environment (The Parliamentary Office of Science and Technology, 2014, The Parliamentary Office of Science and Technology, 2013). Therefore, the traveller can respond to information available within the travel environment (e.g. displays, staff or other travellers) in a similar way to those that are tech-enabled. The availability of travel information in-trip (on-board or at the wayside), enables travellers to see and be made aware of information and react in real-time to in-trip circumstances rather than depend

on pre-drafted estimated travel information obtained during the pre-trip planning stage. Pre-trip planning was separate from the real experience of the travel environment because of that estimated format (Esztergár-Kiss and Csiszár, 2015). As a result, this may cause wayfinding difficulties or highlight data collection shortcomings at the moment of travel for a traveller unfamiliar with in-trip navigation. Travellers that have pre-trip journey planning information will have the ability to check that information during their journey. They are provided with the opportunity to re-plan the journey if they have the wayfinding ability or information to do so (Munyama et al., 2015, Transport for London, 2009). Reviews both by Zhu and Levinson (2011) and Passenger Focus (2011) show that pre-trip journey planning information only really makes sense when used in the travel environment, and travellers see its relevance in the real environment. Those reviews also show that the traveller's reactions to unplanned difficulties, such as a disruption or cancellation, will relate to the traveller's journey needs and the pressure on the traveller to complete that journey successfully.

Time has a significant role in influencing decisions and is considered an essential information need. For example, time-rich travellers can consider other utilities more freely over the travel time (Chorus et al., 2006b, Chorus et al., 2007, Chorus et al., 2006c, Chorus et al., 2006d), while individuals that are time-poor will gravitate to options that satisfy that limited temporal window for travelling (Kalman et al., 2013). It is clear that time also controls the urgency in which travellers have to decide, as those in transit have less time to consider their actions as a bus arrives at their waiting point (Passenger Focus, 2010, Passenger Focus, 2011).

Information provision is moving towards more embedded and responsive methods such as information radiators, display boards, smartphones/watches to distribute timely information directly to the traveller to address the issues that are raised here. The importance of this is that the pre-trip traveller has the advantage of having more time to make decisions. However, the information's relevance to the transit environment is restricted until it is brought into the in-trip environment (Norgate, 2006, Norgate et al., 2014, Mohammed and Harrison, 2013, König and Waller, 2010, Bluedorn et al., 1999).

2.2.1.1 Delivering information in-trip: Access using portable devices

Portable devices such as smartphones are a useful means of bridging the gap between the traveller and the operator and enable the provision of personalised information, noted as a requirement in numerous studies. Consumer research suggests that the number of people that own or use portable devices is increasing. For example, Styles (2013) reported that 7 in 10 people now own a Smartphone in the UK, and that 70% of those users search for information and 63%

use geo-location services. Barnett (2014) also reported that these devices increase the support that can be offered to consumers and improve operating standards and information provision. One are of growth is the smartphone app market, and accessibility to web pages targeting these devices is also growing. To date, there are 500+ UK based, travel-centred mobile applications, 460 of which are public transport applications for London travellers and are powered by TfL's open data policy (Everitt and Dixon, 2016). Examples include: Citymapper, providing multi-modal journey planning using TfL open data; Moovit, providing real-time data obtained via travellers GPS enabled smartphones and GPS broadcasting vehicle; and Waze, providing driving routes based on traffic data and travellers movements via enabled smartphones (The Parliamentary Office of Science and Technology, 2014).

Creative methods of presenting travel information are possible due to the fast-paced application development and the existence of various data sources. Designs for these applications include simple timetables, real-time departure boards, simplistic or extensive journey planners, mapping, geo-location planning and other facilities to address emerging in-trip difficulties (The Parliamentary Office of Science and Technology, 2014). However, little research has explored the best way to present travel information, despite their apparent potential (Bellman et al., 2011, Morris et al., 2002)**.** Instead, research typically addresses the user's feelings towards applications in general and their influence over their willingness to buy in to an offered service or product. For example, Bellman et al. (2011) considered the users' responses to buy-in when using branded vs non-branded apps, transactional vs informative apps and data-push vs data-pull apps.[6] Their findings suggest that users expressed a preference to get the information for themselves, preferred informative apps over ones that expected a financial contribution and trusted branded apps over non-branded apps. This study was also quite informative about the user's specific annoyances. For example, users felt overwhelmed when information was pushed out in the form of notifications and alerts, suggesting that the individuals need control over the information that they access, the users' trust in branded apps and preferring information to come from its originating source rather than a third-party distributor. They found that the approach an application takes can persuade or dissuade buy-in, but called for more research on this subject to define the actual extent of the influence.

[6] Data-push refers to where the application pushes out information when an update is available. Whereas, Data-pull refers to where the user must request new information to be pulled down from the application server to the portable device, in essence, request the new information.

Regarding travel information apps, a critical requirement for any app is the accuracy of travel information, as identified in the earlier discussion regarding in-trip realism. According to Fu et al. (2013), the keys to a successful public transport app is its information accuracy and overall app stability, according to the its user reviews. They also suggested that an app's fundamental weaknesses will already be at the forefront of the user's mind when considering the use of an app, and in public transport, these weaknesses are the information's relevance, accuracy and reliability. Chorus et al. (2007) opined that it is difficult to get accurate travel information or convince the travellers of its accuracy, despite the growing improvements in this area due to real-time tracking. This conclusion was drawn from their prior research that found that, regardless of the growth in technology, travellers will perceive public transport as unreliable (Chorus et al., 2006b).

These sentiments may have arisen from the barriers in information provision because of its proprietary nature and the extent that developers are expected to take on the burden of the information provision. Filippi et al. (2013), argue that app developers are forced to take on responsibilities to fill gaps in services that the operators themselves should be able to fill. Munyama et al. (2015) found that travellers will conclude that the operator failed to meet their travel needs when information that the traveller considers valuable is not available to them. This means that travellers are placing the travel information expectations on the third-party developers instead of the operators and as a consequence, new apps are being released by developers without the practical knowledge of the traveller and their information comprehension needs (Jennings and Khadar, 2015, Transport for London, 2009). This suggests that the longevity or continued use of apps is questionable, particularly the unfamiliar traveller, and is one discussion that is also rarely considered in the literature, but it is eluded to throughout the narrative.

2.3 Summary

This chapter has provided an informative background into the external concepts that have influenced the provision and clarity of information in the field of public transport; the rapid growth of technology and commercial drivers such as the diverse multi-operator nature of public transport. It has also provided insights into the different types of travel IT available to travellers, and the current understanding of their design intent in supporting the travellers' information needs.

Chapter 3. Research methodology

This chapter explores the research methodology, outlining how each method was applied and analysed, along with the justification for the use of a mixed-methods approach.

3.1 Research questions

The aim of this thesis is to build an understanding of traveller comprehension and how this influences or alters the term 'effective action', [7] and, to evaluate present-day travel IT, in this case a journey planner. This aim was to measure their capacity to offer a traveller that unbiased opportunity to gather travel information regardless of ability for the purpose of isolating travel IT system usability. Two research questions were formed and evaluated:

RQ 1	What is an appropriate representation of the traveller concepts that represent travel information comprehension, and influence effective action?
RQ 2	To what extent can current travel IT, e.g. a journey planner, meet the traveller's information needs according to the fourth rule of citizenship?

These research questions focused on important aspects of information accessibility that needed more qualitative and quantitative research to produce the needed design-based guidance for travel IT.

3.2 Systematic outline of the research frame

The original empirical research methodology changed mid-process due to emerging insights, to a mixed-methods triangulation structure. The process is summarised in Figure 3-1.

Preliminary	The starting point for the research where the initial literature review and intercept study was conducted, the catalysts that forced the research process to evolve into a mixed-methods approach.
Exploration	To address the need for contextual evidence and counterbalancing this with a more detailed comparison of insights, a methodological triangulation was adopted including; extended literature review, contextual review and use of focus group transcripts (secondary data). These methods produced a conceptual 'representation' to address research question 1, the Traveller Planning Types (TPT) framework.
Confirmation/ validation	External feedback was sought from peers and key travel IT providers, to critically evaluate the 'representation' produced during the exploration stage. This produced a more reliable 'representation' to be used so structure the final experiment.
Experiment	The insights gained from earlier stages were used to design a usability experiment that would target traveller comprehension and information provision. The methods used particularly focused on observing the traveller's trip planning activity and information absorption, measured by recall, to produce the needed design-based guidance through the successes and improvements identified.

[7] As defined by the fourth rule of citizenship, discussed in Chapter 1.

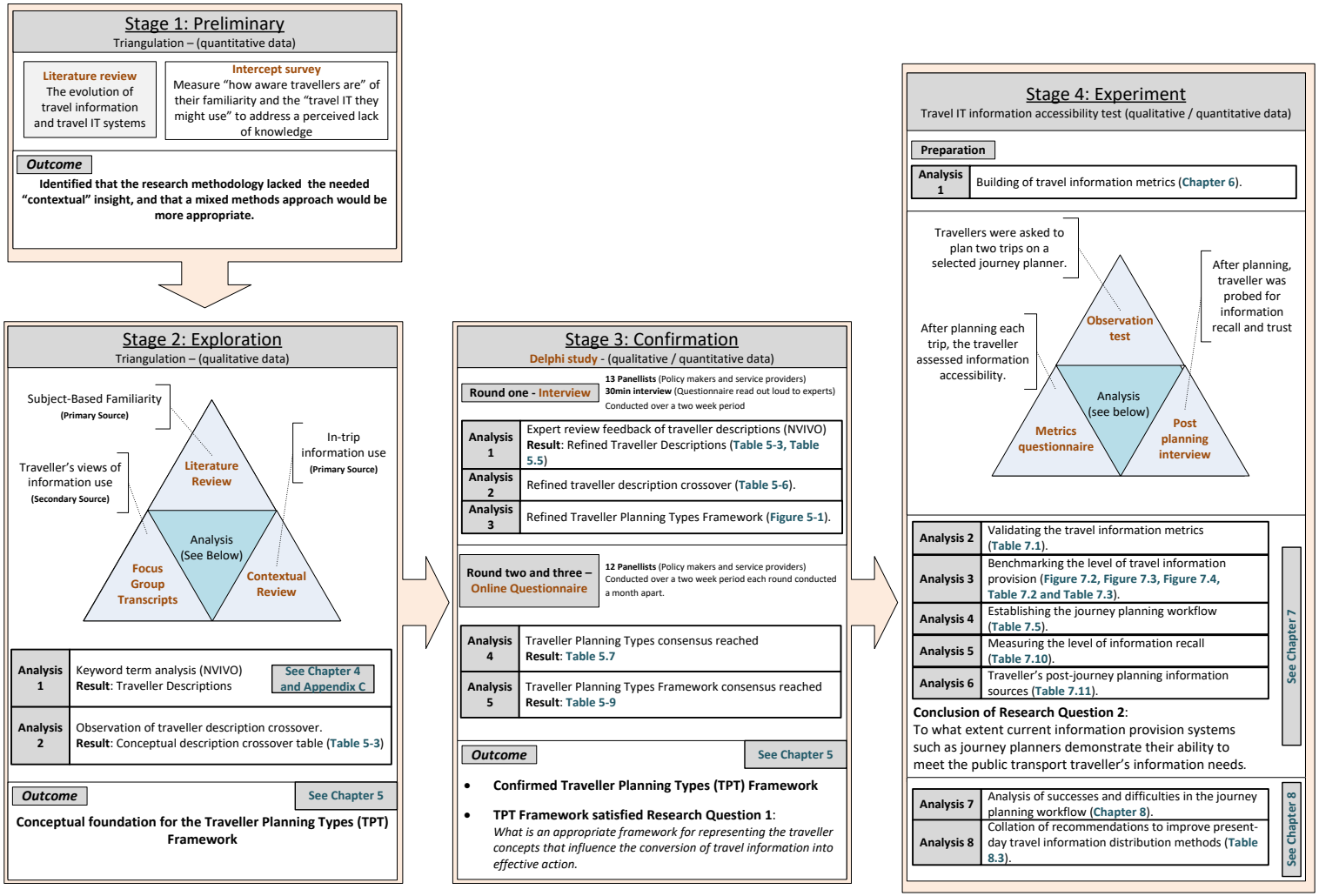


Figure 3-1: Methodology and analysis pathway diagram

3.2.1 Stage 1a: Literature review

During the preliminary stages, the research had a different focus to that stated above, due to the research sponsor's initial requirements for a new smartphone-based travel IT solution (see Section 3.2.3). Therefore, the initial literature review collected insights from journal databases, library catalogues and relevant online newspaper databases for subjects such as travel information, travel IT, system usability and other relevant political and technical factors that influenced travel IT. This included:

- System design;
    - Usability heuristics and user experience (UX) principles.
- Travel information;
    - research methods used to identify travel information needs / the format or structure of travel information / the influence of trip stage on types of travel information used or needed / traveller's desire for types of travel information / Economics of information.
- Travel IT;
    - Forms for accessing personalised trip plans such as journey planners, recommender systems and mobile applications / the change from rigid 'estimated' to sensory 'real-time' travel information / the potential for travel IT through open-source, co-created data and shortwave/longwave data communications.
- Other non-tech-based information distribution methods;
    - 'Printed' timetables, leaflets, magazines, periodicals, maps / and other word of mouth sources such as friends/family, other travellers, staff support and travel shops.
- External factors that affected or have an influence on the provision of travel information;
    - Government-led initiatives for perusing 'open-source' data and the growth of travel information providers responsible for providing travel information since deregulating the bus services.

The literature produced an assumption that public transport-related literature lacked discussion about different traveller types and how these travellers' travel information needs were satisfied by distribution methods, whether IT, printed or through word of mouth. This led to an identified gap in knowledge about the users of travel information and their approach to that travel information based on their specific traits. The clearest defined traveller type that could be evidenced in literature was 'commuters' – those that travel most frequently – leading some authors to comment on familiarity and emphasise the lack of literature regarding the use of travel IT solutions such as a journey planner by unfamiliar travellers (Schmitt et al., 2015).

3.2.2 Stage 1b: Intercept study

This meant that at the time the intercept study was designed, the literature hinted at traveller familiarity as a concept without fully expressing its relevance or impact relating to travellers' information use. Therefore, this subject needed further clarification to identify how aware travellers were of their familiarity with local public transport services and identify their reliance on available travel IT in light of that awareness.

The literature review identified several research methods such as fieldwork (intercept), mail or online questionnaires, or the use of travel diaries to gather data. Each method collected qualitative and quantitative data and aimed to gather the stated or revealed preferences or intentions of the participant involved (Lyons et al., 2007). Following this understanding, a traveller intercept dual survey was conducted, combining both an intercept and an online questionnaire to boost participation by offering passers-by the option to participate at their convenience (see Figure 3-2).

Figure 3-2: Invite to participate online (distributed onsite)

The intercept was planned to be held in three set locations in close proximity to city centre areas where both bus and car drivers could be intercepted. However, due to emerging concerns over the questionnaire design and responses received during the pilot and first intercept location, the study was halted.

Regarding the questionnaire design, the first part asked standard participant demographic questions (age, gender, employment), links to intercept location (travelling to/from, duration living/working in intercept location, satisfaction with intercept locations public transport) and travel options (have a driver's license, own a car, own a smartphone, pay for travel, use a season ticket). The second part used Likert scales (see Table 3-1) to measure the traveller's perceptions of their frequency of travel, knowledge of basic travel information (routes, ticketing, costs, and general information), propensity to obtain travel information and confidence to travel.

The final part focused on the methods of distributing travel information and the circumstances that a traveller would seek travel information, such as before and during travel (see Table 3-2). In addition, this section also asked the respondents whether they would consider seeking travel information and be mindful of service disruption for trips that are familiar or unfamiliar (see Table 3-3). For each option, the respondent was also asked to indicate which information source they would use in that situation, or considerations they would make relevant to that circumstance.

Table 3-1: Excerpt from Intercept Questionnaire – traveller perception

		1	2	3	4	5	6	7	8	9	10	
I never use	Buses											**I always use**
	Trains											
I have limited knowledge of	Bus routes											**I have extensive knowledge of**
	Bus ticketing and costs											
	Bus information											
	Train routes											
	Train ticketing and costs											
	Train information											
I need information to manage	Planned disruptions											**My knowledge is enough to handle**
	Emerging disruptions											
I am not confident in travelling	New/unfamiliar journeys											**I am confident travelling**
	Journeys I travel regularly											

Table 3-2: Excerpt from Intercept Questionnaire – general pre-trip planning propensity

Do you seek travel information before travelling					
Yes		Digital Sources	Printed timetables	Service provider website	
Sometimes			Use social media	Use a journey planner	
No			Travel app on a smartphone	Search travel forums	
			Use google maps	Search online	
		Personal Sources	Call the service provider	Use my knowledge	
			Ask friends/family		

Table 3-3: Excerpt from Intercept Questionnaire – pre-trip propensity to plan FAM/UNFAM

12a – Do you pre-plan for journeys that are…?					
Familiar		Familiar Journey	Search for information	Check planned disruption	
Unfamiliar			Create a travel plan	Consider alternative routes	
I do not plan					
		Unfamiliar Journeys	Search for information	Check planned disruption	
			Create a travel plan	Consider alternative routes	

Regarding the sample-related decisions, the study sought to determine how familiar travellers were with local public transport services and identify their reliance on available travel information

sources in light of that awareness. The participants in the study were any traveller, regardless of any set characteristic, ability or travel choice. The intention of the study was to intercept individuals in a set location travelling from one destination to another, with the desire to obtain their views of familiarity with local public transport services, and where necessary offer an alternative method of participation if the intercept time was not appropriate. This meant that the limitations of the sample were that the intercepted person was a visitor to the locality and that infrequent travellers might not be intercepted, presenting a bias towards familiar travellers and their views. Therefore, the questionnaire sought to obtain these details to identify whether these assumptions were accurate, such as their frequency of travel and whether they were a resident, worker or visitor of the locality.

Three locations were chosen, but only one was visited because of insights gained in the piloting stages (see Section 3.2.3). This location, Churchill Square in Brighton, was chosen because trends had indicated that public transport use was growing on average 5% each year since 1993 by the Brighton and Hove Bus Company, often referred to as a uniquely successful provider of public transport services (Butcher et al., 2015, Cairns et al., 2004). Regarding the sample size, the intention was for the study to obtain a minimum of 30 participants per location in order for the planned analysis based on the normal distribution (i.e. z tests and t-tests) to be valid as the sample size is no longer considered 'small' and sufficient for initial exploratory studies (Cohen, 1988). To avoid any issues with the post-data collection, it was planned to obtain around 45 completed scripts per location to account for any potential incomplete or abandoned questionnaires to ensure the minimum 30 was collected.

3.2.3 Justification of the mixed-methods

During the research process decisions were made regarding the methods that were adopted and this section explains a core decision point – the switch from empirical-analytical methods to an interpretative group of methods (Hammersley, 2008).

3.2.3.1 Initial research direction

The initial research direction was structured through the aims that the research sponsor, Southampton City Council, had as part of their own project;[8] in essence, to improve the quality of public transport services and travel information provision using hard infrastructure and soft behavioural measures (Rider, 2014). As part of that project, this research was involved in exploring the provision of present-day travel information provision and to develop smartphone application

[8] Working in partnership with other local transport authorities on a £7.3m 'blended' measures project.

to work alongside the other measures. This meant that the first year of the research included a collation of smaller scale investigations into mobile application functionality in Southampton and the literature review detailed above.

3.2.3.2 Rigour of piloting the intercept study

The rationale at this time was of an empirical nature and based on an unformed understanding of the concept of subject matter familiarity, which was explored in more depth later in the research. As a result, the intercept study encountered challenges that indicated a need for a more comprehensive look into subject matter familiarity, and evidenced that the intercept study was conducted too early in the research design as the literature review scope was initially too narrow. This meant that the piloting stage, including desk-reviews of the questionnaire design with colleagues and a test of the questionnaire in an intercept setting,[9] revealed issues with the questionnaire design and individuals' ability to make binary judgements of travel information use for familiar or unfamiliar journeys or quantify their familiarity empirically via a Likert scale.

The decision at that time was to continue with the intercept study but to incorporate reading the questionnaire out loud and observing the travellers' responses to the survey. This would enable the surveyors to feed back any arising concerns in administering the questionnaire and for the data collected in that location to evidence whether the survey should extend to the other planned locations. In total, four surveyors collected 32 completed scripts during the morning period (9 am – 11:30 am) and at the lunchtime review the surveyors reported that there were difficulties as the questionnaire was too long for an intercept study, an anticipated reason for a lack of participation (Kassabian, 1982). The feedback at that meeting also revealed that participants were rationalising their responses about subject matter familiarity with a 'yes/no' response rather than the intended Likert scales, instead rating in an arbitrary way.[10] A possible reason for this behaviour was that the participants were addressing the questionnaire in relation to their regular routines, and thus were thinking predominately of familiar journeys to judge their travel information use. This meant that it was harder for them to judge their ability in general or in relation to unfamiliarity, showing that the research at that point lacked clarity on travel information use as a skill. The intercept demonstrated that travellers were naturally able to think about information use through their

[9] Five colleagues independently reviewed the questionnaire design and wording submitting feedback which was addressed, then the modified script was used on campus intercepting staff, students and professionals working in nearby offices, completing 17 scripts.

[10] Rating it five on a 0-10 Likert scale, where ten in this example implied 'I have extensive knowledge'.

habitual pattern, but needed to be exposed to an unfamiliar trip demand to accurately judge their travel information use as a skill for that circumstance (Dunning, 2005).

3.2.3.3 Rationale to form mixed-methods using triangulation

The collated feedback and methodological options available demonstrated that the research was less about the causal relationship between variables, and more about a specific phenomenon – the ability to use travel information in either a familiar or unfamiliar trip planning context (Sale et al., 2002). This was confirmed when a basic investigation of information needs in relation to a skill brought out the fourth rule of citizenship from the literature, expressing the components of that skill; access to information and the interpretative abilities to apply that information accurately (National Consumer Council, 1977).

This meant that the mixed-methods approach came to the forefront as the most appropriate and able to draw the facts (either qualitative or quantitative) together to describe the intricate nature of a phenomenon, especially one influenced by varied contextual settings (Morse, 1994, Sofaer, 1999). Therefore, the mixed methods approach was selected, but was controlled using the triangulation method to set the precedent and approach for drawing the mixed methods together in a cohesive way. This meant that the initial research objectives agreed with the research sponsor needed to be adjusted to a more analytical stance towards travel information system ability in light of the traveller's skill, rather than to provide a practical travel information application, designed and developed through this research. This altered direction was accepted by the research sponsor, which supported the mixed methods approach by requesting that a prior focus group transcript data be used in the methodological triangulation.

3.2.4 Stage 2: Methodological triangulation using 'complimentary' information analysis

The strength of interpretative methods is the aim to draw out the meaning or rationality[11] that human subjects make in relation to a phenomenon, in this case how awareness of local public transport services influence the ability to use travel information effectively (USC Libraries, 2018). The approach that was used in this case was a mixed-methods triangulation, including:

- A more detailed literature review pertaining to the subject of familiarity and its subsequent link to comprehension;
- The use of past focus-group transcripts with fresh analysis about travellers stated views toward public transport use and information use; and

[11] The why, how or by what means.

- A contextual observation of in-trip travellers to observe revealed manifestations of pre-existing public transport knowledge whilst in transit.

The analytical procedure for these methods was to seek complementary information in the form of descriptive keyword terms (Hammersley, 2008), gathering them from the different methods that are considered an aspect of the overall subject and produce a more complete picture of the phenomenon (Hussein, 2009). The reason for selecting keyword descriptive terms was due to literature encapsulating specific characteristics about travellers' information-seeking behaviour into similar terms[12] (e.g. Schmitt et al., 2013, Schmitt et al., 2015) and that other literature uses keywords terms as a consistent approach for measuring the desirability of information systems from the user's perspective (Benedek and Miner, 2002). This meant that each source was reviewed according to a thematic analysis: (1) familiarisation with contents produced from each method[13] described separately; (2) generation of initial themes and keyword terms based on the first literature review; (3) searching for themes, linked to familiarity, stage of trip and preference, both abductively and deductively; (4) reviewing themes in relation to the keywords that link to them; and (5) defining themes and producing a report, or in this case consolidating the keywords into descriptions to summarise them (Silver and Lewins, 2014).

Alternative analytical procedures such as validity-checking, [14] indefinite triangulation [15] and triangulation as epistemological dialogue or juxtaposition [16] (Hammersley, 2008) were not selected because the research at that point needed a clearer picture of how an individual's awareness of local public transport services influenced travel information use as a cognitive ability or skill, and the manifestations of that ability either by application (contextual review) or awareness of that ability (focus groups). In regards to the analytical process, the thematic analysis was chosen. This meant that alternative approaches such as analysis of discourse, narrative enquiry, framework and grounded theory were not selected because some focused on how the story was told through the words used or to classify or order data into emergent interconnected themes which a thematic analysis approach also delivers (Silver and Lewins, 2014).

[12] Such as 'seeker' of that information or 'anxious' when there is a lack of clarity around travel information.
[13] The initial familiarisation and deductive/adductive analysis was conducted systematically; from literature review to focus group transcripts, and finally to the contextual review notes. This was to enforce a sense of importance behind the methods used and control the familiarity that the material would have in applying the common sense principles behind the analytical procedure.
[14] Rooting out threats to validity.
[15] Addressing accounts of the 'same' scene.
[16] Comparison of the positions each research method brings about the phenomenon.

3.2.4.1 Literature review

The first part of the triangulation included a broader literature review that collected insights from journal databases, library catalogues for subjects such as: (1) the travellers' rational decision making ability (e.g. reasoning, memory, judgement); (2) how information is used in that process (e.g. the stimuli, response, learning and recall); (3) choice architecture and information use (e.g. Theory of Planned Behaviour or Reasoned Action (TPB/TRA), NUDGE and Stages of Change (SOC)); (4) extension of the types of travel information and how information facilitates that need; (5) exploration of the fourth rule of citizenship as an emergent topic encountered post-intercept study; and (6) travellers' perceptions towards continued public transport use and fostering familiar public transport travel. This set of literature and the prior literature was the initial source material for the themes and keyword terms that were produced.

3.2.4.2 Focus group transcripts

The second part of the triangulation included the use of secondary data recommended by the research sponsor, Southampton City Council (SCC), which was in possession of existing focus group transcripts from 2013. This secondary data was collected for SCC by the Transport Research Group (TRG) which investigated the barriers to uptake of local bus services, and what factors might encourage or deter continued bus use by grouping regular users and infrequent users into separate focus group sessions.

Focus groups are an ideal method for expanding on subjects as they provide broader details about that subject compared to alternative methods such as a mail-back questionnaire (Lyons, 2006). However, they are limited to qualitative analysis and coding to allow for statistical inferences because of their open nature, allowing participants the freedom to discuss topics and follow new ideas (Oppenheim, 2001). This means that the moderator of a focus group is responsible for keeping the structure of the session, allowing freedom and managing group dynamics such as the dominance effect and collective unconscious that can skew the relevance of the focus group (Durkheim, 1982, Linstone and Turoff, 1975).

As the focus groups were conducted by members of the TRG, of which this research is also a part of, it was possible to have conversations with one of the moderators involved to gauge how these sessions were conducted and their design. The five transcripts (one pilot session and four main sessions) were formed of a sample of travellers who had previously participated in other TRG related travel surveys. For each session, 12 individuals were randomly invited to attend and around 7-12 participants managed to participate, a potential of 60 participants. The participants were split into two groups: those who regularly travelled by local public transport and those that

regularly travelled by private transport to accommodate Myside bias (Perkins, 1989, Barron, 2003). During each session, lasting 80-90 minutes, three points were discussed: the travellers' past and present travel behaviour; reasons for modal choice; and in light of recent local improvements in travel information (displays, apps, NFCs and smartcards) and buses, whether these initiatives would incentivise the traveller to make short distance local trips by bus. These transcripts formed qualitative data which was re-analysed in the triangulation by searching for the themes identified in the first analytical steps (familiarity, stage of trip and preference) both abductively and deductively, and then these themes were reviewed in relation to the keywords.

3.2.4.3 Contextual enquiry

The final part of the triangulation included a non-contact contextual review, a design-based research method that incorporates real-world perspectives by crossing the boundary of theory by actively observing and engaging the community or practice under investigation (Lave and Wenger, 1991, Barnes and Melles, 2007). This was conducted between October 2013 and March 2014. The structure of this contextual review was to observe traveller behaviour in-trip on weekday morning (6:30 am – 9:30 am) and evening peaks (3:30 pm – 8:30 pm) for three days per week, a total of 75 days by conducting trips in and around the Southampton area. This included the use of different modes (trains and busses) and providers.[17] The study was not set specific planned routes, but to freely travel within the bounds of Southampton and observe traveller behaviour at stops and interchanges or during transit by making notes of notable occurrences and emailing them to the researcher's university email address to capture the date and time of the occurrence. Such occurrences might include service disruption, travel enquiries to staff or travellers, and travellers spending long periods of time looking at in-trip information stimuli (real-time displays and printed information).

The main criticisms regarding the use of contextual reviews are that the observed context is typically defined by the researcher, subject to researcher bias, and that it is a loosely structured and not exhaustive at exposing all the contextual perspectives it seeks to address (Durling, 2002). To overcome these weaknesses the review was a part of a combined methodological approach and was the third element to be incorporated into the analysis process, meaning that its significance was lower than the other elements in the methodological triangulation. In addition to this, the structure and intent of the review was clearly defined and sought to observe the actions of travellers without interrupting their travel activities. The researcher's role was to monitor: (1)

[17] Trains from Southern, First Great Western and South West Trains; buses from Bluestar, Unilink and First Bus.

relevant conversations about topics that travellers in context are mindful of e.g. weather, service disruption and winter timetable changes; (2) evidence of travellers with a lack of travel information knowledge relevant to their journey and the anxiety or lack thereof because of that; and (3) the provision of travel information in terms of stimuli, accuracy or miss-information, and the coping strategies that travellers use when they lack the needed travel information.

These guidelines were to address the dearth of literature on these subjects and to carry out the observations to cover as many travel scenarios as possible. As the contextual review was 'non-contact', it was done covertly with no interaction with the observed travellers before, during or after the occurrence was noted. The only occasions where the researcher engaged with these travellers was when the traveller themselves engaged with the researcher to address a barrier they were facing, when advice and support was offered to the traveller the researcher tried to clarify whether the traveller had previously sought pre-trip information and whether they had conducted that trip previously. This happened on two occasions, and in both instances the traveller had not sought out pre-trip travel information and they had not done those trips previously. Regarding the number of travellers observed, as this was a six-month study it was not possible to accurately monitor the number of participants. However, annual public transport patronage figures for 2013/14 indicated that there were approximately 26,000,000 passenger movements on Southampton bus and train services during 2013/14 demonstrating an approximate observation sample of 5,342,466 travellers[18] (Southampton City Council, 2017, Rider, 2014).

3.2.5 Stage 3: Delphi (expert review)

The conclusion of stage two resulted in a conceptual foundation for a Traveller Planning Types (TPT) framework using the descriptions produced through the keyword terms thematic analysis. At this point in the research, The TPT framework proposed some assertions about the application of the fourth rule of citizenship and how effective action is encouraged or hindered through the stage of information use (either pre- or in-trip) and the traveller's ability to autonomously process travel information (familiarity/unfamiliarity). The first part of the research sought to build an understanding of traveller comprehension and how this influences or alters the term 'effective action'. Thus, the first research question (see Section 3.1) was formed to evaluate the accuracy of this subject and the TPT framework as a representation of that subject.

[18] Calculation based on an average annual patronage for bus and trains, 18 million and 8 million respectively (26 million) over 365 days (71,233 per day) for 75 observed days (5,342,466). **Granularity is set to a day level.**

As travel information comprehension is scarcely discussed in the literature, there were limited points of reference for research methods to address this issue. Therefore, the Delphi method – an expert review – was selected as it provided a clear basis for the evaluation being conducted (Janev and Vraneš, 2011). As a general rule, experts are familiar with the topic area and so there are concerns that they might empathise more with the descriptions of familiar travellers rather than those unfamiliar for the same reasons identified in the intercept study (Ireland et al., 2004). However, one of the keys to a Delphi study is that, although familiar with the subject, experts are still unlikely to have preconceived responses towards familiarity and unfamiliarity because they are also unlikely to have considered the research questions being asked, thus offering genuine views for each subject (Adler and Ziglio, 1996). The rigour of a Delphi study is in its execution, and the management and control of the different forms of bias through control measures such as using anonymity of feedback to reduce group conformity (Brown, 1968, Dalkey et al., 1969).

3.2.5.1 Controlling bias

This Delphi study applied many techniques to raise the researcher's awareness of participant bias and provide interpretative clarity to the analysis conducted after each of the three rounds, particularly round one. To control collective unconscious[19] and the dominance effect[20] (Durkheim, 1982, Linstone and Turoff, 1975), each expert provided their data separately and was given selected descriptive feedback that represented the collective group opinion to maintain anonymity. To control the individual biases shown in Table 3-4, the first round involved an initial one-to-one interview lasting about 30 minutes with the experts, where the questionnaire was read to them and allowing for discussion about the topic to reveal their opinion. During this interview period, the most observed forms of bias were myside bias, recency effect and attentional bias.

[19] The tendency to join popular opinion.
[20] The tendency to adopt the opinions of one usually very vocal member of the group.

Table 3-4: Examples of participant bias

Bias	Description	Source
Myside bias	The tendency to focus on one side of the subject and promote a favoured view.	(Perkins, 1989, Barron, 2003)
Attentional bias	The tendency to remember/perceive what was given attention.[21]	(Hallowell, 2009)
Confirmation bias	The tendency to interpret or remember things that align with beliefs/values.[22]	(Klayman, 1995)
Von Restorff effect or 'Negativity' bias	The tendency to remember only negative details relating to the subject topic and likely to skew the subject negatively.	(Krimsky and Golding, 1992)
Neglect of probability	The tendency to disregard the likelihood of specific subject's occurrence.	(Martin, 2006, Rottenstreich and Hsee, 2001)
Recency Effect	The tendency to focus on the occurrence of recent examples linked to the subject.[23]	(Hallowell, 2009)

The final forms of bias that were controlled were the contrast effect[24] and the primacy effect[25] (Bjarnason and Jonsson, 2005). As this research wanted to target information use as a skill and its link to familiarity, the questionnaire was designed to ensure that this topic was the first thing the experts reviewed.

3.2.5.2 Questionnaire design

The first part of the questionnaire asked the experts to review the four definitions for the stages of information use (pre- and in-trip) and the traveller's ability to autonomously process travel information (unfamiliarity and familiarity) along with the keywords that formed those descriptions. By forcing the experts to rate both the overall description and also to state their agreement to specific keyword terms that formed that description enabled the feedback to be more targeted to the cause for the ratings provided by the experts. As the purpose of an expert review is to critically evaluate or judge existing information about that subject for its accuracy (Cafiso et al., 2013, Currie and Hensher, 2008, Currie and Wallis, 2008, Scapolo and Miles, 2006, Janev and Vraneš, 2011).

The second part of the questionnaire design focused on the TPT framework as a representation of the themes outlined in the first part. Here, the experts were asked to review using a 10-point Likert scale the framework's clarity, interpretability, validity, relevance and to what extent they agreed that the framework represented those themes. A 10-point Likert scale was selected to allow for more differentiation than a smaller five or seven-point scale (Coelho and Esteves, 2006, Miller, 1956). This questionnaire remained consistent throughout each round of the Delphi study and after round one it was re-distributed via an online survey system to ease continued

[21] E.g. A woman not remembering where the male toilets are.
[22] E.g. hearing or seeing only the information that confirms individual beliefs.
[23] E.g. recalling a recent event where someone dealt with a familiar or unfamiliar trip.
[24] The tendency to judge the importance of a topic based on what preceded it.
[25] The tendency to unconsciously assign importance to the first stimuli or topic.

participation along with the relevant descriptive statistics as feedback (see Figure 3-3).

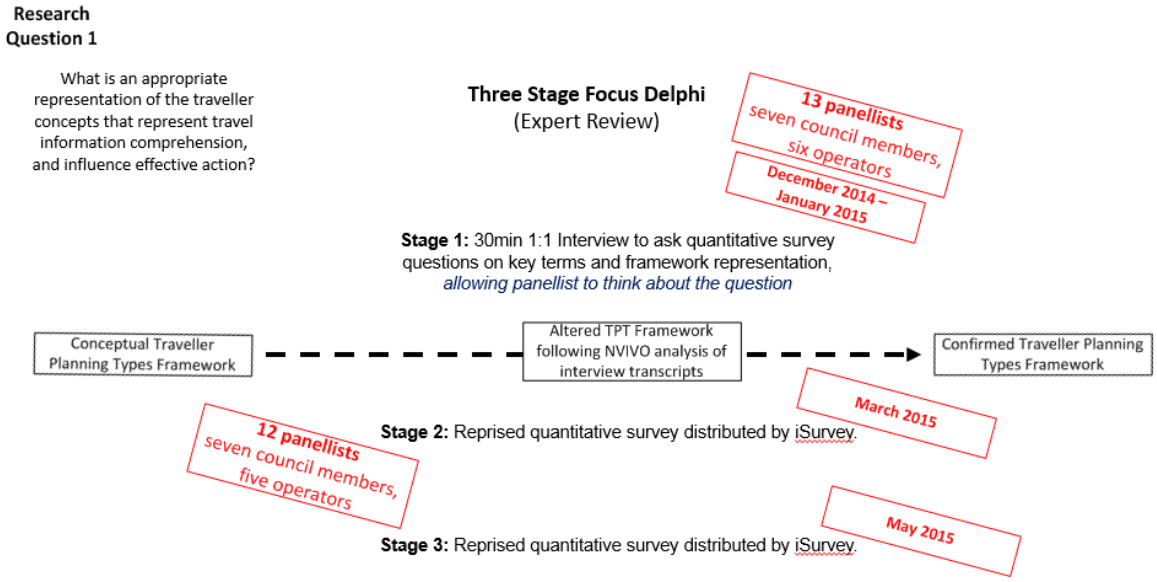


Figure 3-3: Structure of the Delphi Study

3.2.5.3 Expert panellists

The number of experts in a Delphi study is dependent on each expert's willingness to participate in a longer, multi-round study. In some cases, Delphi studies have been conducted with as few as three experts or as many as 171 because it is controlled by how many recognised experts there are on the subject and their availability (Okoli and Pawlowski, 2004). Similarly, the wide variation in participation is also linked to the fact that a Delphi study is not seeking a random sample from a population, therefore, the recruitment and sample size should not be considered from that standpoint (Magnuson, 2012).

In this instance, the aim was to get an equal representation of experts who meet specific criteria: (1) they were actively involved in the public transport travel information chain in Southampton, either as the owner of that information or being responsible for setting local public transport information policies that influence information distribution; (2) had sufficient time; and (3) a willingness to participate over an extended period of time. The experts were not selected randomly; the researcher selected them based on knowledge of the population following the contextual review, and thus applied purposive selection (Hasson et al., 2000). In round one, 13 panellists (seven council members, six operators) participated in the first round interviews. In rounds two and three, 12 participants (seven council members and five operators) reprised their role as an expert, providing their anonymous feedback via the online questionnaire.

The key limitation of a Delphi study is its reliance on the expert knowledge of the participating panellist members and the researcher has to reconcile the positives and negatives of this reliance

(Ireland et al., 2004). In the worst case scenario, the subject might be new or novel to the participating experts, that the experts prone to human error and misjudgement, or that the subject requires perspectives from a broad range of specialisms. In the best case, those that are directly responsible for the subject are most likely to accurately evaluate it as they have prior exposure to projects that are relevant to the subject matter. It was considered appropriate to use professionals from the travel information chain as they would have encountered and supported unfamiliar travellers through travel advice shops and telephone enquiries, and the familiar travellers who use their services on a regular basis.

3.2.5.4 Analysis

The analysis included both qualitative data from the first round interviews that were transcribed and quantitative data from 10 point Likert scales presented in the questionnaire. For the quantitative data captured during all three rounds, the range and central tendency scores were feedback to the panellists (see Figure 3-4). The qualitative data obtained from the transcribed one-to-one interview held with each expert during round one was cross-referenced with the findings from stage 2 to adjust the keyword terms. From this adjustment, the Traveller Planning Types (TPT) framework was also amended. The progression of those terms and the responses given are captured in Chapter 4, Table 4-9.

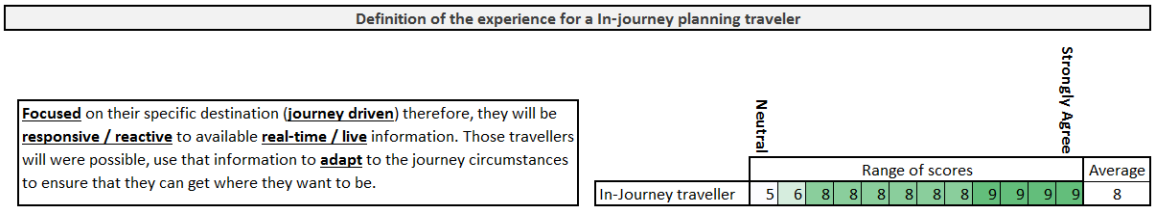


Figure 3-4: Feedback Example (Round 3 – In-trip journey planner type description)

3.2.6 Stage 4: Data Triangulation using 'indefinite triangulation' analysis

At this stage in the research, a series of methodological considerations were encountered and had to be accommodated to produce the desired insights about public transport travel information use as a skill. For example, the intercept demonstrated that travellers need to contextually experience the situation that requires travel information to think more flexibly about the skill, outside the boundaries of normal or familiar experiences. Similarly, when rationality and judgement are factors, as was the case with the Delphi study, different forms of participant and moderator bias had to be managed. Thus, it took a while to generate the right approach to bring these concepts together in a practical experiment that would address the gap identified.

Considerations were raised to the weekly TRG panel by presenting the findings of the prior research stages and the experiences from the contextual review. The outcome of this presentation was to use event-based research methods, such as witness testimonials and cognitive interviewing methods. After looking over similar mixed-methods and how they might apply in this case, the 'indefinite triangulation' analytical style which investigates accounts from the same scene or source, combined with the mixed-methods triangulation formed of different data sources was selected (Denzin, 1978, Hammersley, 2008). The scene that would be investigated was a selected set of travel IT systems that each participating traveller would judge based on the ease of planning a familiar and an unfamiliar journey and the general usability of the system in relation to forming effective action.

The example travel IT system that was used in this study was a journey planner defined as a multi-source and often multi-modal travel planning service that enables a traveller to query at any time or place (pre- or in-trip) a journey and see all the options for that journey (Spitadakis and Fostieri, 2012). Although the term 'effective action' includes the ability to take what is learnt in a pre-trip planning setting into the in-trip environment, this was not included in experiment. The study used three journey planners – Google Maps, MyJourney and Traveline South West – that would allow the participating travellers from Southampton to plan the two journeys.

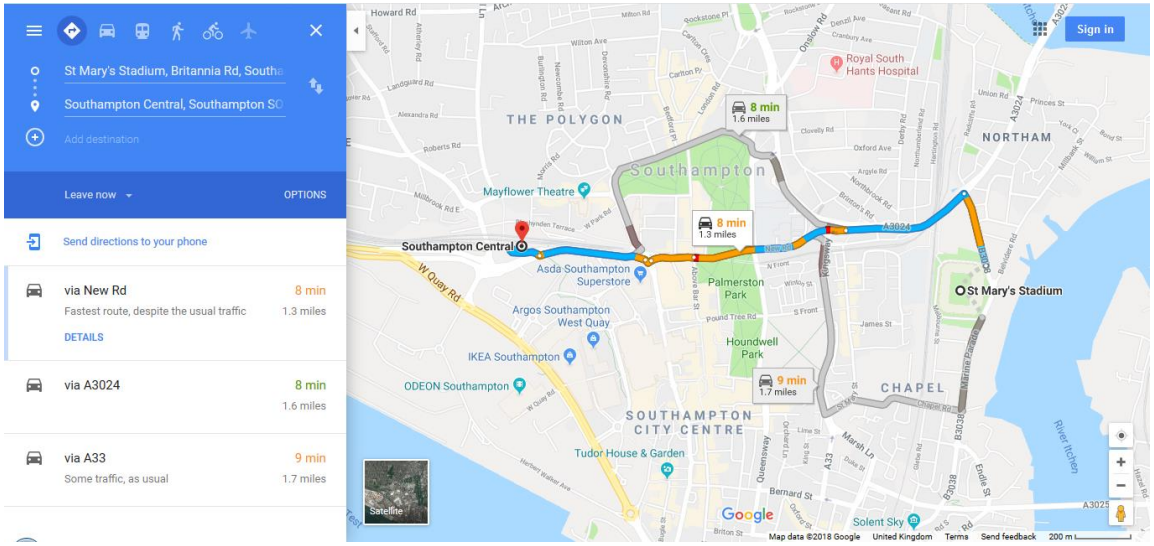


Figure 3-5: Google Maps initial solutions: Trip – St Marys Stadium to Southampton Central

The Google Maps online journey planner (see Figure 3-5) was selected for its prevalence among the tech-enabled community, reaching 41% of internet users worldwide in 2014 (Privat, 2014). Recent figures suggest that Google Maps exists on over five million websites and 46% of websites that use mapping technology (BuiltWith, 2017a, BuiltWith, 2017b, SimilarTech., 2017). However,

the most influential factor was Google's attempts to build user inclusivity. For example, Google popularised browsing the local environment with the introduction of responsive maps based on pre-rendered tiles that allowed the traveller the freedom to learn about their surrounding area (Sample and Ioup, 2010).

The second planner was Southampton City Council's 'MyJourney Southampton' (see Figure 3-6). This was selected because of the initiatives behind its conception, such as the desire to improve the traveller's local knowledge. Southampton City Council and the MyJourney team have spent the last five years investing in the continuous improvement of their technical solutions (Balfour Beatty, 2016), and reshaping the image of public transport information distribution through their legible city campaigns (Southampton City Council, 2008, Walker, 2010). As a result of their efforts, they won the prestigious 'Transport Local Authority of the Year' at the 2013 National Transport Awards (Discover Southampton, 2015) and more recently were awarded the V3 Technology Leaders Award in 2016 (Balfour Beatty, 2016). The MyJourney site itself sees reasonable activity from local travellers of up to 3,500 unique visits per month. Also, the MyJourney team noted that the most journey enquiries are made during the December-January period, potentially linking to seasonal effects raising new and unfamiliar journeys (Centre for Sustainable Travel Choices, 2013, Schmitt et al., 2015).

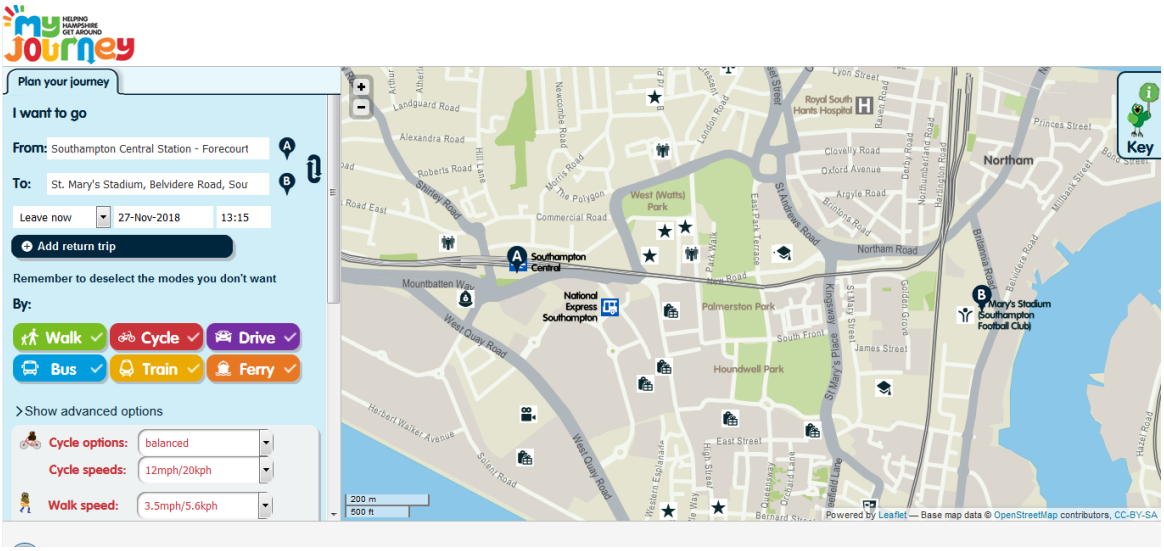


Figure 3-6: MyJourney initial solutions: Trip – St Marys Stadium to Southampton Central

Finally, Traveline South West's journey planner (Figure 3-7) was selected because MyJourney Southampton uses the regional open source data managed by Traveline as its data source (MyJourney Southampton, 2017). Traveline is an excellent example of the availability of open source data used by third-party providers to offer travel information in new and innovative ways,

as exemplified by its use in over 500 third-party apps and websites. It has also been used by local authorities and operators to run real-time information systems and increase general travel information publicity material at bus stops (Traveline, 2017).

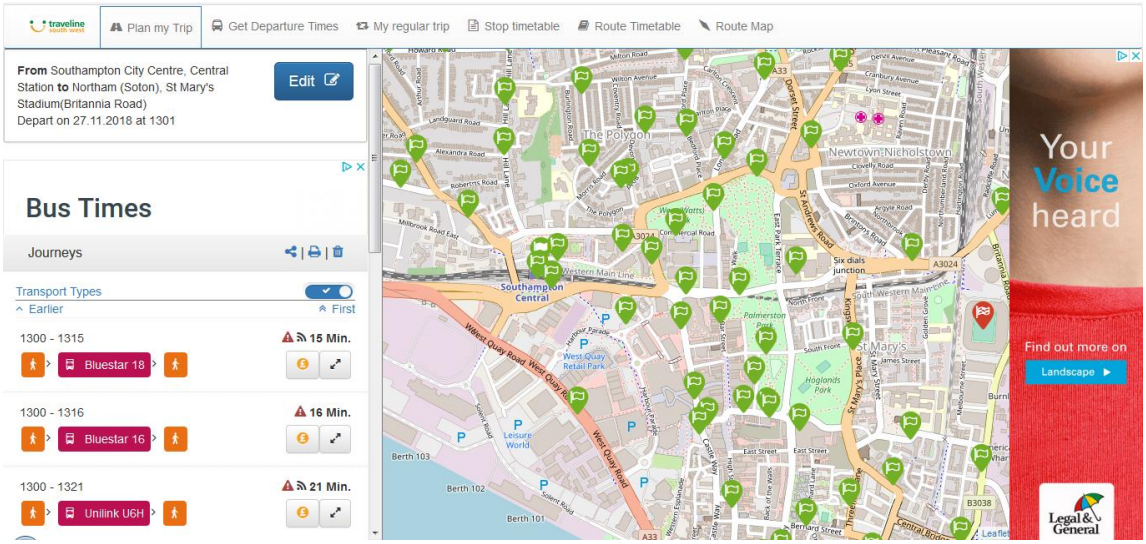


Figure 3-7: Traveline South West initial solutions: Trip – St Marys Stadium to Southampton Central

The journey planners were evaluated by using the 'data' triangulation approach to design a usability study and collect the users' opinions using qualitative autonomous views and interviews along with quantitative metric data collected from surveys or obtained by observing the users' interactions with the journey planner. This study included a 'naturalistic' observation of travellers' pre-trip travel information use with each planner, an accompanying set of quantitative questionnaires to measure information provision, and a post-planning interview to assess information recall.

A usability study is an evaluation of the extent that a product can be used to achieve the user's needs effectively, efficiently and to the desired level of satisfaction (ISO 9241-11). Usability studies are a widely recognised method for evaluating IT and a key part of its development lifecycle (Norman and Panizzi, 2006). There are two types of usability study: a formative study that evaluates the usability problems in a prototype, and a summative evaluation used to measure the performance of an existing product (Nielsen, 1993, Barnum, 2002, Capra, 2006). Therefore, a summative usability evaluation forms the basis for the data triangulation and centred on addressing research question 2 (see Section 3.1). This study was structured and analysed according to the usability measures defined by (Nielsen, 1993, p. 26 - 33) which are summarised in Table 3-5.

Table 3-5: Application of Nielson's Usability Measures in this usability study

Factor	Rationale	Application in this study
Learnability	The system should be easy to learn so that the user can rapidly start getting some work done with the system.	During the naturalistic observation, the traveller's journey planning activity was monitored using screen monitoring software and with cognitive interviewing method 'speak/think' aloud to observe the travellers learning process and workflow.
Efficiency	The system should be efficient to use, so that once the user has learned the system, a high level of productivity is possible.	During the analysis of the naturalistic observation, the length of time was recorded to assess the speed that the travellers felt satisfied they possessed enough knowledge to conduct that journey.
Memorability	The system should be easy to remember so that the casual user is able to return after some period of not having used it, without having to relearn everything.	This factor was the most important aspect to the study and memorability in this case was measured by what relevant travel information a traveller could remember (either through knowledge, or learnt during the planning tasks in the naturalist observation stages of the study) as this is the role of a journey planner. This detail was drawn out from the user during the post-planning interview using cognitive interviewing method, probing.
Errors	The system should have a low error rate so that users make few errors during the use of the system, and so that if they do make errors, they can easily recover from them. Further, catastrophic errors must not occur.	During the naturalistic observation, the travellers journeys captured using screen monitoring software were reviewed for evidence of error and its impact on the traveller.
Satisfaction	The system should be pleasant to use so that users are subjectively satisfied when using it; they like it.	During the post-planning interview the traveller's views about the journey planners ease of use was discussed by drawing out the main strengths and weaknesses they felt during the activity.

To conduct this usability study, 30 participants were randomly selected by email invitation from a pool of travellers who had previously attended Southampton City Council roadshows or TRG-related travel surveys. The sample size of 30 participants was decided on based on the extensive nature of the usability study, the amount of time the participants were required to participate,[26] and the level of analytical effort required as this study was planned, conducted and analysed by a single researcher. The sample was made up of an equal number of male and female participants, and the participants were equally split between three age groups (under 30, 30-49, 50 and over). Each participant was incentivised with £10 per journey planner reviewed. The intention was to obtain 30 participants to run quantitative analysis tests, a figure higher than the minimum 12

[26] Three sessions lasting 45 minutes, and an extra 30 minutes for survey administration including intro/outro questionnaires and complying with ethics procedures by confirming participants agreement to participate and their data to be collected.

participants needed to identify 98% of usability problems (Fu et al., 2002, Cohen, 1988). This was also considered a sufficient sample size because of the repeated nature of the study and that it observed 30 participants who collectively planned 90 familiar and 90 unfamiliar trips (Morse, 1994, Morse, 2000).

For the participant, the study was structured into three main activities per journey planner as described in Figure 3-8. The first two activities incorporated the 'naturalistic' observation and set of quantitative questionnaires to measure information provision which formed the journey planning activity part of the study. For the unfamiliar trip, the traveller was provided with a randomised trip that needed to be planned from one of the nine possible unfamiliar trip routes, (see Table 3-6). The traveller was instructed to plan that trip until they were satisfied or confident that they could conduct that trip, and if time remained in that activity time slot (10 minutes), they were asked to answer the provided information provision questions related to unfamiliar travel information needs.

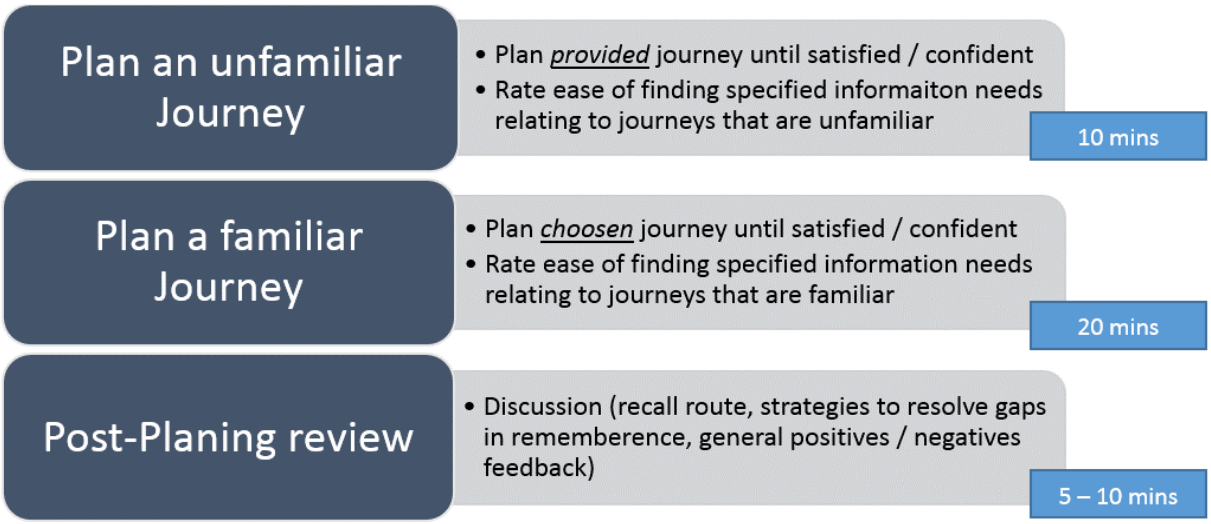


Figure 3-8: Usability study activity plan

For the familiar trip, the traveller was asked to choose a trip that they know and conduct regularly and follow the same structure as before. If time remained in that activity time slot (20 minutes), they were asked to answer the information provision questions related to general and familiar information needs. After the planning activity was completed, the website was closed and the traveller had a short 5-10 minute discussion with the researcher.

Table 3-6: The perscribed and randomised sets of unfamiliar trips

Work	Southampton Central train station → St Marys Stadium (***conference***) Home[27]→ Debenhams (***workplace***) Home → Southampton Airport (***business trip***)
Leisure	Home → St Marys Stadium (***Football/Event***) Home → Queen Elisabeth II Cruise Terminal (***cruise***) Home → Mayflower Cruise Terminal (***cruise***)
Medical	Home → Royal South Hants Hospital Home → University Hospital Southampton Home → Princess Anne Hospital

3.2.6.1 Usability observation

The first method used in the data triangulation included a 'naturalistic' observation of the traveller's use of the selected journey planners by letting them interact with the interface, navigation and information design and discover the journey planner's ability to facilitate journey-related travel information needs. The researcher sat in silence behind the participant out of their line of sight and did not offer advice or correct them if they encountered issues (Garrett, 2002, Nielson Norman Group (NNG), 2016). This was conducted twice per journey planner, producing an observation of one planned familiar trip and one planned unfamiliar trip. The observation itself was structured using two approaches: on-screen monitoring using Camtasia and cognitive interviewing methods capturing what the traveller saw, said and did.

The travellers were required to conduct the journey planning activity on campus using the lab computer running Camtasia, an audio/visual recording application designed to record what the participant sees on screen. It recorded the time spent on specific journey planning tasks, non-verbal cues (e.g. frustration) and the traveller's information processing (Chaney et al., 2013). When the traveller reached saturation or the confidence necessary to conduct the journey, they were directed to the questionnaire that focused on the journey planners travel information

[27] The home address was chosen at random as Sandell Court, SO16 3PH.

provision. This part of the study enabled the researcher to assess the journey planner's workflow and understand how it supports the traveller to build a mental picture of where they are and what they can do to plan their trip (Garrett, 2002).

Camtasia also had the ability to capture audio content, which enabled the cognitive interviewing method 'speak/think' aloud to be used and the information processing to be monitored through verbatim dialogue (Bull, 2013). This allowed for additional qualitative data to be collected that described what information the traveller was processing and how they thought about the journey in relation to personal knowledge (Collins, 2003). The use of verbal processing is a particularly valuable cognitive interviewing technique that enables researchers to better understand how the participants understood or interpreted the activities and questionnaires (Dillman, 2000). The 'speak/think' aloud process is also participant-driven as it draws the interviewer's attention to subjects that are of more interest or concern to the participant, reducing interviewer bias (Chaney et al., 2013).

Finally, to mitigate the results demonstrating efficiency, such as learning effects through exposure and continued participation in a longer study, certain aspects of the trial were deliberately randomised and controlled (see. Wright, 1936, Wu and Sun, 2006, Guo, 2016, Shochi et al., 2016, Kami and Sagi, 1993, Batt and Gallino, 2017).

Table 3-7: Trial Ordering – Randomized Journey , trip and full address

	Session 1					Session 2					Session 3				
	Tool	Type	Unfamiliar Journey			Tool	Type	Unfamiliar Journey			Tool	Type	Unfamiliar Journey		
1	My journey	Business	Soton Central	St Marys Stadium	With	Traveline	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
2	Google Maps	Business	Soton Central	St Marys Stadium	With	My journey	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	Without	Traveline	Medical	Sandall Court	Princess Anne Hospital	With
3	Traveline	Business	Sandall Court	Soton Airport	Without	Google Maps	Leisure	Sandall Court	St Marys Stadium	With	My journey	Medical	Sandall	Princess Anne Hospital	With
4	My journey	Business	Sandall Court (home)	Soton Airport	With	Traveline	Leisure	Sandall Court	St Marys Stadium	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
5	Google Maps	Business	Sandall Court	Debenhams	With	My journey	Leisure	Sandall Court	Mayflower Cruise Terminal,	Without	Traveline	Medical	Sandall Court	Royal South Hants Hospital	With
6	Traveline	Business	Sandall Court	Debenhams	Without	Google Maps	Leisure	Sandall Court	Mayflower Cruise Terminal,	With	My journey	Medical	Sandall Court	Royal South Hants Hospital	With
7	My journey	Business	Soton Central	St Marys Stadium	With	Traveline	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
8	Google Maps	Business	Soton Central	St Marys Stadium	With	My journey	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	Without	Traveline	Medical	Sandall Court	Princess Anne Hospital	With
9	Traveline	Business	Sandall Court	Soton Airport	Without	Google Maps	Leisure	Sandall Court	St Marys Stadium	With	My journey	Medical	Sandall Court	Princess Anne Hospital	With
10	My journey	Business	Sandall Court	Soton Airport	With	Traveline	Leisure	Sandall Court	St Marys Stadium	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
11	Google Maps	Business	Sandall Court	Debenhams	With	My journey	Leisure	Sandall Court	Mayflower Cruise Terminal,	Without	Traveline	Medical	Sandall Court	Royal South Hants Hospital	With

	Session 1					Session 2					Session 3				
	Tool	Type	Unfamiliar Journey			Tool	Type	Unfamiliar Journey			Tool	Type	Unfamiliar Journey		
12	Traveline	Business	Sandall Court	Debenhams	Without	Google Maps	Leisure	Sandall Court	Mayflower Cruise Terminal,	With	My journey	Medical	Sandall Court	Royal South Hants Hospital	With
13	My journey	Business	Soton Central	St Marys Stadium	With	Traveline	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
14	Google Maps	Business	Soton Central	St Marys Stadium	With	My journey	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	Without	Traveline	Medical	Sandall Court	Princess Anne Hospital	With
15	Traveline	Business	Sandall Court	Soton Airport	Without	Google Maps	Leisure	Sandall Court	St Marys Stadium	With	My journey	Medical	Sandall Court	Princess Anne Hospital	With
16	My journey	Business	Sandall Court	Southampton Airport	With	Traveline	Leisure	Sandall Court	St Marys Stadium	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
17	Google Maps	Business	Sandall Court	Debenhams	With	My journey	Leisure	Sandall Court	Mayflower Cruise Terminal,	Without	Traveline	Medical	Sandall Court	Royal South Hants Hospital	With
18	Traveline	Business	Sandall Court	Debenhams	Without	Google Maps	Leisure	Sandall Court	Mayflower Cruise Terminal,	With	My journey	Medical	Sandall Court	Royal South Hants Hospital	With
19	My journey	Business	Soton Central	St Marys Stadium	With	Traveline	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
20	Google Maps	Business	Soton Central	St Marys Stadium	With	My journey	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	Without	Traveline	Medical	Sandall Court	Princess Anne Hospital	With
21	Traveline	Business	Sandall Court	Soton Airport	Without	Google Maps	Leisure	Sandall Court	St Marys Stadium	With	My journey	Medical	Sandall Court	Princess Anne Hospital	With
22	My journey	Business	Sandall Court (home)	Soton Airport	With	Traveline	Leisure	Sandall Court	St Marys Stadium	With	Google Maps	Medical	Sandall Court	University Hospital Southampton	Without

	Session 1				
	Tool	Type	Unfamiliar Journey		
23	Google Maps	Business	Sandall Court (home)	Debenhams	With
24	Traveline	Business	Sandall Court (home)	Debenhams	Without
25	My journey	Business	Soton Central	St Marys Stadium	With
26	Google Maps	Business	Soton Central	St Marys Stadium	With
27	Traveline	Business	Sandall Court (home)	Soton Airport	Without
28	My journey	Business	Sandall Court (home)	Soton Airport	With
29	Google Maps	Business	Sandall Court (home)	Debenhams	With
30	Traveline	Business	Sandall Court (home)	Debenhams	Without

Session 2				
Tool	Type	Unfamiliar Journey		
My journey	Leisure	Sandall Court	Mayflower Cruise Terminal,	Without
Google Maps	Leisure	Sandall Court	Mayflower Cruise Terminal,	With
Traveline	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	With
My journey	Leisure	Sandall Court	Queen Elizabeth II Cruise Terminal	Without
Google Maps	Leisure	Sandall Court	St Marys Stadium	With
Traveline	Leisure	Sandall Court	St Marys Stadium	With
My journey	Leisure	Sandall Court	Mayflower Cruise Terminal,	Without
Google Maps	Leisure	Sandall Court	Mayflower Cruise Terminal,	With

Session 3				
Tool	Type	Unfamiliar Journey		
Traveline	Medical	Sandall Court	Royal South Hants Hospital	With
My journey	Medical	Sandall Court	Royal South Hants Hospital	With
Google Maps	Medical	Sandall Court	University Hospital Southampton	Without
Traveline	Medical	Sandall Court (home)	Princess Anne Hospital	With
My journey	Medical	Sandall Court (home)	Princess Anne Hospital	With
Google Maps	Medical	Sandall Court (home)	University Hospital Southampton	Without
Traveline	Medical	Sandall Court (home)	Royal South Hants Hospital	With
My journey	Medical	Sandall Court (home)	Royal South Hants Hospital	With

This produced a series of both qualitative and quantitative data that expressed the traveller's user experience and cognitive processing actions as they planned the trips. The qualitative analysis produced 180 video logs, audio logs and transcripts for all the planned trips to identify errors in entering and retrieving information related to the planned trip, and how each journey planner handles the communication and coordination of the journey planning processes (Garrett, 2002). This was then examined for specific quantitative data such as elapsed time for specific stages of the journey planning activity: the time confidence was declared, routes investigated, modes considered, and other factors using the repeated measures ANOVA procedure (Salkind, 2016).

3.2.6.2 Questionnaire

In some usability studies, a quantitative questionnaire can be a part of the test plan and it is normally run before, during and after the study to capture specific insights about the individual and the systems under evaluation (Usability.gov, 2016). This study included three questionnaires and they were run during each of the typical stages.

The first questionnaire administered prior to the review of the selected journey planners aimed to identify the travellers' prior travel information use and their exposure to the selected journey planners, which is consistent with a questionnaires administered at this stage of a usability study (Usability.gov, 2016). This questionnaire had some questions that were included in the initial intercept study, for example the first part included the same demographic questions, travel options questions and travel behaviour questions from the intercept study. The second part focused on the methods by which travel information is distributed and the circumstances in which a traveller would seek that travel information, also included in the prior intercept study. The final part focused on the journey planners, such as prior use, frequency of use, and whether it satisfied their travel information needs. The data captured during this survey was used as some of the ANOVA factors used along with the mined data from the usability observation and the second questionnaire.

The second questionnaire administered during the usability study aimed to address research question 2 by providing the scale in which 'to what extent' would be measured. Typically, a questionnaire in a usability study will ask the participant questions related to the ease of the task (Usability.gov, 2016). In this study, ease was assessed in finding specific travel information (see Table 3-8).

Table 3-8: Collated informaiton points travellers require travel IT systems to provide.

		Construct	Information needs that from that construct
Evaluated after planning an unfamiliar journey	**1**	Basic information needs (reduced wayfinding ability)	Ability to support the traveller with reduced ability covering; finding routes, times to travel, interchange information, ticketing, interpretability of information.
Evaluated after planning a familiar journey	**2**	Basic information needs (significant wayfinding ability)	Ability to support the traveller with significant wayfinding ability covering; findings first/last service, the frequency of services, operator ticketing restrictions, ways to pay, journey time and cost comparisons.
	3	Advanced information needs	The ability for the information to be personalised to a traveller's personal needs covering; local area mobility, disability, facilities and comfort.
	4	Information presentation styles	Methods of presenting travel information to travellers covering; breakdowns, comparisons and viewing the information in the way that matters to the traveller.
	5	Information reliability	Presenting the future reliability of travel information covering; relevance of offered information, the reliability of offered information and representative of the real environment.
	6	Methods to support decision-making	Supporting the cognitive style of travellers making a choice covering; applying preferences and settings, comparisons and recommendations.

These information needs were reviewed by the traveller when they had completed the trip-planning activity and had declared their confidence in the allotted time. In this questionnaire each information need was reviewed by the participant for: the ease of finding, and the importance of providing that information point, using a five-point Likert scale. This decision was made because of the number of items to be rated was large and that Likert scales of a larger size can decrease reliability because of increased variability, and in this study reliability was important (Coelho and Esteves, 2006). The data was used to produce a composite score, and the average of all scores collected.

The final questionnaire administered after all three journey planners had been reviewed aimed to capture the participants' ease of use, satisfaction and the likelihood of using that journey planner in the future (Usability.gov, 2016). The data was used as an indicator of the travellers' overall view of the journey planner's utility and all their observations were compared to this final outcome.

3.2.6.3 Interviews

The final method used in the data triangulation included a 5-10 minute discussion with the traveller after they had completed both familiar and unfamiliar trips on a journey planner. This discussion got the traveller to recount all the details they could recall about both planned trips and to judge whether their present understanding of that trip (either through familiarity or learnt

through the planning activity) was sufficient for conducting that trip without further travel information intervention. This interview also used cognitive interviewing techniques, verbal and judgement probing to draw out the traveller's source of recall (Willis, 1994). The purpose for this discussion was to question the traveller's CBR, discussed in the following Chapter, suggesting that cognitive processes related to the storage and retrieval of travel information is influenced by strong associations to that trip and that the point of learning important travel information was optimal (Fisher and Geiselman, 1992, Dillman, 2000, Deffenbacher, 1980). For example, if the traveller had to pay attention to non-relevant peripheral information at the same time that important travel information was offered, the encoding of the relevant information in memory could be affected and be the cause of their difficulties in reliably retrieving that information in-trip (Broadbent, 1957). This is because individuals are typically limited to devoting their conscious processing to one information-producing activity at a time (Fisher and Geiselman, 1992) and multitasking activities increases the likelihood that mistakes will occur and inaccurate information will be processed, encoded and stored (LaBerge and Samuels, 1974). This aspect of the study was a key indicator of the journey planner's ability to efficiently support the traveller in understanding the trip options that they were given according to the usability measures. The last part of the discussion then turned to addressing the gaps in knowledge by getting the traveller to judge the sufficiency of their recall and what other sources they would use if they felt they needed more information before conducing that trip. This was to identify the long term relevance of information learnt through a journey planner, and how this fits in with the overall journey planning activity.

3.3 Outcomes of the research frame: usability guidelines supporting traveller's travel information needs.

All aspects of this research, as well as the findings from all parts of the usability study were collated into a series of best practice and areas of improvement relating to the way that travel IT should support the travellers travel information comprehension needs. The guidelines that were produced aimed to improve travel IT, specifically a journey planner, and provide travellers with the information and support that they need when planning a familiar or unfamiliar trip demand.

Chapter 4. The travellers' ability to use travel information effectively

This chapter sets out a key part of the research narrative: the traveller's ability to autonomously use travel information because of familiarity and exposure to local travel information. It begins by discussing the need for additional travel information, and then the effects of depending on different information sources. It then examines the balance between external and internal information.

4.1 The demand for external travel information systems to make travel-related decisions

The identification of a new journey demand will often prompt a traveller to make some travel-related decisions that lead to an action. This will also identify whether the traveller is in need of additional travel information, and is described as goal-directed decision making (Hansson, 1994). The identification of information is determined by historical experiences that the individual can draw on to produce a new solution to the new situation (Kolodner, 1993). This is followed by an evaluation of the gaps in knowledge due to a lack of exposure to similar types of situation (Berger and Luckmann, 1966). For example, a car driver without access to a car may have limited experience of public transport alternatives when needing to make a journey (Moutinho, 1987). The traveller will attempt to evaluate available travel information both internally from past exposure, and externally via travel information distribution sources (see Chapter 2). This balance between what information is held internally and what information is sought through external means is influenced by situation-led requirements and the individual's specific criteria or preferences (Gursoy and McCleary, 2004). According to Alexandra (2013), travel agents supporting tourists planning a trip will take into account this internal/external balance and tailor how new travel information should be offered to the traveller. Swarbrooke and Horner (2007) suggests that external knowledge is gained through available information sources in the travel environment, information obtained from the destination (e.g. routing suggestions) and word of mouth recommendations from trusted friends and family.

The process of forming a travel-related action is dependent on the individual's ability to perceive and understand the system in question to form an effective action and, where this is lacking, the necessary support to form that action through the provision of additional information (National Consumer Council, 1977). The traveller's ability to from a response to a new travel demand is linked to the balance between the internal knowledge they possess and external travel information that they can understand, and is managed within the confines of their cognitive ability. Neisser (1976) opined that individuals are more sensitive to this balance or 'anticipatory

schema' as they actively and selectively search for relevant information to respond to the new demand, exposing their lack of compression in the process. The anticipatory schema is formed on information either learnt through repetition (habituation) or accessible in that environment (Berger and Luckmann, 1966).

The process of enhancing internal knowledge can be expressed in the way that an individual learns a language via social cues (external input), and that it stimulates a specific response to those cues. Schneider et al. (2015) explained that the individuals would respond to external input cues using self-referencing by referring to their own mental representation of the situation to generate their response. Successful referencing requires the individual to have past experiences or personal understanding of that subject and the nuances that relate to the specific stimuli providing the input. Schneider et al. (2015) also suggest that self-referencing helps the individual make sense of or cope with a situation by exploiting solutions that previously worked well and avoiding past mistakes. In cases where the internal foundation is limited, the individual will increase their reliance on external sources to address the identified knowledge gaps, and attempt to strengthen their internal foundation to conduct the action effectively. Caiafa (2010) suggests that travellers store and retrieve knowledge about the transport environment based on past travel examples, such as prior successful and unsuccessful travel experiences, or successful and unsuccessful use of external travel information sources. These examples lead to the assumption that travellers' travel information use is goal-directed and shaped based on the described internal schema.

4.1.1 Applying case-based reasoning (CBR)

CBR captures past cases that were personally experienced as the prototype for producing new solutions and is a strong method in decision theory, as people naturally want to go out of their way to avoid past mistakes (Kolodner, 1993). In cases where situations reoccur with regularity, as is the case with repeated 'daily' travel patterns, there is a greater likelihood of retrievable examples to access when new or uncommon trip needs arise (Alterman, 1986a). However, according to Bovy and Stern (1990), habituation can still be limited to a select portion of the overall transport network, and services that the traveller actively uses within that network, typically around their home and places of activity. This means that a traveller may struggle to construct personalised travel plans autonomously outside habituation because of the lack of cases that are in memory (Mc Ginty and Smyth, 2001, Berger and Luckmann, 1966). The ease of recalling past examples to form a new solution is limited by the individual's understanding of the new situation's requirements (Kolodner, 1993), reduced experience based examples (Bovy and Stern, 1990), indexing difficulties affecting storage and retrieval due to emotional state (Fisher and Geiselman,

1992) and the level of attention that the individual gave during the past example (Shepard, 1964, Shepard, 1974). The indexing, storage and recall of examples are often easiest when the situation is particularly memorable and different from what was normally expected (Fisher and Geiselman, 1992). Cases that correspond to situations that occurred as expected are typically stored and used to produce one composite generalisation of what is normal, blending minor alterations into one specific generalisation (Kolodner, 1993). Techniques that support decision making will need to strongly emphasise what is normally expected, whilst also identifying what is expected to deviate from this to anticipate how those experiences become encoded in internal memory (Tversky and Gati, 1978).

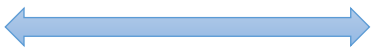
Shepard (1964) explained that attention governs the perceptual features of examples that are stored and extracted from memory. The problems affecting recall are linked to which aspects of a situation the individual paid attention at the time of capturing and encoding that experience. Jones (2001) stated that our attentional processes are very much affected by emotion, and what an individual is feeling influences how that memory is encoded, which means that it will often go beyond simple encoding from the clinical perspective (Fisher and Geiselman, 1992). When strong emotions such as anxiety are present, the recollection of case examples will be affected by the deficit of attention and the focus on the aspects that induced the anxiety (Caiafa, 2010, Schmitt et al., 2015).

Jones (2001) also suggested that the recall of information is not always drawn rationally and that the process of sorting relevant and irrelevant examples in memory is affected by the individual's emotional state and the detail available in the affected memory. According to Simon (1996), the individual has to focus on information and interpret it at the same time, which can lead to information overload. Simon (1996) also states that overload can be caused by the individual's ability to maintain focus, a scarce resource, rather than the abundance or lack of available information. Neisser (1976) implied that the process of seeking and processing information leading to effective action would use information attainment and experience to update, alter and adjust the mental schema held by the individual. Part of this is the individual's interpretability capabilities and ascribing meaning to information that has been attained, encoded and used for retrieval. This interpretability is linked to the individual's value system and beliefs about the world that the information relates (Lloyd, 1976). Hommel et al. (2001) suggested that the mental schema is used when an input is received that requires an action, such as an imminent trip requiring travel from one location to another. The process that the schema activates is based on specific perceptions attributed to that action, such as the presence of strong positive or negative

associations to travel or aspects of travel choice (Morris et al., 2002). This perception of action is driven by the previous experience, and past experience and familiarity with that subject plays an important role in influencing choice. Hommel et al. (2001), also suggested that the individual will attempt to match their perceptions of past experiences or solutions to produce the best possible outcomes; thus a traveller will match their beliefs and experiences to the new situation – an imminent trip – and will construct a journey plan from what was shown to be the best travel route. Where this foundation of experience is lacking, the traveller will have exposed weakness in their mental schema and will struggle to recall successful examples to help plan the trip. Therefore, familiarity with the public transport network is the strongest link to the traveller's ability to form an action.

As no two travellers have the same travel experiences, the foundation for CBR will naturally vary (Transport for London, 2009, Fisher and Geiselman, 1992). As shown in Table 4-1, the range of recall goes from direct recall of details and emotions (remembering) to no solid foundation for the items recalled, and instead draws piecemeal elements by linked associations (guessing). Therefore, it is likely that the individual will express a sense of confusion and uncertainty when there are many gaps they are able to identify in their recall of information when that information matters (Chaney et al., 2013).

Table 4-1: Analysis of the range of recall (Moran and Goshen-Gottstein, 2015, Schmitt et al., 2015)

Remember	Knowing	Guessing
Remembers specific details and the feelings it invokes	Lacks recall, but residual awareness is present	No solid or residual memory (association)
Significant grounds for ability due to exposure/experience, thus responds personally or internally.		**Reduced grounds for ability and reliant on support from external means**
e.g. more is known		**e.g. more is unknown**

Travellers may struggle with specific recall after attempting to plan journeys where their reliance has been on external support versus internal experience as there is no link with real transit experience (Mitsche, 2016). The process of attaining information for the purpose of recall may also be affected by the presence of peripheral information at the time relevant information was being encoded in memory, thus interrupting the flow of reliable storage and retrieval (Broadbent, 1957). Generally, individuals are only capable of devoting their consciousness processing to one information-producing activity at a time (Fisher and Geiselman, 1992). If the individual finds that one or both multitasking activities producing important information is unpractised (e.g. unfamiliar), then the likelihood that mistakes will occur increases, and that inaccurate information will be captured, processed and stored (LaBerge and Samuels, 1974). Deffenbacher (1980)

described how optimal conditions of information attainment – that allowing ease of identification of information – enables individuals to encode information for easier retrieval at a later point. CBR is typically applied to recommender systems that attempt to direct travellers through the learning process by offering prescribed examples to match their journey requirements (Mitsche, 2016). These systems are often found in travel and tourism and to assist tourists through the early stages of holiday planning in an unfamiliar environment (Loban, 1997). These systems are designed to offer counselling and knowledge-building by interpreting travel needs as expressed in journey preferences (Hruschka and Mazanec, 1990).

Recommender systems can assist in the gathering of knowledge about unfamiliar tourism locations (Mitsche, 2016), but their key weakness is that they lack information about the travellers using the system and their specific needs and lack the experiential memory imprint that allows them to recall and reuse that knowledge. This knowledge is required in the travel environment when the in-trip environment stimuli link to that experiential memory (Fisher and Geiselman, 1992). These systems employ a collective history of past user experiences in parts of the tourists' journey planning (e.g. hotel bookings, restaurants and places to visit). They incorporate a user-centred design by accommodating established user experience into the information system (Ricci et al., 2002, Ricci, 2002). Moseder (2014) suggests that, whilst such systems offer a wealth of information to travelling tourists, they can expose their users to information overload, reducing their effectiveness.

4.1.2 Effects of current public transport trends

The key premise behind successful self-referencing using CBR is that the individual has had sufficient exposure to aspects of the transit network to build up their internal knowledge. As use of public transport has been particularly low in recent years, there is increasing likelihood of reduced public transport knowledge among travellers and some will be reliant on external support. For example, trip rates observed between 1995 and 2014 demonstrated that the local bus service outside of London decreased by 18%. Alternative options for travel present a different picture as demonstrated by increased growth for rail and buses inside London (67% and 45% respectively) (Department for Transport, 2014b). The observed decline in bus service use outside London is not linked to increased use of private transport, as both driver and passenger trip rates also decreased over the same period. The observed decline in all modes, bar rail and London services suggest that initiatives such as car share schemes might not produce the increase in-trip rate uptake that they are designed for (Sloman et al., 2010). People appear to be opting out of travel, and this may be evidence of a change in the way that people work. Some previous would-

be commuters may have switched their behaviour to teleworking and teleconferencing through the increase and stability of technology to enable such a working lifestyle (Cairns et al., 2004). This is demonstrated by a decrease in the number of commuting trips by 18% (Department for Transport, 2014b). In addition, some would-be shopping travellers may have chosen home deliveries, exchanging their trips with the freight and logistics industry (Cairns et al., 2004). This has also been demonstrated by a decrease in the number of shopping trips by 24% (Department for Transport, 2014b). Further influences affecting travellers' reasons for travel and building travel experiences is a decline in social outings such as visiting friends and family members, also down by 28% (Department for Transport, 2014b). This produces a significant shortfall in experience and exposure when it comes to planning journeys. One element that can be drawn out from the trends is the locality of services (see Figure 4-1).

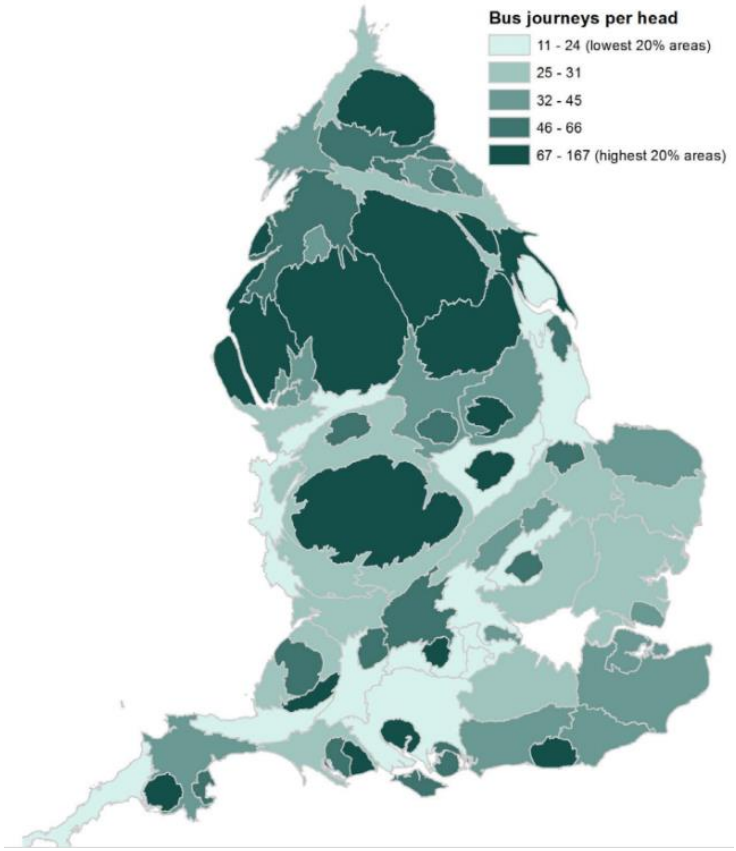


Figure 4-1: Bus use (trips) per head of population by local authority outside London, 2013/14 (Department for Transport, 2014b)

Figure 4-1 shows a heat map of trips per head of the 'regional' population which visualises the regional variance of bus use across the UK and demonstrates that certain areas of the UK have increased exposure to and learning about public transport operations, providing more recallable cases. According to this figure, the level of local uptake depends largely on different types of

settlement. For example, the population in the north is much more likely to be city-based and thus promote an urban travel profile. By comparison, the south (except for key areas such as Plymouth, Bristol, Reading, Bournemouth, Southampton and Brighton as highlighted on the map) present a more dispersed or rural travel profile. This means that travellers in the south will have to travel further to reach key services which may present an increased reliance on private transport alternatives (Department for Transport, 2014a).[28]

Despite the prevailing national trends for travel, some locations have been able to break this trend and even promote a thriving public transport service. For example, Brighton and Hove have a higher number of bus journeys per head of population (Avg. 167 trips per head) than London (Avg. 51 trips per head) where most public transport use occurs. The Brighton and Hove Bus Company is often seen as an excellent successful example of growth for a bus company (Butcher et al., 2015). This success is due to the use of measures such as improved infrastructure and parking enforcement. These strategies are supported by softer measures such as flat-fare ticketing, re-branding, advertising the most frequent routes as 'metro' lines and building a customer service culture by spending around £100,000 per year on staff training (Cairns et al., 2004). The TAS Partnership (2002) also reported that the Brighton and Hove Bus and Coach Company achieved growth of 8% a year on its five core branded routes. This implies that building experience and exposure is also linked to the type of location and the presence of public transport which is encouraged through various hard and soft measures.

One force behind the general decline in public transport use is travellers' attitudes towards travel choices and their intentions towards changing their travel behaviour. According to the British Social Attitudes Survey (BSA) conducted by NatCern, travellers express a desire for freedom of movement regardless of any potential impact on the environment (NatCern, 2005, NatCern, 2011a, NatCern, 2011b, NatCern, 2012). This suggests that travellers are unlikely to change their travel behaviour because of issues such as climate change. The TAS Partnership (2002) found that the strongest motivation to change behaviour and increase uptake of public transport services was improvements to those services. For example, if the service was considered 'frequent' with services each 10 minutes, 60% of sampled participants wanted to change to public transport. A frequency of two buses an hour led 40% to consider changing, and none would consider public transport if headways were greater than 30 minutes. This may be due to the traveller requiring a frequent service that reduces the need to overly concern themselves with travel details. If the

[28] See Chapter 6, Figures 6-2

traveller is confident that their intended services are reliable, they would not need to expend mental resources to plan and manage travel. Currie and Wallis (2008) found that operators agree with travellers on this, suggesting that travel time and details on which travellers naturally focus when planning are areas that would need to be improved on to increase uptake. However, the prevailing influence on a travellers' willingness to change behaviour is driven by social perception and expectations of public transport services. For example, (Chorus et al., 2006c) noted that travellers would perceive public transport as habitually unreliable because at the times when reliable travel time estimates are needed (e.g. in the case of service disruption) they are often not available or subject to frequent change. Social expectation and perceptions of local bus services were greatly hit in the 1980s by legislation deregulating buses and coaches. Initially, the deregulation process was intended to foster competition and decreased fares for travellers to promote uptake. Instead, it became apparent that an unhealthy rivalry or 'bus war' between operators was emerging when the Office of Fair Trading presented their findings to Central Government. Examples of such hostility are provided below.

> 'There is still a perception that bus services are generally unreliable and of a poor quality; that vehicles are old and inaccessible; that drivers are rude and that passengers are unsafe and uncomfortable' (BBC News, 2006a).
>
> 'The problem has arisen over congestion at the depot between rivals UK North/GM Buses and Stagecoach […] Both bus companies have increased the number of buses on the route and passengers say the volume of vehicles has made boarding buses dangerous' (BBC News, 2006b).
>
> 'The court heard claims of friction and bad blood between drivers at Inverness-based Scotbus and Stagecoach over certain routes in the Highland capital […] 'The court heard that Stagecoach drivers goaded Scotbus staff by making a zero sign with their hands to signify they had no passengers' (BBC News, 2006c).

The growing tenuous relationship between providers and the nature the competition gave travellers opportunities to observe the operators' competitiveness during transit (Butcher et al., 2015, Copsey et al., 2014, Preston and Almutairi, 2013, Preston and Almutairi, 2014, White, 2010). According to Fisher and Geiselman (1992), this allowed travellers to build a suite of memorable cases that were particularly negative, and these cases would be the easiest for the traveller to recall when planning subsequent travel journeys. The traveller would naturally want to avoid this environment and opt out of using public transport by seeking private transport alternatives, as part of the CBR approach. Stevenson (2000) found that travellers were experiencing an increase in fares, decreased off-peak and weekend services and an excessive numbers of operators merging in key urbanised areas where travellers congregate. For example, 350 buses per hour

running through Sheffield's city centre, and in Merthyr Tydfil (population: 40,000) a bus left its tiny station every 30 seconds.

Donald and Pickup (1991) found that travellers felt that service reliability and information provision had declined. This added to the difficulties of adjusting to the change in the transit environment with a lack of relevant external support needed to make that adjustment. They stated that travellers often dismissed timetabled information because of its instability and constant change. This information is one of the key sources of travel information influencing traveller behaviour, as illustrated by the example of service headways. In recent years, the UK government has attempted to restore the travellers' perceptions of public transport services by increasing collaboration links between service operators, such as the introduction of cross-operator ticketing schemes (The Parliamentary Office of Science and Technology, 2015, Butcher et al., 2015) and by pushing for improved public transport information provision to address the dispersed nature of multi-operator information through open data policies.

To help travellers understand the travel environment and feel encouraged that public transport would satisfy their journey requirements, attempts are being made to nudge them back into the environment (The Parliamentary Office of Science and Technology, 2014, Department for Transport, 2012). Driver/traveller relations are still particularly poor in certain areas, and this is not necessarily associated with the effects of deregulation. Recent research conducted by TfL found that passengers reported a lack of in-trip guidance offered by drivers. This affected on their perceptions of the environment and the way that they encoded that travel situation for recall at a later point in time.

> 'It is like TfL purposefully hand picks the most miserable people for this job […] When the bus finally came, I asked the bus driver to confirm the route, he was very rude and dismissive' (Munyama et al., 2015).

The point to make here is that improving the experience for the traveller by enabling and educating them to understand the environment can help them see their local bus services as a viable option for future transit journeys. This was supported by Gwyneth Dunwoody, one-time chair of the Transport Committee who said that 'a good experience of using buses when young could influence travel choices later in life' (UK Parliament, 2006). Good experiences are influential in self-referencing CBR. However, there are two main negative social nudges affecting a traveller's lack of willingness to change. The first is the stigma surrounding public transport travel. Low patronage and overcrowding send messages to the travellers of significant problems, which deters

use. The second is society's image of public transport services by media and governmental leaders. For example:

> 'A man who, beyond the age of 26, finds himself on a bus can count himself a failure' (Thatcher, 1986, cited in Davies, 2006 and The Economist, 2006)
>
> 'What will I do for public transport? I will improve the economy so you can find good enough work to be able to afford a car' (George W. Bush, Election Campaign Speech, cited in Vliet, 2009).

UK society has been built on a strong consumer culture which was nurtured to combat the effect of a weak economy following the Second World War. According to Victor Lebow's views at this time:

> 'Our enormously productive economy demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfactions, our ego satisfactions, in consumption. The measure of social status, of social acceptance, of prestige, is now to be found in our consumptive patterns […] We need things consumed, burned up, worn out, replaced, and discarded at an ever increasing pace' (Lebow, 1955).

Once consumption had become part of an individual's identity, curbing that consumption becomes complex. The consumption has come to fill a need in an individual's life, and that need would have to be fulfilled by something else. This 1955 consumer ideology may be the very cause of the British social attitudes towards travel in regard to environmental consequences.

4.2 The impacts of depending on different sources of travel information.

The discussion so far in this chapter has set out the underlying principles behind travellers' decision making and recent travel trends that can affect the stability and level of internal travel knowledge used for wayfinding. This section draws out the terminology associated with strong and weakened wayfinding experience stemming from '*Stage 2: methodological triangulation using 'complimentary' information analysis*' of the research methodology, and explored further using '*Stage 3: Delphi (expert review)*'.

4.2.1 Dependence on external information sources

A traveller with a weak internal source of knowledge, due to a reduced number of cases, are likely to guess the relevance of travel information when it is presented and are more reliant on external support, e.g. travel IT, to address new travel demands because they lack the independent insight to produce solutions autonomously. Hochmair (2005) reasoned that travel could take place in an unfamiliar environment where the traveller would have limited knowledge regarding structural identification (local landmarks, street names and general structural hierarchy), an inability to perceive environmental information, an inability to communicate their wayfinding issues to a

passer-by and difficulty finding external information sources that provide for their wayfinding needs. This suggests that travellers at this end of the spectrum will struggle to understand the problem, communicate the problem and resolve the problem (Kolodner, 1993). This means that the traveller would need to focus on basic information needs such as journey times and location details, and may attempt to seek advanced travel information such as personalised journeys. However, this will require more mental resources to process and encode into memory (Fisher and Geiselman, 1992).

Specific information needs are defined by what travel information is sought and how urgently it is required (Schwanen and Kwan, 2008). This means that the traveller will be forced to confront their lack of knowledge by first addressing the basic logistic concerns of how best to get from one location to another (Hochmair, 2005, Allen, 1999). Depending on the traveller, this back-to-basics approach to wayfinding may lead them to feel uncertain or anxious (Schmitt et al., 2015, Transport for London, 2009). This also means that the resources required by the traveller to process new information such as focused attention and clarity of mind can place them in a situation where they feel unprepared. Flaws in this learning process may be revealed when travelling in the physical environment (Kolodner, 1993). Bissell (2010) confirmed that these travellers would require much more information about the physical environment to account for ramps, stairs, escalators, and safe crossing places. The traveller that is aware of this natural weakness in their cognitive map will naturally be **cautious** when using external information sources such as journey planners to plan their upcoming journey. TfL's Customer Touchpoint's Typology consistently demonstrates that travellers with weakness in knowledge will express concerns that can potentially intensify and develop into anxieties (Munyama et al., 2015, Transport for London, 2009). This leads to a significant **reliance** on external information sources used during the pre-trip planning, which will also be consistent in the in-trip environment. This means that the in-trip traveller with unreliable travel information and a weak internal representation of the network itself will feel as if they have been left **stranded** when the information gathered is insufficient for the journey needs.

The focused literature review identified key terminology:

- Is **cautious** of the in-trip experience due to lack of personal knowledge;
- Will be more exposed to **anxiety** as a result;
- When exposed to the in-trip environment, pre-trip planning **concerns** manifest as a **reliance** on reliable travel information; and
- When pre-trip and the in-trip information is in disagreement, this leads the traveller to assume they are unsupported or **stranded** in the in-trip environment.

The contextual review and focus groups allowed further insight into these behaviours. For example, the observation of travellers using multiple sources of in-trip information, such as printed information, real-time screens and direct questions to staff and other travellers. Travellers that seek assistance from others will often ask for clarification multiple times or constantly observe available information tools before and after the discussion. This suggests that the individual is **unsure** of what to do in that environment. Perhaps they have encountered a situation where more information was required than they previously considered at the pre-trip planning stage.

From a logical perspective, information obtained in the transit environment would allow that traveller to address and negate the lack of physical environment knowledge, through direct interaction and observation. However, making in-trip adjustments produces greater consequences when made on a foundation of limited knowledge. The extent to which a traveller expresses their concerns demonstrates a reliance that can also be observed in the travel environment. For example, enquiries made by the traveller either to another traveller or staff member will be based on their prior searched information or their foundation of knowledge. Using the self-referencing process, they indicate their level of reliance and concern towards the in-trip circumstances. The likelihood of the traveller being stranded is minimal, as travellers will observe others and often use this as a source of information, especially in the case of service disruption where information provision is at its weakest. At present, there is limited research surrounding the stability of information provision in times of disruption, other than suggesting that this is when it is unreliable (Chorus et al., 2006b). The contextual review found that, as the disruption occurs, tech-enabled information provision dissolves into directing travellers to seek personal support or listening for further announcements. In railway stations, this will often create a melee of people surrounding staff for information (see Appendix A, Image 5). In the bus network, travellers can be left with no information and will often resort to changing their plans if they are able. During the contextual review, a longer distance service between Southampton and Gosport was running significantly late, by over an hour. The discussions by travellers at this stop and with the researcher revealed that some travellers had no choice but to accept this and were unable to alter their plans. In this setting, they are likely to turn to tech-enabled information sources connected to social media (or to other travellers who are tech-enabled if they are not), which was observed on this occasion.

During the integration and ‘complimentary information’ analysis of the focus group transcripts, two themes continued to emerge, the lack of local service knowledge linked to the provision, cost

and or availability of services (Table 4-2) and the desire for methods to resolve those gaps in knowledge (Table 4-3).

Table 4-2: Extracts from focus group sessions linked to a lack of knowledge of local service operations.

Verbatim commentary[29]	Tagged NVIVO Codes
'Fine going, but then coming out I thought it would still be day-time services. And I was absolutely frozen; really freezing weather, absolutely freezing weather, and I had to wait about 50 minutes for a bus, and you know I got there just before 9 o'clock. I thought it was absolutely appalling because I didn't know what time the evening service started'.	Service provision fluctuations
'My husband came home on the ferry and then you know he said there were no buses there'.	Service availability
'For the driver still to be having to you know find five pence or ten pence or something'.	Payment method variations
'But they couldn't believe that there was more than one bus company'.	Understanding local service operations

Table 4-3: Extracts from focus group sessions linked to a need for external travel information sources.

Verbatim commentary[29]	Tagged NVIVO Codes
'In London, you travel on the tube, and you expect to see your map, don't you?'	Visual aids (maps)
'For all the tourists we get and, as you say, the students. If it says, ''Next stop University' or something, it's very useful!'	Vocalised, location specific information
'I think we miss the conductress'.	Available staff
'I've had a couple of attempts at using the bus, in the last couple of years. I couldn't understand the timetables or bus routes. The times were alright, but the bus routes I didn't sort of understand'.	Legibility of information

These example extracts from the focus group sessions with 'infrequent' user of public transport indicate that there is a lack of specific knowledge about service provision. They also suggested that the tourist population was surprised by the multi-operator-led provision. This particular demographic appears to be affected by reduced internal knowledge regarding local service provision as they built their knowledge in the areas they come from and so need information to address the gap. In-trip changes will expose this weakness and cause them to gravitate to visual aids, location-specific information and available staff in preference to tech-enabled sources of information.

Overall, the previous findings of this study were upheld by the subjective sources of the contextual review and focus group. In addition to this, a new term emerged; the traveller is 'unsure' of what to do and exposed to the uncertainty that leads to their potentially cautious and concerned

[29] Example of comments driving the observation, these tables are not exhaustive of the verbatim that was coded in NVIVO.

nature. Therefore, identified key terms were converted into a specific definition to personify the reduced wayfinding ability type of traveller.

Table 4-4: Reduced wayfinding ability perspective

Reduced wayfinding ability
A traveller who has little experience or trust in public transport services will be naturally unsure of what services will satisfy their journey needs. Therefore, seeking travel information tends to leave the traveller concerned as to whether they can trust the information they find. When they travel, these concerns grow into anxieties and they are cautious of things deviating from the plan that they are following. This ultimately makes them reliant on reliable services (not subject to service disruption) as their limited knowledge leaves them stranded and in need of external information sources such as staff and other travellers for assistance.

4.2.1.1 Exploring the dependence on external travel information support (expert review)

To explore the underlying keyword terms and formed description produced from stage 2 of the research methodology, they were presented to a panel of experts supporting travel information to unfamiliar travellers during the '*Stage 3: Delphi (expert review)*'. The outcome of the first round interviews regarding the reduced wayfinding traveller is summarised in Table 4-5. The panellists' reactions towards this traveller type (the overall description and descriptive keywords) appeared more negative and varied. Being mainly public transport users themselves, and believing that most travellers were habitual users of public transport, the panellists felt that travellers would generally not be as anxious as the description portrayed. However, they were able to offer views on the effects of being in a position of reduced ability, and thus reduced confidence in their actions.

Table 4-5: Reduced wayfinding ability perspective – Key terms

	Cautious	Concerned	Anxious	Unsure	Reliant	Stranded
Strongly agree	2	1	2	1	2	1
Agree	8	7	4	9	6	3
Neutral	1	0	0	0	1	0
Disagree	2	5	7	3	4	1
Strongly disagree	0	0	0	0	0	8

Recommended alternatives

Confused more than anxious **Frustrated** **Less anxiety** **Lack of control** Anxiety dependent on experience and the individual	Feel stranded

Despite this strong reaction, the panellists agreed these travellers are the least known about, and after breaking down the initial negative reaction were able to identify areas were anxiety would be exacerbated, even if the level of that anxiety would be disputed.

'**Anxiety** does come into play if for example, the bus is late to arrive'.

'Half the time you try showing them and reassuring them what you are showing them, using the computer and hopefully they will understand, and we see this all too often in this shop, and if they have a difficulty or are unable to take in what we tell them, they start getting stressed, making themselves ill, **anxiety** sets in, and you almost have to explain it like you would explain it to a baby, just to say this is how you do it' (Referring to supporting tourists or visitors from other countries where a language barrier is present)

Expert panellists 1 and 13, Representatives of Public Transport Service Providers

'Travellers with limited familiarity of public transport, are they all terribly **anxious**? To be fair, if you have limited knowledge if you're doing something that you don't often do, it is only natural that this would come with a certain level of **anxiety'.**

'Someone who perhaps has driven everywhere for 25 years, because that's the only thing that they know and they have never even considered it, and they are forced to consider it, will probably be less able to tolerate this level of **anxiety**, than those that would have opted out of public transport through choice'.

'I think that if it's as **anxiety** inducing as your description is saying, I suspect they simply will not travel rather than put themselves through this'.

'Those with limited familiarity, well connections are instantly off-putting as it immediately increased or doubled the **anxiety'**

Expert panellists 4, 8, 9 and 12, Southampton City Council Public Transport Members

Regarding the use of information, the panellists' were split. Policy makers placed more focus on travellers using journey planners for pre-trip planning and real-time methods such as apps or display boards for in-trip support. Operators placed greater importance on personal support through their websites, local travel shops, phone line and social media for direct enquiries, in both pre- and in-trip planning. Regarding the keyword suggestions, they felt the term 'concern' was more representative of a traveller's experience than 'anxiety'. The term 'stranded' made the panellists think that travellers were stranded with no means of dealing with their situation, and the best way of representing the effect of travelling without knowledge in service disruption is that the traveller 'feels' stranded rather than literally is stranded.

4.2.2 Reliance on autonomy

This next type of traveller will have a strong internal source of knowledge and is typically able to remember relevant travel cases. They will have a strong foundation from which they can plan travel independently and require minimal external support when new travel situations arise.

According to Bovy and Stern (1990), an individual's wayfinding ability correlates to their spatial knowledge of the environment and the exercise of patterns to build up relevant knowledge. This suggests that those with significant ability will be aware of the physical environment and aspects of it because of the repetition of exposure (Alterman, 1986b). Allen (1999) confirmed this perspective by also suggesting that travellers' experience of a network allows them to observe its constructs as a result of habitual patterns such as the daily commute.

Prior knowledge means that individuals can focus on how a journey meets their needs, rather than on logistic concerns, allowing for **dynamic** evaluation of their options. This means that the individual is **capable** of finding what they consider to be the most appropriate route for their journey (Lyons et al., 2007). This level of confidence in where they need to be, without need for external information, describes a traveller who is confident in their route or knows that a service is at a high enough frequency not to need external support (Currie and Wallis, 2008).

Due to their greater knowledge of the environment, less has been documented about how this more confident group regards the transition from pre- to in-trip planning. Some references consider that the traveller will be able to work **independently** of rigid journey plans and will even consider this a personal challenge (Transport for London, 2009). This dynamic action in processing decisions and choices is a key example of a traveller (reasoner), actively using their internal knowledge to compare and contrast solutions that are relevant the new situation (Kolodner, 1993). They are able to do that efficiently and with less mental resource because of the daily use of those examples (Kolodner, 1993, Fisher and Geiselman, 1992). Travellers of this type are described as actively seeking out information in correlation with the pre-set knowledge to support a present travel information need (Hochmair, 2005). This action usually corresponds to circumstances where the traveller's current journey experience or existing perceptions changes such as service disruption. Beyond this, they work autonomously (Lyons et al., 2007).

The focused literature review identified key terminology:

- Has actual or perceived **knowledge** of route possibilities;
- Will be **capable** of finding the most appropriate routes/options due to that knowledge;
- Will have the ability to **dynamically** evaluate travel options; and
- Will be able to work **independently** using their knowledge of the travel experience rather than in-trip information.

The other triangulation sources were able to observe and give perspective on these behaviours. For example, the contextual review observed that some travellers do not demonstrate a need for

information by arriving at their waiting point (bus stop or train station) and not referring to information available in their environment or their possession (tech-enabled sources). Travellers who feel comfortable within the transport environment and do not need to seek external information to confirm where they are may be confident due to familiarity with their route or know that this service is at a high enough frequency not to need external support. Alternatively, they could have been on a journey with flexible time constraints, reducing the anxiety produced by needing a specific arrival time. Examples of pre-knowledge confidence are demonstrated more often by travellers who will arrive at the station and go directly to a platform without consulting travel information. In this contextual review, travellers seen regularly (over a number of days at the same time) between Fareham and Southampton Central would also stand in the same similar places. The reasoning for their choice of location on the platform was only revealed when the trains arrived, and they were next to the doors. In these instances, it appears the traveller is working independently using their own knowledge of the travel experience rather than external information. This behaviour could be seen as the individual valuing the ability to board first and obtain seating, behaviour observed mostly during typical commuting times. During service disruption, some travellers would be able to manage what to do without seeking support from other travellers or staff, either finding an alternative task to fill the time or aid travellers who lacked the experience of similar events on that route. Here, the significant wayfinding traveller starts to act as the external information support used by a traveller with a weak internal understanding of that journey. In these discussions, travellers were able to reveal that they had already worked out their strategy and even that they were expecting this because of past experiences. This demonstrates how these types of travellers incorporate journey flexibility to address the in-trip variations. This circumstantial learning can be observed by an event that occurred during the contextual review (see Table 4-6), highlighting the specific policy of one operator to cancel services in favour of scheduled running services.

Table 4-6: Extract from contextual review tagged to "emergent disruption"

Date	Observation notes	Refers to
6th December (PM)	At 18:03, purchased a southern ticket, passed barriers, found out that this service was delayed by 10 mins. No announcements made and the National Rail app was incorrect even though the delay existed at the time of checking departure times at arrival to the station via the app. An alternative provider South West Trains was running to schedule, however, as I was in possession of Southern only ticket I was unable to board alternative services. 30 mins after my arrival, announcements with platform alterations were made regarding the	Different operator ticketing issues, inconsistent in-trip information,
	18:10 service, no reason was given for the delay. The next timetabled Southern was at 19:14. Considered getting an alternative ticket, but unable to pass barriers to get an alternative ticket, couldn't be sure that I would be allowed past. Commuters statements, in a similar position to me include 'it is messed up', 'to complain' or raise a complaint.	lack of explanation for in-trip delay
	19:14 arrives, boarded, on-board announcement suggests it will skip stops inc. Swanwick, Cosham and Havant. Six people exit, with vocal annoyance (unrepeatable), shortly after another on-board announcement was made and suggested an alternative service and platform, despite the passengers it relates to previously exiting the train after the first announcement.	Lack of context announcements
	Passenger discusses the issue with staff on-board, staff indicated Southern and South West Trains have different policies. Staff said 'Southern prefer to arrange things so that trains run to timetable. I can't say for certain that missing the three stations will provide that, but Southern believe so […] if they can't keep to timetable then they won't operate'.	Different operating policies

During the contextual review period, this cancellation was observed numerous times, and the process of response was consistent across each experience. It was found that the traveller who commutes by that operator will often learn this process and even mitigate or avoid that as part of the CBR they conduct (Kolodner, 1993). The sample of focus group extracts (see Table 4-7) show travellers' learnt frustrations towards the operations of local public transport services. If they have certain service knowledge, they will use that to respond to it dynamically, such as by selecting a different service because of its ability to get the traveller closer to their desired destination. This demonstrates that the traveller is actively using this experience in the process of reasoning a specific travel behaviour.

Table 4-7: Extracts from focus group sessions linked to learnt knowledge

Session	Verbatim Commentary	Tagged NVIVO Codes
Regular user of local buses	'I live on a very good bus route. I only live about five, seven, minutes from a bus stop so it's quite easy'.	Local knowledge
	'But if I catch the one that goes the long way round it stops on the right side of the road for me. So depending on how much time I've got, sometimes I'll 'Oh, there's the number 1 down there; I've got enough time I'll go for it, a few minutes more what difference does it make?'	Time based knowledge
	'There's not much space is there at all on a number 2'.	Crowding knowledge
	'That's part of my bugbear I think, and they do turn up – I know the sequence now: a 23, another one, then the 7, then the 2, and so I know when my bus is going to come along and nine times out of ten you get two turn up at the same time. It's the same old story'.	Patterns, experience and 'recallable cases' relating to consistency
	'But no, I spend a lot of time just looking at – I don't really use what's on my phone because I still like, I prefer, the paper timetables, and I'll spend hours just looking through timetables and looking at the transport maps. But I think that's just part of the fun for me of going somewhere; it's the planning'.	Natural planner/Enjoyment

Overall, the subjective sources were not in disagreement with the previous findings and two new terms emerged: that a traveller is **flexible** – able to work autonomously – and **knowledgeable** because of circumstantial learning. These terms were converted into a specific definition to personify the reduced wayfinding ability type of traveller.

Table 4-8: Significant wayfinding ability perspective

Significant wayfinding ability
Due to their detailed working knowledge of specific routes and local transport service providers they are naturally capable of finding the travel information. They are able to work independently of rigid journey plans and in some cases do not need use plans at all. When travelling these travellers are dynamic, using past experience and their knowledge to manoeuvre through the network. In the eventuality of service disruption, they can flexibly recalibrate their journey or understand incoming information to effectively re-plan.

4.2.2.1 Exploring the reliance on autonomy (expert review)

To explore the underlying keyword terms and formed description produced from stage 2 of the research methodology, they were presented to a panel of experts supporting travel information to familiar travellers during the '*Stage 3: Delphi (expert review)*'. The outcome of the first round interviews regarding the significant wayfinding traveller is summarised in Table 4-9. The panellists' reaction to this traveller type was more consistent overall with the ratings that were offered for the keywords. In fact, the panellists did not really offer any specific alternatives for the original set of key terms, agreeing to their relevance.

Table 4-9: Significant wayfinding ability perspective – Key terms

	Flexible	Dynamic	Capable	Independent	Knowledgeable
Strongly agree	1	2	1	1	2
Agree	12	10	11	11	11
Neutral	0	0	1	0	0
Disagree	0	1	0	1	0
Strongly disagree	0	0	0	0	0

The panellists were all in agreement that they will use available information despite the contextual review indications suggesting that they may not travel seeking further external support. The reasoning behind this selection of external information is something that is currently unexplained in the literature. Nevertheless, there is sufficient evidence in this triangulation study to conclude that travellers' identification of areas of weakness or trust in a situation is the key driver for seeking travel information. The way that panellists viewed travellers with sufficient background experience was related to the travellers' awareness of options and methods of obtaining information, compared to other less confident travellers. Their extensive knowledge allows them to identify appropriate sources for certain travel-related enquiries, as the defining factor behind their degree of information flexibility. The panellists also drew attention to the travellers' awareness of issues inherent in external information provision sources due to the direct testing of that information's reliability in the real travel environment. Therefore, the traveller is likely to adjust the information based on those considerations based on its proven reliability, or unreliability, when taken into the in-trip environment. These aspects demonstrate their 'extensive personal experience' and 'awareness of options'. This means that the individual can grow their knowledge about timetabled arrival and departure times and routes especially for peak-time travel, enabling these travellers to have a dynamic and creative mind-set when faced with less familiar routes.

All the panellists agreed that these travellers would have already determined their means of obtaining information in the form of preferred tools. During discussion, panellists also recalled instances where they themselves took their experience and confidence and used this to support confused travellers. There is an awareness that travellers with significant wayfinding ability would offer assistance and advice to other travellers if they had knowledge that the traveller with reduced wayfinding ability lacked.[30] It was unsurprising that the panellists related better to this end of the traveller-type spectrum as it is an example of an individual with a strong level of habituation. Therefore, they were more aware of the nuances in this traveller type's mind-set and

[30] Witnessed multiple times during the contextual review.

were able to rate more consistently across the suggested terms in comparison with travellers lower down the spectrum.

4.3 The relevance of the internal/external balance in forming effective action

The findings so far considered the key terms that progressed from the exploration studies and the first round Delphi study discussions, confirming the relevance of information use and its link to this internal/external knowledge balance (see Figure 4-2). In response to the progression of learning, the original descriptions for both types were amended to take into account alternative keyword terminology or removal of irrelevant terms, and the results are presented in Table 4-10.

Table 4-10: Wayfinding spectrum descriptions

Reduced wayfinding ability	Significant wayfinding ability
Limited personal experience with public transport will be unsure of what services will satisfy their journey needs. These travellers will, in a pre-planning context, be naturally cautious and confused when making travel choices if there are any choices to make. In a travelling context, those concerns lead to greater reliance on things following the plans that they have made or expectations that they have. If the journey experience deviates from those perceptions, then the traveller will feel stranded, frustrated and in need of external information sources such as staff, other travellers, travel shops or information tools for assistance.	Will have extensive personal experience with public transport will be capable of finding services will satisfy their journey needs. These travellers will, in a pre-planning context, be able to call on their prior experiences and awareness of options. However, these travellers are also the least likely to pre-plan. In the travelling context, they are able to work independently of rigid journey plans and are self-sufficient. These travellers will have preferred information sources if more knowledge is required. During service disruptions, these traveller's will feel frustrated but will have coping mechanisms to deal with the problems and feel confident enough to offer support to their surrounding travellers.

These new descriptions were then re-submitted to the panellists for two further rounds using the same questionnaire to confirm whether the views could be brought to consensus by observing the central tendency, using the mean and standard deviation to account for group opinion and spread of disagreement (Powell, 2002). According to this data (see Table 4-11), for both descriptions the standard deviation decreased over the three rounds for the reduced wayfinding description, implying that the spread of disagreement also decreased, from 3-10 in round one to 8-9 in round three. As the participants were not tracked round-to-round, statistically testing whether the observed score stabilisation was due to chance was not possible. However, an independent samples t-test of the means between rounds one and three shows that the population means are statistically significant for both definitions, reduced ($t_{12.644}$= 2.228, p= .006), significant (t_{12}= 1.806, p<.001), and thus there is a statistical difference between the scores received in the latter rounds of the study. This is assumed as the panellists accepting and use of the group consensus feedback in the later rounds to form their responses.

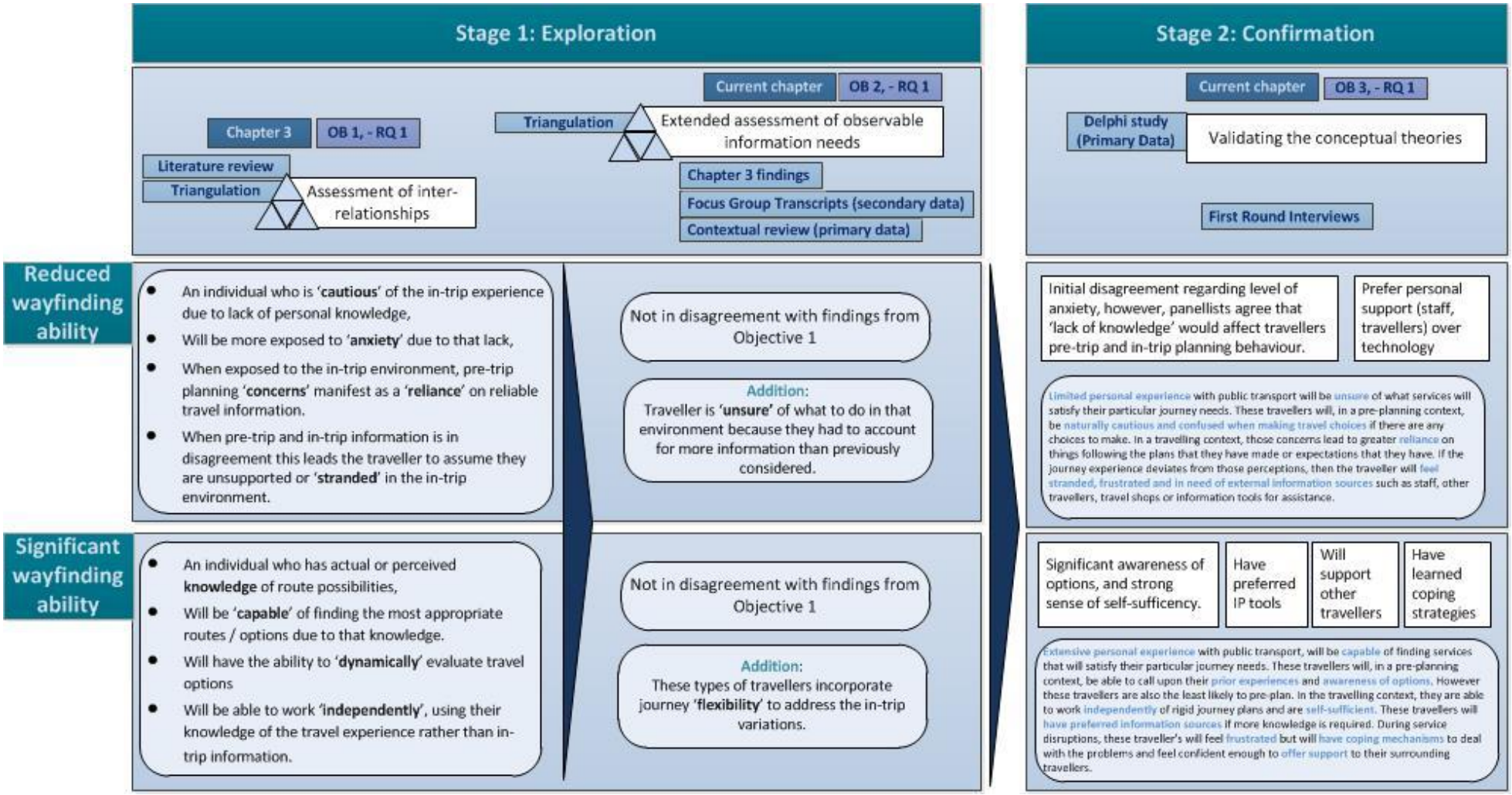


Figure 4-2: Traveller Perspectives Process of Learning

Table 4-11: Delphi study rounds results: Average score for the wayfinding spectrum description

		Council			Operator			Total		
		N	Mean	Std. Deviation	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Reduced wayfinding ability	Round 1	7	8.14	1.07	6	7.33	2.50	13	7.77	1.83
	Round 2	7	8.43	0.98	5	8.00	1.41	12	8.25	1.14
	Round 3	7	9	0	5	8.8	0.45	12	8.92	0.29
Significant wayfinding ability	Round 1	7	8.57	0.54	6	8.67	1.03	13	8.62	0.77
	Round 2	7	8.86	0.69	5	8.40	1.14	12	8.67	0.89
	Round 3	7	9	0	5	9	0.00	12	9.00	0.00

Overall, consensus was achieved and the newer definitions were considered as reasonable descriptions of the two types of traveller familiarity (strong or weak), despite the second round variation. In regards to the key terms that were used to build those descriptions, none of the original terms was rejected due to terminology issues. However, a considerable number were merged or amended and converted into a descriptive statement that best portrayed the motivating thoughts behind the terms (see Table 4-12).

The areas that appeared important to the panellists were the expression of limited personal experience and reliance on external information provision, in particular, personal sources such as other travellers and staff. This originated from the round one discussions which stated that travellers with significant wayfinding ability would support travellers with reduced ability. Additionally, the panellists' response to strong terms such as **anxious** was negative, which is contradictory to existing literature which states that a traveller would be anxious when they have limited knowledge and are exposed to a higher level of uncertainty (Dunning, 2005, Caiafa, 2010, Appelbaum, 2012, Spitadakis and Fostieri, 2012). However, the panellists responded favourably to the consequences of that potential anxious state such as being 'reliant' on external information provision, suggesting that the panellists related to the consequences of travelling with limited knowledge rather than the potential root foundation of those consequences. The practicality of the consequences would reasonably be the area these types of panellists would focus on as they are directly responsible for aiding a traveller with limited understanding of that network.

Table 4-12: Delphi round results: Agreement with key terms

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree		Strongly agree	Agree	Neutral	Disagree	Strongly disagree		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	
Reduced wayfinding ability	**Cautious**	2	8	1	2	0	A												
	Concerned	1	7	0	5	0	A												
	Anxious	2	4	0	7	0	D												
	(Merged) - Will have limited personal experience							0	10	2	0	0	A	12	0	0	0	0	SA
	(Merged) - More likely to be cautious and confused							4	7	1	0	0	A	0	12	0	0	0	A
	Unsure	1	9	0	3	0	A												
	(Altered) - Unsure of what services meet their travel needs							3	8	1	0	0	A	0	12	0	0	0	A
	Reliant	2	6	1	4	0	A												
	(Altered) - Reliance on external info sources (staff, travellers, travel shops, technology)							4	6	2	0	0	A	11	1	0	0	0	SA
	(Altered) - Have greater reliance on plans and reliable services							2	8	1	1	0	A	0	12	0	0	0	A
	Stranded	1	3	0	1	8	SD												
	(Altered) - 'Feel' stranded when things deviate from what is expected							2	9	1	0	0	A	0	12	0	0	0	A
	(New) - 'Feel' frustrated when things deviate from what is expected							4	8	0	0	0	A	0	12	0	0	0	A
Significant wayfinding ability	**Flexible**	1	12	0	0	0	A												
	(Altered) - Can be frustrated by journey circumstances							2	8	2	0	0	A	0	12	0	0	0	A
	(Altered) - Will have coping mechanisms to manage difficult journey circumstances							1	9	2	0	0	A	0	12	0	0	0	A
	Dynamic	2	10	0	1	0	A												
	(Removed) - Duplicated theory																		
	Capable	1	11	1	0	0	A												
	(Altered) - Capable of finding services to meet journey needs							4	7	1	0	0	A	0	12	0	0	0	A
	Independent	1	11	0	1	0	A												
	(Altered) - Will be independent / self-sufficient and not require ridged journey plans							3	7	1	1	0	A	0	12	0	0	0	A
	Knowledgeable	2	11	0	0	0	A												
	(Altered) - Will have extensive personal experience / confidence							3	6	3	0	0	A	0	12	0	0	0	A
	(Altered) - Will have knowledge of available options (e.g. ways to pay)							4	7	0	1	0	A	0	12	0	0	0	A
	(New) - Will rely more on their experience over external information tools							5	5	2	0	0	A	11	1	0	0	0	SA
	(New) - Will have preferred information tools							4	8	0	0	0	A	0	12	0	0	0	A
	(New) - Will be confident enough to offer support to other travellers							3	6	3	0	0	A	0	12	0	0	0	A

For the significant wayfinding ability traveller, the newer theories that emerged from the first round discussions such as the belief that this type of traveller would support other travellers whilst in-trip stood out over other ratings. This consensus view evidences the panellist's view of traveller's in-trip behaviour. The panellists also strongly agreed that a traveller's response to travel information suggests they will have trust in their learned knowledge of the travel environment and will be aware of the successful routes of obtaining more information if needed. These scores are clear evidence that the awareness of the internal/external knowledge balance is highly significant in supporting effective action.

4.4 Summary

The purpose for building the definitions discussed above and dedicating a whole chapter to this topic was to inform designers of travel IT of the necessity of building seamless connections to travel information that promotes an unbiased opportunity, regardless of traveller ability. Later in the thesis, these definitions will be explored further by describing key traveller planning types to consider in the design of travel IT (Chapter 5), the travel information types that travel IT should provide (Chapter 6), the present design of an example travel IT (Chapter 7) and a collation of design based guidance to address areas where this objective is not met.

The definitions were reviewed by a panel of 13 experts involved in the travel information chain, either as distributers or being responsible for setting local transport policy that influences travel information distribution. Overall, these experts concurred that these definitions (and underlying keyword terminology) represent travellers with strong or weak familiarity with local public transport services. However, the rigour of individual panellists' agreement and their individual journeys to that consensus could not be tested as the experts were not individually tracked throughout the process.

Chapter 5. Traveller Planning Types (TPT) Framework

5.1 Introduction

At the end of 'Stage 2' of the research methodology, a large amount of analysis[31] was done to address the identified gap in literature surrounding what makes travel information accessible to travellers, regardless of their ability, and how to make travel IT more effective. To take stock of this analysis, in particular the keyword terms and descriptions, it was informally reviewed[32] and an overlap was detected in the set of definitions that were produced (see Table 5-1 and Table 5-2).

Table 5-1: Confirmed stages of information use descriptions

Planning before a journey (pre-trip)	Planning during a journey (in-trip)
An active seeker of scheduled travel information and travellers that are particularly unsure of what choice to make will use various methods to evaluate that information. The traveller's personal, journey and security needs define the preferences that drive the information sought and its ability to meet the traveller's journey needs. However, some travellers do not pre-plan as much as had been assumed, unless an unexpected journey is needed or they have a natural planning personality.	Are Focused on their destination (journey driven) therefore, they will be responsive to available real-time information. Those travellers will, where possible, use that information to adapt to the journey circumstances to ensure that they can get where they want to be.

Table 5-2: Conceptual familiarity with public transport (wayfinding ability) descriptions

Reduced wayfinding ability	Significant wayfinding ability
A traveller who has little experience or trust in public transport services will be unsure of what services will satisfy their journey needs. Therefore, seeking travel information tends to leave the traveller concerned over whether they can trust the information they find. When they travel, these concerns grow into anxieties and they are cautious of things deviating from a plan that they are following. This makes them reliant on reliable services (not subject to service disruption) as their limited knowledge leaves them feeling stranded and in need of external information sources such as staff and other travellers for assistance.	Due to their detailed working knowledge of routes and local transport service providers they are capable of finding the travel information. They are able to work independently of rigid journey plans and in some cases do not need use plans at all. When travelling, these travellers are dynamic, using past experience and their knowledge to manoeuvre through the network. In the CASE of service disruption, they can flexibly recalibrate their journey or understand incoming information to effectively re-plan.

Table 5-1 shows the finalised definitions for the stages of travel information use (pre-trip and in-trip). For the full analysis of this definition set, see Appendix B Table 5-2 shows the conceptual

[31] This included aspects from the 'Stage 1a' literature review, 'Stage 1b' intercept study and the 'Stage 2: methodological triangulation'. The literature reviews are discussed in Chapters 2, 4 and 6. Stage 2 was covered in Chapter 4 and Appendix B. All these chapters inform this Chapter.

[32] The author asked the main supervisory team and select members of the Transport Research Group (TRG) whether they also saw the identified overlap.

definitions for the travellers' ability presented in Chapter 4. The conceptual version expresses the original outcomes based on the analysis prior to the execution of 'stage 3: Delphi (Expert review)'. Table 5-2 also shows that these definitions for familiarity are formed of two parts which evidences the detected overlap. This identified overlap was then modelled in a framework indicating a crossover of concepts and duplication (see Table 5-4).

5.1.1 Addressing travel information comprehension needs

The traveller's ability to form effective action and stage of information use determine the way that travel information is used or comprehended. The stages of information use determine the urgency, accuracy and relevance of travel information as the traveller plans their trip and the level of importance in obtaining accurate, timely and relevant travel information. The traveller's ability described through their strong or weak wayfinding ability (familiarity) determines the importance of travel information comprehension in relation to the amount of pre-set knowledge.

The detected overlap that was modelled in Table 5-4 indicated that both concepts are important in interpreting the traveller's unique travel information comprehension needs. The four identified bespoke areas of travel information comprehension that Table 5-4 shows are represented in Table 5-3.

Table 5-3: Descriptive thoughts for cross over type

Cross over type	Descriptive thought of this type
Pre-planning / strong wayfinding ability	'I have work in the morning; are there any problems with the number 4 service to Southampton?'
Pre-planning / weak wayfinding ability	'How do I get to the local hospital from my house?'
In-Journey / strong wayfinding ability	'I see that the bus is delayed, what is my new arrival time?'
In-Journey / weak wayfinding ability	'The bus is delayed, I'm going to miss the connection, what do I do?'

The four types in Table 5-4 are by no means exhaustive as there is some degree of variability between the identified extremes presented in Chapter 4. However, as general guidance for the types of travellers that may use travel information technology, it give a broad range of coverage for the key areas of need.

Table 5-4: Conceptual foundation for the TPT Framework

		Reduced wayfinding ability	Significant wayfinding ability
Is a **seeker** of **static** travel information and will use various methods to **compare** and **evaluate** that information, typically through a journey planner. The traveller's **preferences drive** what sort of information they need and its ability to meet the journey needs.	**Pre-planning**	A traveller who has little experience or trust in public transport services will be naturally **unsure** of what services will satisfy their journey needs. Therefore, seeking travel information tends to leave the traveller **concerned** as to if they can trust the information they find.	Due to their detailed working **knowledge** of specific routes and local transport service providers they are naturally **capable** of finding the travel information. They are able to work **independently** of ridged journey plans and in some cases do not need use plans at all.
A traveller who is in transit will be **focused** on their specific destination whether that be for work / leisure or other activity (**journey driven**). They **react** to incoming real-time and **dynamic** information using that to **check** and **re-plan** their journey ensuring that they get where they want to be.	**In-journey planning**	When they travel these concerns grow into **anxieties** and are **cautious** of things deviating from a plan that they are following. This ultimately makes them **reliant** on reliable services (not subject to service disruption) as their limited knowledge leaves them **stranded** and in need of external information sources such as staff and other travellers for assistance.	When travelling these travellers are **dynamic**, using past experience and their knowledge to manoeuvre through the network. In the eventuality of service disruption they can **flexibly** recalibrate their journey or understand incoming information in order to effectively re-plan.

This chapter draws on the insights independently discussed in Chapters 2 relating to travel IT, 4 relating to the travellers information comprehension and 6 relating to specific types of travel information. In addition to this, the second half of the questionnaire in used in the expert review relating to the Traveller Planning Types framework and the round-by-round progress towards confirming that framework is to address research question one.

5.2 The Traveller Planning Types (TPT) framework.

The conceptual framework expressed in Table 5-4, was presented to a panel of experts who judged the conceptual framework based on:

- the use of keyword terms,
- the accuracy of the definitions,

The reader is referred to Chapter 4 and Appendix B for the stage by stage results for the keyword terms and overall definitions relating to the travellers ability and stages of information use.

- the validity of the overlap including the relevance of the four bespoke traveller planning types, travel information comprehension, and
- the overall TPT framework as a representation of each of these themes (terms, definitions and types).

This section presents the revised overlap, based on the expert's confirmation of the set of definitions being more accurate. This section also gives a detailed description of the now five bespoke traveller's travel information comprehension needs that were concluded through Chapter 4 and Appendix B.

Table 5-5: Confirmed definition crossover

		Reduced wayfinding ability	Significant wayfinding ability
An **active seeker** of **scheduled / timetabled** travel information and travellers that are particularly unsure of what choice to make will use various methods to **compare / evaluate** that information. The traveller's **personal, journey and security needs define the preferences that drive the information sought** and its ability to meet the travellers journey needs. However, some travellers do not pre-plan as much as has been assumed unless an unexpected journey is needed or have a natural planning personality.	**Pre-planning**	**Limited personal experience** with public transport will be **unsure** of what services will satisfy their particular journey needs. These travellers will, in a pre-planning context, be **naturally cautious and confused when making travel choices** if there are any choices to make.	**Extensive personal experience** with public transport will be **capable** of finding services will satisfy their particular journey needs. These travellers will, in a pre-planning context, be able to call upon their **prior experiences** and **awareness of options**, however these travellers are also the least likely to pre-plan.
Focused on their specific destination (**journey driven**) therefore, they will be **responsive / reactive** to available **real-time / live** information. Those travellers will were possible, use that information to **adapt** to the journey circumstances to ensure that they can get where they want to be.	**In-journey planning**	In a travelling context those concerns lead to greater **reliance** on things following the plans that they have made or expectations that they have. If the journey experience deviates from those perceptions then the traveller will **feel stranded, frustrated and in need of external information sources** such as staff, other travellers, travel shops or information tools for assistance.	In the travelling context, they are able to work **independently** of rigid journey plans and are **self-sufficient.** These travellers will **have preferred information sources** if more knowledge is required. During service disruptions these traveller's will feel **frustrated** but will **have coping mechanisms**

The responses from the experts indicated that the conceptual framework was incomplete, based on their first impression of the conceptual TPT framework, primarily because the pre-trip stage of information use consisted of two perspectives:

1. **Advanced planning with a reasonable lead time before actual travel**: The pre-trip journey planning definition described this stage of information use.

2. **Transition planning on the day of travel with limited time before actual departure**: The purpose of this stage of information use is to support travellers and re-affirm their expectations whilst verifying whether travel information collected at the 'advanced planning' stage is still relevant.

Therefore, the TPT framework incorporated a 'transition' stage between pre-trip and in-trip planning stages with the caveat that this would occur on the day of travel or with a short interval of actual departure to acknowledge this recommendation. According to one of the panellists that represent public transport service providers, this type of travel information use is seen most frequently among walk-in travel advice shops.

> 'We do often find that there are a lot of people that are not prepared for their journey especially those that are seeking jobs. You would be surprised how many people come in and say 'I've got a job interview at so and so, how do I get there?' and you tell them and ask them when their interview is and majority of the time they say something silly like in half an hour, and there is no way they have left enough time to make their journey' (Expert Panellist 9, Representative of a local public transport operator).

The title for the original crossover, shown in Figure 5-1, was changed to convey the vertical band more clearly as some panellists felt that audiences, such as application developers, would not have full comprehension of the term 'wayfinding', instead opting to replace this with the term 'familiarity'. Figure 5-1 also shows the altered version of the TPT framework that encapsulates these high-level structural changes along with the segment based changes discussed separately.

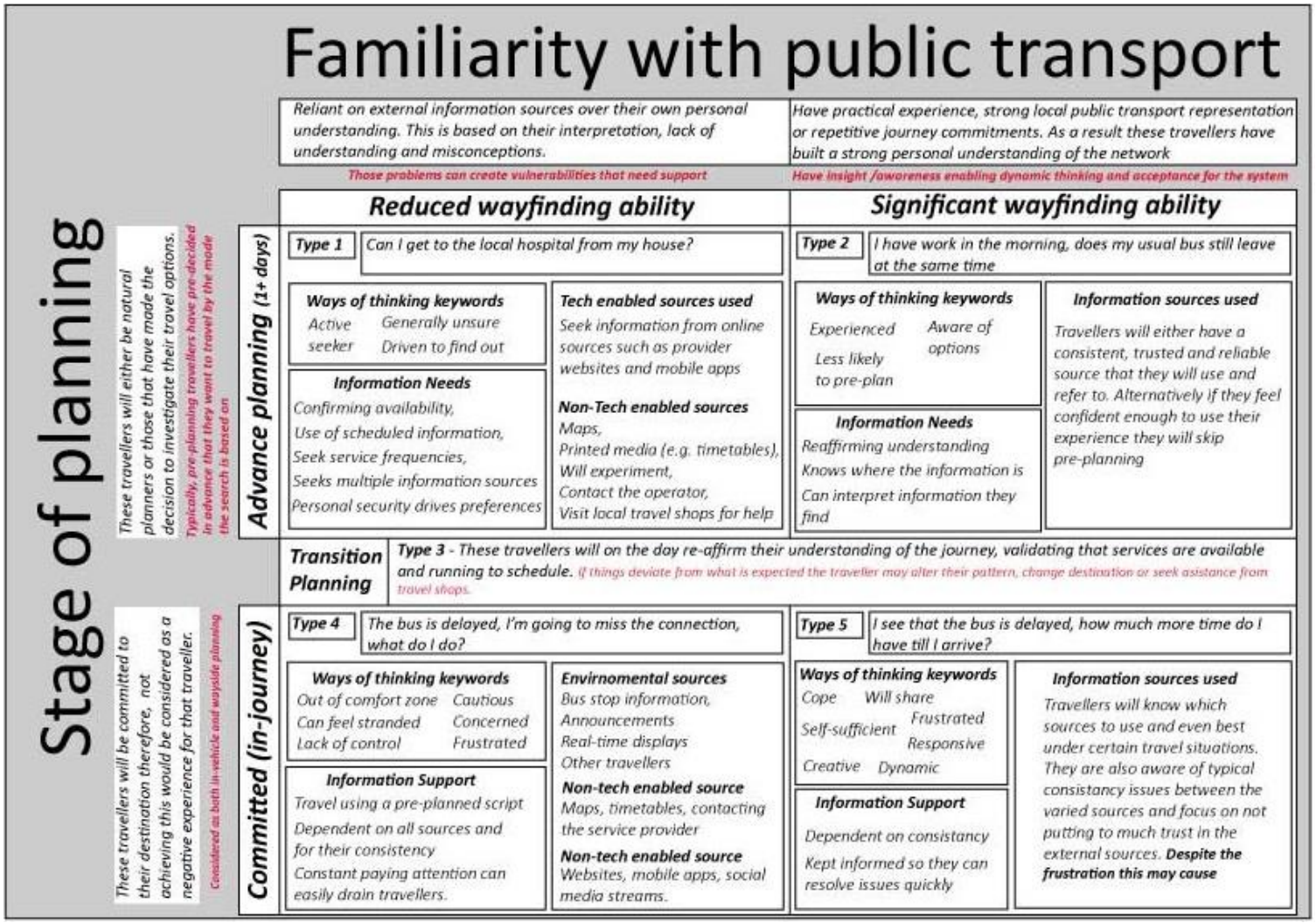
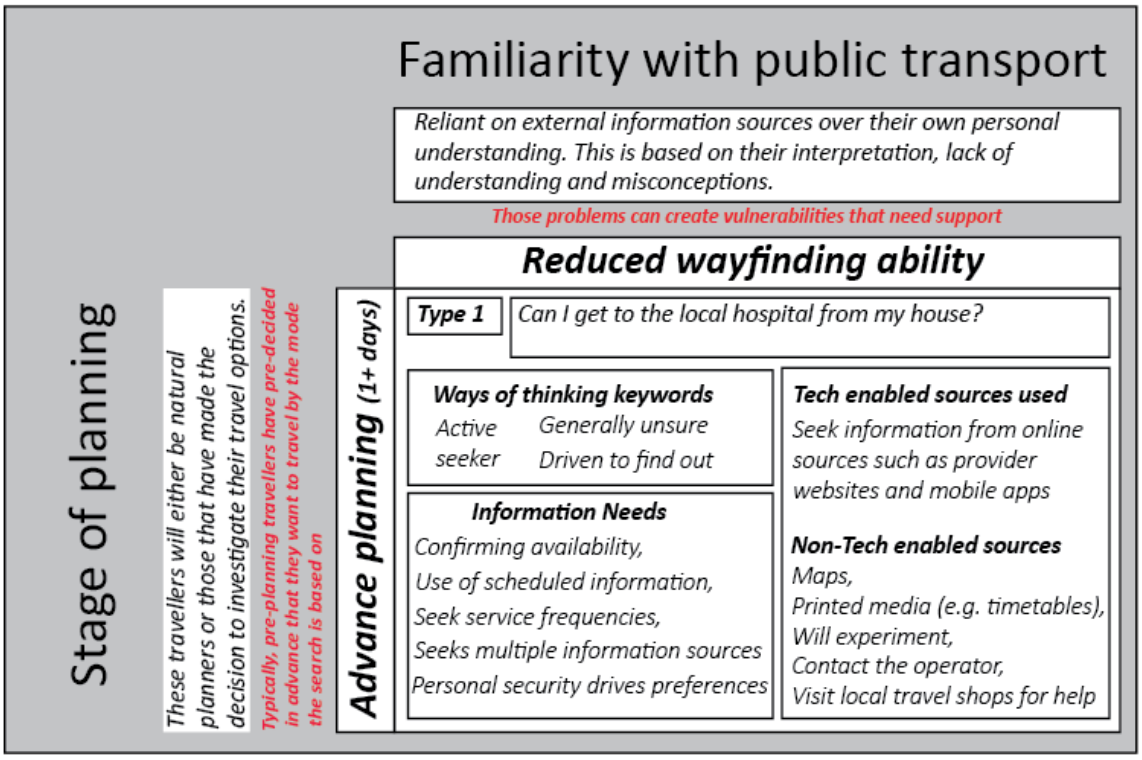


Figure 5-1: Confirmed Traveller Planning Types (TPT) Framework

5.2.1 The Traveller Planning Types (TPT)

This section discusses the individual TPTs. Each type describes the traveller's perspectives and goals when planning or conducting a journey, paying attention to their resilience and abilities to process and use travel information. Each planning type segment is formed on the specific feedback given by the experts during the first round as they reviewed the originating concepts from 'Stage 2'. The full analysis for the 'ways of thinking', 'information needs' and 'information sources' used are explored in more detail within Chapter 4 and Appendix B. This section is a summary of the findings, and a means of personifying these findings into specific traveller planning types.

5.2.1.1 Type 1 – Advanced pre-trip planning and of reduced wayfinding ability



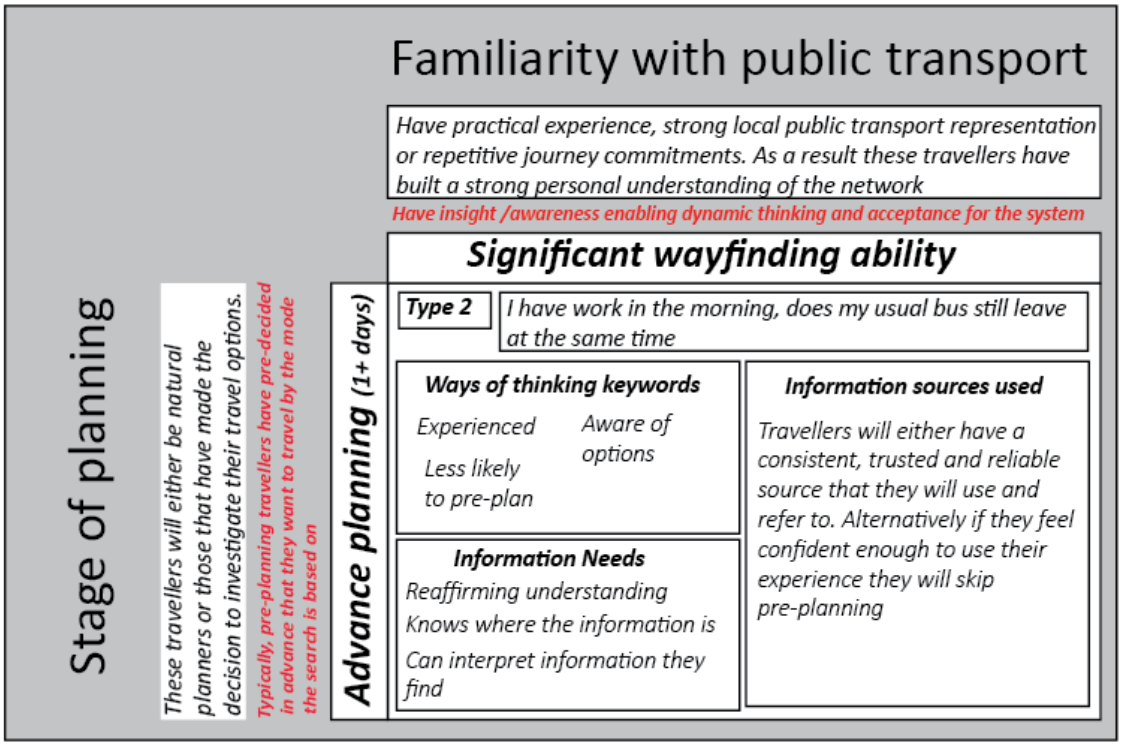
The first traveller planning type represents pre-trip journey planning travellers that have limited exposure to the public transport network or lack familiarity with how it operates. These travellers plan their trip with significant lead time before actual travel and not on the day of travel. They will give their attention to route availability and the flexibility of travelling that journey, e.g. route frequency. As this traveller is planning their trip well in advance, they will only have access to schedule information which demonstrates what the traveller would expect if they were to travel. However, given the nature of pre-drafted estimated travel information, this traveller will have limited understanding of the real transit environment until they travel as they will lack the experience needed to judge the reliability of that information in practice.

It is likely that some travellers will have already decided that they will travel by a mode and are seeking to confirm this by accessing pre-trip travel information. However, the final decision that the traveller will make is unique to the person processing travel information and how much their preferences and growing confidence steer their information gathering and subsequent decisions. Some of these travellers may be aware of their gaps in experiential knowledge and will work with the available travel information to resolve them. Others will seek to find information about a journey and discover the lack of knowledge and need for more information throughout the journey planning process. In either case, the traveller is actively seeking to resolve a need with the use of travel information. They would expect external travel information to meet them at this point of need and work with their journey needs and personal preferences.

Chapter 4 also suggested that these travellers need more assistance and support to understand presented travel information and the nuances of travelling a route which the more experienced traveller will take for granted. It is thus important to meet their basic information needs and help them engage with the travel information and convert it into effective, accurate action as the fourth rule of citizenship stipulates. Those basic information needs are: localising their origin and destination easily, suggestions of routes to meet the journey needs, and information accuracy.[33] The key to successfully supporting this traveller type is educating them about the real-transit experience, and this can come in the form of positive notifications that show that there are no planned disruptions, and enable a way of explaining what to do if there were to be a disruption in the future.

[33] As described in Chapter 6.

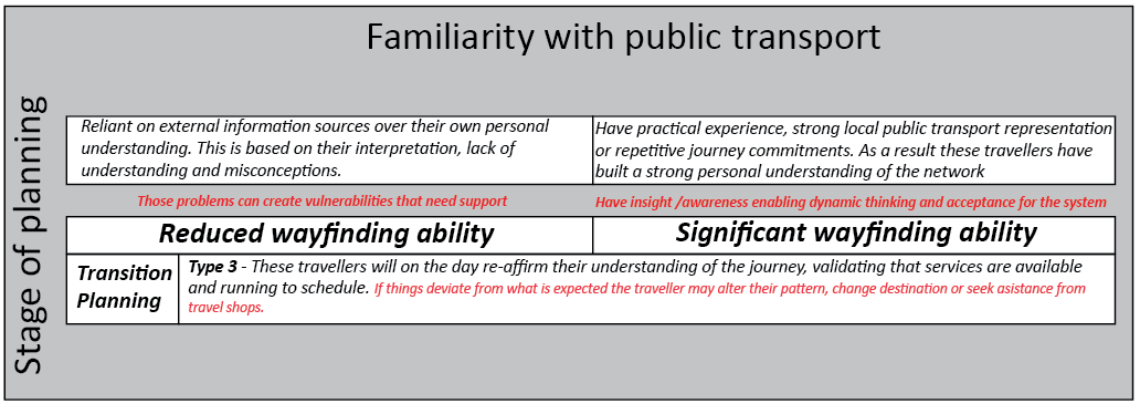
5.2.1.2 Type 2 – Advanced pre-trip planning and of significant wayfinding ability



Type 2 represents pre-journey planning travellers that have more exposure to the public transport network or familiarity with how it operates. They also plan their trip well in advance. This traveller will also have access to pre-drafted scheduled travel information. However, this traveller has the necessary skills to compare this to their experience of day-to-day operations and make adaptive travel plans to account for learnt experience.

This traveller's use of travel information will be to re-affirm their expectations about service operations or to address a weakness in their mental schema that they are more consciously aware they have compared to the less familiar traveller types. This is predominantly because this traveller type has certain areas of pre-learnt familiarity that enables them to respond more accurately to the 'unfamiliar' parts of the trip that they might not have direct exposure to. This traveller has a background of knowledge that gives them an awareness of their travel options such as potential routes, operators and operating times and they are thus capable of working independently alongside information provision sources that they trust. They are the least likely to pre-trip journey plan, but when they do they need less support in learning the network and instead require easy methods to access route details – a map and timetable rather than a comprehensive journey planner.

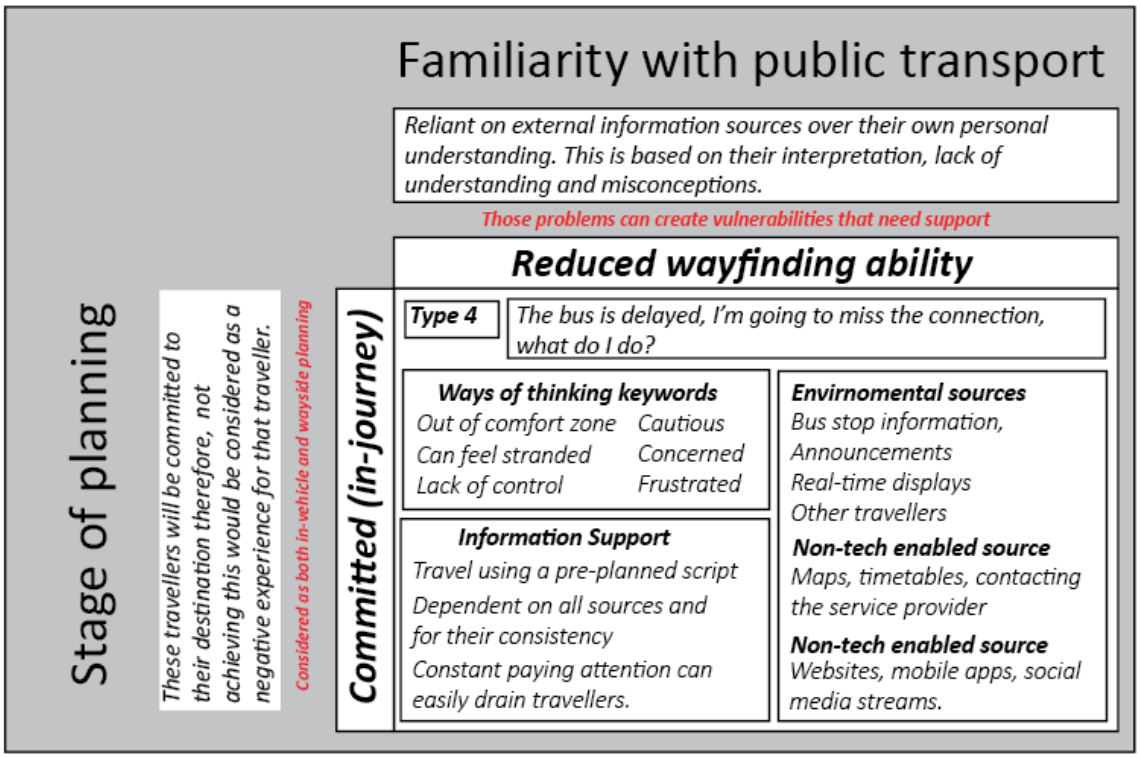
5.2.1.3 Type 3 – Transition planning



The next traveller planning type covers travellers of all planning abilities transitioning into the in-trip travel environment where the traveller is planning their trip on the day of travel, but before departure. Due to these circumstances, the traveller will have access to more real-time travel information that presents the present travel situation as it evolves. This TPT is exclusively for re-affirming learnt travel information gained through pre-trip journey planning (TPT 1 and TPT 2) or re-affirming beliefs or expectations that the traveller has formed through personal experience (TPT 2). It may also cover some travellers that underestimate their knowledge of the public transport system and need more support or guidance to address the lack of knowledge that has now come to light through the expert pannelists feedback. As this planning type is new to the TPT framework, the foundation for the travellers' use of travel information and primary motivations reflect the panellists' review.[34] This TPT can cover all levels of public transport familiarity with the motivation to find more accurate travel information such as arrival and departure times to reduce journey time or waiting time. It reflects a traveller that is aware of day-to-day service fluctuations or has more reliance on real-time travel information because of the existence of this form of travel information.[35] Thus travellers require a means of refreshing pre-trip travel information obtained in the pre-trip planning stage so that it reflects the actual service provision. Similarly, it must be able to notify the traveller of and resolve travel issues, to convey a realistic expectations of completing the journey successfully.

[34] See Appendix C for more details about transition planning resulting from the panellist's suggestions.
[35] Identified in Chapter 2.

5.2.1.4 Type 4 – Committed in-trip planning and of reduced wayfinding ability

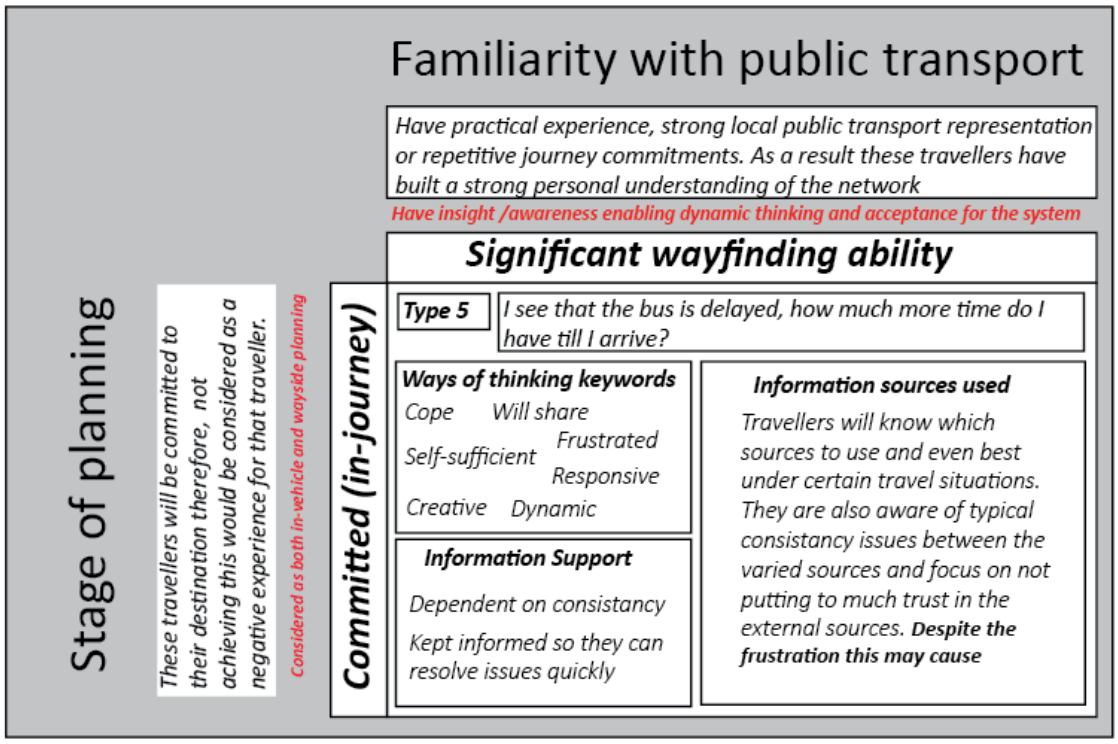


The next TPT represents in-trip journey planning travellers that have limited exposure to the public transport network or lack familiarity with how it operates. They will have different motivations to travel information as they are now conducting their journey and will be driven by the need to complete that journey successfully. This TPT includes unfamiliar travellers that sought pre-trip travel information to prepare themselves for the journey, and those that may not have obtained pre-trip information. In some cases, an urgent or impromptu journey demand may have limited the extent to which they could have planned their journey in advance. They may have some external frame of reference to make in-trip travel decisions to replace their lack of personal knowledge, and the adequacy of that information will become apparent as the traveller faces the reality of the journey.

Travellers with limited exposure or familiarity naturally rely on conduit sources such as a journey planner, friends, family members or travel shops to produce their travel plans, further showing their lack of ability to operate autonomously with the public transport system. They are naturally more reliant on the service to run as it is timetabled or for information sources in-trip such as a departure board to reflect clear details about what to do next. This level of personalised support and guidance is crucial when dealing with in-trip variations. As is often the case for these traveller types, staff and other travellers become the most valuable information sources as they can tailor information to the travellers' information comprehension level and journey needs. This traveller

planning type may be able to observe the actions of surrounding travellers and work out the next appropriate step to take to continue their journey, demonstrating the power of conduit travel information that these travellers rely on. Travellers that are particularly new to or unpractised at public transport journeys will underestimate the level of cognitive effort they may need and the drain on their mental resources as they pay attention to their travel details. Providers often underestimate the toll that this has on travellers because of their keen awareness of the regular traveller. The way to support these travellers is to find ways for them to engage with travel information as they travel that connects with what they found and understood pre-trip. This will encourage them to feel at ease with the change from estimated travel information to real-time information and validating that their journey can be completed successfully.

5.2.1.5 Type 5 – Committed in-trip planning and of significant wayfinding ability



The next TPT represents in-trip journey planning travellers that have sufficient exposure to the public transport network or familiarity with how it operates. This traveller will have similar concerns about completing their journey successfully, but the difference between this traveller and TPT 4 is their ability to process and respond flexibly to service variation, in some cases planning for these difficulties. Due to their frequent use of public transport services, they will have gained a general awareness and acceptance of these daily variations and may even be able to predict more accurately what the in-trip journey progress would be like by the things they observe. They will respond to and plan journeys around the frequency of the route rather than a

set time of travel. As a result, they respond more flexibly to the travel situation and identify the information they need to react to their situation with greater ease, using trusted and reliable sources of travel information that have worked for them in the past.

Although it is unlikely, this traveller can temporarily feel the effects of the TPT 4 traveller unfamiliar with their in-trip surroundings when they encounter severe disruptions that go beyond their means to handle autonomously. However, the temporary reliance on external support will progress to self-sufficiency as they engage and gather the details about the problems they have found themselves in. These travellers need precise information about changes so that they can decide what their next action will be.

5.2.2 Analysis of the overall TPT framework

A key part of the expert review was to conclude whether or not the TPT framework was appropriate to represent the concepts that influence the conversion of travel information into effective action. The panellists judged the individual TPTs according to their accuracy in representing the described TPT and the overall framework.

5.2.2.1 Review of the TPTs

Initially, the experts reviewed the individual TPTs and rated, using a 10-point Likert scale their belief that these traveller planning types sufficently reflected the help that these travellers would need the future. The results are shown in Table 5-6.

Table 5-6: Delphi study rounds results: Representative of described TPT

	Round 1			Round 2			Round 3		
	mean	n	std deviation	mean	n	std deviation	Mean	n	std deviation
Type 1 – Pre- trip / reduced wayfinding ability	7.46	13	1.94	7.67	12	1.23	8.08	12	0.29
Type 2 – Pre- trip / significant wayfinding ability	7.46	13	1.94	7.92	12	1.08	8.17	12	0.39
Type 3 – Transition	-	-	-	7.75	12	1.14	8.17	12	0.39
Type 4 – In-trip / Reduced wayfinding ability	7.46	13	1.94	8.17	12	1.19	8.17	12	0.39
Type 5 – In-trip / Significant wayfinding ability	7.46	13	1.94	8.33	12	1.30	8.17	12	0.39

In the first round, the range for the TPTs was broad (lowest=3, highest=9), thus the standard deviation was high. In rounds 2 and 3, after making the necessary alterations to the TPTs, they were re-submitted to the panellists resulting in a less varied response because the TPTs were much more clearly defined and they incorporated the panellists' anonymous views from round

one. The results were particularly encouraging because consensus (lower deviation) was possible, and the study aimed to find consensus on these broad TPTs. An indeplendent sample t-test of the means between rounds one and three shows that the differences in population means are statistically significant for type 1 (p=<.001), type 2 (p=<.001), type 4 (p=<.001) and type 5 (p=<.001). Type 3 was not included as this type was introduced after the first round interviews at the panellist's recommendation.

5.2.2.2 Review of the overall Framework

In addition to discussing the TPTs, the panellists reviewed the overall TPT framework for clarity, creditability, learnability, relevance and significance using a 10-point Likert scale (see Table 5-7 and Table 5-8) to highlight areas of the framework for improvement and reflect concise views that the panellists had towards the framework's ability to represent the traveller concepts that represent travel information comprehension, and influence effective action.[36]

Table 5-7: Subject descriptions

Subject	Description (read aloud or presented to panellists)
Clear	To what extent would you agree that the framework is organised? Is it clear and uncluttered, and a clear representation of its aim?
Credible	To what extent would you agree that the framework could enable successful information provision?
Learnable	To what extent would you agree that the framework is easy to understand so that if you were provided just this framework, you would know enough about what it does?
Relevant	If this framework was to become a mandatory component of information provision, and you would have to apply this today, would it benefit or improve your efforts to improve information provision?
Significant	As you are an expert in the field of public transport you would be able to identify if this framework is considered new knowledge or a re-representation of current knowledge, would you say this represents new knowledge.

Table 5-8: Delphi study rounds results: Judging the framework by perspective

	Round 1			Round 2			Round 2		
	mean	n	std deviation	Mean	n	std deviation	mean	n	std deviation
Framework is clear	7.31	13	2.18	7.33	12	1.83	8.08	12	0.29
Framework is credible	7.38	13	1.66	7.92	12	1.08	8.00	12	0.00
Framework is learnable	7.15	13	1.86	7.25	12	1.86	8.00	12	0.00
Framework is relevant	7.54	13	2.18	8.08	12	1.44	8.92	12	0.29
Framework is significant	7.31	13	2.32	7.67	12	1.07	8.00	12	0.00

[36] Research question 1.

In the first round, all the scores were random, including low rankings (lowest=2, for clear, relevant and significant) and high ratings (highest=10, also for clear, relevant and significant), much as expected. During the second and third rounds, variation decreased and the ratings became more consistent. However, two areas – clear and relevant – marginally reduced the varied ratings received which suggest that they needed improvement. An independent sample t-test of the means between rounds one and three showed that the means were statistically significant for clear (p= .003), credible (p= <.001), learnable (p= <.001), relevant (p= <.008), significant (p= <.001) and representative (p= <.006).

The framework may have maintained some variability because of the extensive level of information that this framework captures per TPT, as the variation was not due to low scores. One operator panellist rated this framework as a nine for clarity, compared to their peers all rating it as eight. This suggests that if the framework were to address the spectrum of familiarity as an example, it could improve its clarity. The variation in relevance was due to one local council representative rating an eight compared to their peers collectively rating relevance as a nine. However, these minor variances do not disprove the framework's overall validity to represent the concepts that influence the conversion of travel information into effective action. Ratings of eight or above higher may demonstrate that the framework encapsulates relevant topics that are of value, and so the concluding questions in the expert review directly asked the panellist whether the framework was directly applicable to the travellers that they support. The results are shown in Table 5-9.

Table 5-9: Delphi study rounds results: Does the framework represent the travellers you support?

	Round 1			Round 2			Round 2		
	Mean	N	std deviation	mean	n	std deviation	mean	n	std deviation
Council panellists only	8.29	7	0.49	8.71	7	0.49	9.00	7	0.00
Operator panellists only	6.33	6	2.25	7.60	5	1.52	9.20	5	0.45
All panellists	7.38	13	1.80	8.25	12	1.14	9.08	12	0.29

The group that rated initially low throughout this study was the operator panellists, and it appears that their ratings increased by concurring with the anonymous responses from their peers. This remained true for the third round when improving the relevance of the framework, the changes

between the first and second rounds and the introduction of the newer improved TPT framework did reduce variance and improve overall acceptance of the framework. This suggests that the conceptual framework could be improved on in line with views offered by both panellist groups, but the swaying factor was the collective opinion.

For the intended audience,[37] all the panellists agreed that it had relevance to the strategies that they were presently working on, so the experts recognised that they were the intended audience. However, other groups emerged such as developers and third-party travel information providers, including those that distribute information via local media. This means that the primary audience of this framework will naturally be policy makers, operators and third-party distributors of travel information.

5.3 Discussion

The '*Stage 3: Delphi (expert review)*' results show that the TPT framework is appropriate for representing the traveller concepts that represent travel information comprehension, and influence effective action.[38] It can also express those concepts in such a way as to reveal the reason for travel information and the value of appropriately providing support in line with the fourth rule of citizenship outlined in Chapter 1. Given the advantages of the TPT framework outlined above, it stands to reason that it should be contrasted with similar models and frameworks before concluding that it is the best way of representing TPTs. Existing multi-disciplinary models that represent the individual's decision-making process were evaluated on their approach to supporting the conversion of travel information into style-appropriate delivery.

5.3.1 Influencing choice – affecting CBR

Choice based architecture models are designed to target the individual's choices or process of choice to influence these decisions, hence their multi-disciplinary nature. The Stages of Change (SOC) and NUDGE models attend to this method of thinking. The former describes five stages – pre-contemplation, contemplation, preparation, action and maintenance – that describe the process of individuals gaining awareness of an action and progressing to a point at which they can maintain it (Prochaska, 1979, Prochaska and Norcross, 2009, Prochaska et al., 2013). This model encapsulates the transtheoretical stages of change and corresponding actions made by the individual at that stage in the transition between awareness and maintenance (Nisbet and Gick, 2008). This model expresses that strategies aimed at the whole group would be ineffective as

[37] The last question on the questionnaire.
[38] To a reasonable level

some individuals will not operate in the same logic space as others at different stages of the transition process. Morris et al. (2012), concur with this view, explaining that the individual will temper their progress through the various stages of change by their cognitive, affective and conative beliefs and opinions. For this reason, the SOC model is particularly effective at expressing the stages at which the information might be captured, used and processed in the pursuit of an action like gaining familiarity to increase the success of planning a journey. It is capable of expressing methods that the audience of this research could use to assist in the transition of travellers from reduced wayfinding ability to the possession of a strong wayfinding ability.

However, this does not target the rationale of both these two dynamics interchangeably – the growth of experience and the impact of a change in stages – neither does it target the process of stages (pre-trip vs in-trip). Rather, it uses exposure and learning to assist the individual in adopting a change. This shows that the SOC model is reliant on exposure and experience and is in support of the TPT types as a representation of those overlapping concepts.

The NUDGE model described by Thaler and Sunstein (2009) hold that expresses choice architecture models need either to force the individual to slow down their automatic processing of decisions or stimulate reflective decisions through smarter information provision support. This is supported by Evans and Stanovich (2013) who refer to these styles as duel-processing theory, which resonates with the discussion regarding CBR (see Chapter 4). The NUDGE model itself describes strategies that can be used to slow down or stimulate the way that individuals process information through: incentives (**N**), understanding mappings/areas of choice (**U**), managing defaults to optimize status quo or inertia (**D**), giving feedback, both positive and negative to encourage attention (**G**), and expecting errors (**E**) (Thaler and Sunstein, 2009). These strategies are intended to optimise the information source to work for the sake of the individual and promote a response. This is particularly valuable when identifying strategies. However, the NUDGE model itself does not express the effectiveness of strategies to the concepts raised by the TPT framework and therefore does not meet the criteria for direct comparison.

5.3.2 Capturing the process flow of case-based reasoning (CBR)

An equally significant area that choice based architecture models target is the breakdown or flow of choices, often representing the application of CBR. The Theory of Reasoned Action (TRA) and the extended model addressing its weakness – the Theory of Planned Behaviour (TPB) – attend to this method of thinking (see Figure 5-2).

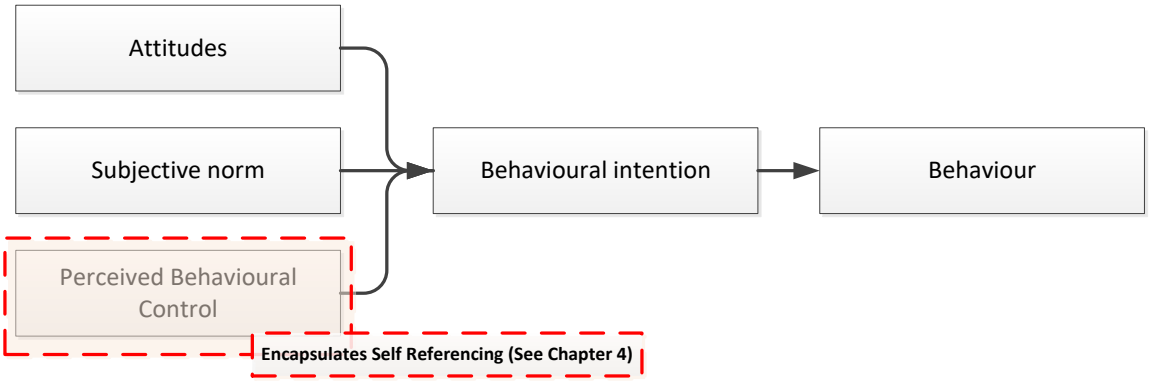


Figure 5-2: Analysis of difference between the extended TPB model originating TRA model (Analysis of: Ajzen, 1991, Ajzen, 2005, Ajzen, 2011, Montaño and Kasprzyk, 2008)

Figure 5-2 depicts the high-level factors of the related models, and the red section demonstrates the core changes made to the TRA model. The original TRA model describes that an individual's behavioural performance (willingness to undertake an activity) is controlled by two factors – the positive or negative beliefs towards that activity and the present subjective norms that depict how people should conduct that activity by introducing social expectation and personal perceptions. Figure 5-2 also shows that the extended TPB model absorbs the insights attained through the factors in the TRA model with one additional factor; perceived behavioural control. This factor draws on the individual's ability to reflect on past experiences and skills (Morris and Dillon, 1997) alongside the individual's self-belief about being able to adopt situations or activities (Ajzen, 2005). This self-belief has particularly strong ties to difficulties such as 'misguided exceptionalism' which is the individual's struggle to determine introspectively what they would do when faced with certain social behaviour, also known as a difficulty with 'self-insight'. The individual will potentially exclude themselves from their response by the justification that they respond based on their known intentions and free will (Dunning, 2005, Kruger and Gilovich, 2004). In this research, it was found that this misconception occurred regarding traveller's self-insight about information use behaviour, and thus the methodology plan for the research was adjusted.

These models encapsulate many of the overarching principles of CBR, such as the principle of self-referencing using past experience (see Chapter 4). The models themselves are particularly focusing on user behaviour in response to attitudes and past experience and not the consumption of information. This is why these models are not a valid comparison to the research questions' requirements, despite the extended TPB model being the most used model in evaluating user behaviour (Ajzen, 2011). Therefore they strongly support the TPT framework presented in this chapter, based on its encapsulation of this theory targeting the domain of public transport information provision and use.

5.3.3 Supporting the distinct TPTs

The modelling of CBR flow does not address the concepts the TPT framework was constructed from. These models were required to demonstrate how they support the conversion of travel information into style appropriate delivery to the traveller's travel information needs. In these examples, they demonstrate that the proposed framework is the most appropriate, as these models are shadows that point to the principle of CBR, either by interrupting and influencing that reasoning or capturing specifics of that reasoning through process flow. This is a consequence of their multi-disciplinary nature expressing the CBR approach for the benefit of multiple disciplines. In this situation, a discipline model is needed to validate this from a public transport perspective. In particular, the Customer Touchpoints Typology (CTT) formed by TfL in 2009 demonstrates that subject matter familiarity is a strong principle in modelling travel information comprehension (Transport for London, 2009). The CTT used this experiential learning as the concept that drew out seven traveller types based on the traveller's propensity to plan and their confidence expressed by experiential knowledge.

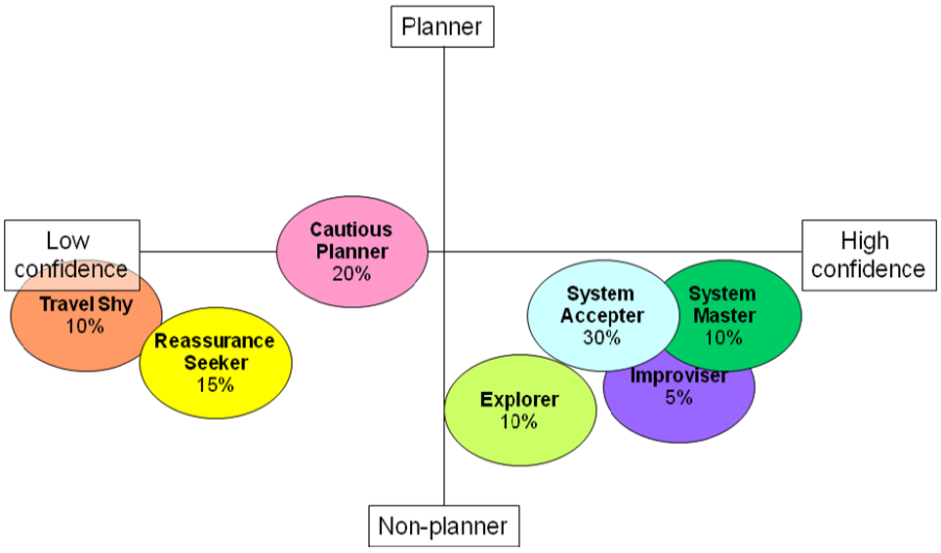


Figure 5-3: Seven customer types (Transport for London, 2009)

The CTT is significant in that it demonstrates the desire to model the TPTs alongside the need to do so by experiential knowledge. Nevertheless, the seven traveller types suggested by this typology were not well defined and contained a lot of overlap detracting from the value of such a model. This was largely caused by the exclusion of the 'stages of information use' and the attempt to explain specific traveller groups e.g. commuters and or travel enthusiasts. For example, the 'explorer' is included to represent tourists or visitors that have an overlapping description with a system accepter, but applying leisure-type preferences in circumstances where they are of a weak ability. Thus, while this typology does not present ways of targeting information provision, it is

valuable in confirming that subject matter familiarity is an important factor in the field of public transport information provision and that the TPT framework addresses a lot of the repetitious noise within the prior CTT (Transport for London, 2009, Transport for London, 2014, SPA FutureThinking, 2013).

5.4 Summary

This chapter set out to answer research question one: **What is an appropriate representation of the traveller concepts that represent travel information comprehension, and influence effective action**. To do this, the traveller concepts, familiarity and stages of information use were reviewed to describe how they influence the level, format and quality of travel information use. It revealed that there was an overlapping theme, demonstrating that the two concepts respond to one another and affect or modify information use and comprehension.

The expert review panel produced a robust version of the TPT framework which the expert panellists concurred was an appropriate framework to represent the traveller concepts that influence the conversion of travel information into effective action. They also agreed that the updated TPT framework was easy to understand and apply, and relevant to their field. The review could thus conclude that the TPT framework was fit for purpose.

Chapter 6. The structure of travel information in forming effective travel plans

6.1 Introduction

In this chapter, attention is given to the nature of travel information that travellers find valuable when planning a public transport trip. It discusses the traveller's relationship with their information needs, and then focuses on the natural structure of travel information in facilitating the construction of travel plans. Finally, it collects travel information into types as a means of measuring the level of travel information that is offered by travel IT. This discussion is based on the collated literature obtained through the initial literature review (stage 1a) and the extended literature review in Stage 2.

6.2 Establishing a travel information need

This section explains important concepts relating to information use and consumption and the difficulties researchers have in understanding an individual's information needs that was learnt following the outcomes of the Stage 1b: Intercept.

6.2.1 Processing information to satisfy an 'information need'

As the fourth rule of citizenship suggests, people in society can survive and thrive when they have access to the information they need, and that information touches on all aspects of functioning well in our society (National Consumer Council, 1977). This information covers a wide variety of subjects relating to general day-to-day living, including health, leisure, employment and housing. Other more direct information covering subjects in public transport service provision, including time, cost, geographical coverage and real-time conditions in the transit environment are expressed as either hard facts and figures or as 'experience-based' information that is able to assess these 'hard' facts and figures based on exposure to its relevance in context (Simpkins, 1994). CBR holds that an individual can relate to facts and figures with greater ease when that individual has an awareness of how the information applies in context. Individuals who lack this level of awareness rely on external information sources to obtain relevant facts and figures and will also expect that information to be clear and understandable to foster a positive growth of experiential knowledge (see Chapter 4). A travel information need arises when the individual lacks experiential knowledge about a service or how it relates in context and needs to know that information. Thus, the individual will use available travel information sources, such as a journey planner, to readjust their understanding of the public transport system using available facts and figures or experiential knowledge (Simpkins, 1994).

6.2.2 Using travel information to facilitate journey planning

Filippi et al. (2013), Spitadakis and Fostieri (2012) and the DfT (2011) describe travel information as being key to the act of planning and executing a journey. This relationship between travel information and journey planning was explored in this thesis using a flow diagram with the insights gained from the previous chapters (see Figure 6-1) and it shows that travel information is the source that satisfies a question relating to an emerging in-trip travel need (Southampton City Council, 2008). This indicates that the traveller's use of travel information is typically led by a clear travel demand.

The journey planning activity is where the traveller makes judgements about the public transport network using obtained facts and figures and experiential knowledge, obtained from various sources. It enables the traveller to process travel information and obtain additional support such as recommendations, guidance or increased confidence to conduct that journey (Farag and Lyons, 2012). Travel information is the source that offers facts and figures or experiential information about the travel environment, whereas journey planning is the moment that this information is consumed and interpreted for the purposes of promoting a successful journey (Lyons et al., 2007, The Parliamentary Office of Science and Technology, 2014).

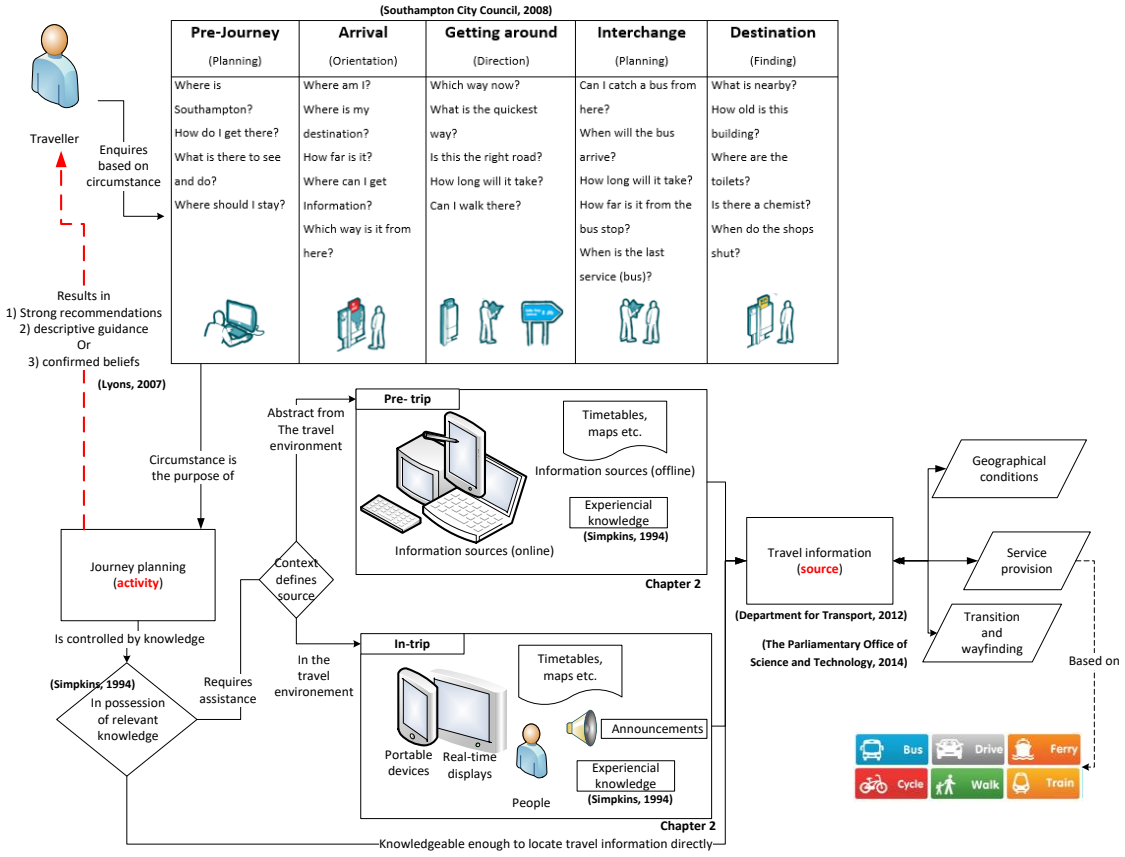


Figure 6-1: Analysis of the correlation between journey planning and travel information

6.2.3 Methodological application in researching information needs

Typically, any form of research expects a certain level of clarity about what to measure, however, a barrier in research relating to information needs is the individual's ability to convey their information needs clearly (Simpkins, 1994). This is because the individual is not naturally aware of their information needs until they become aware of a gap in knowledge and require information to resolve that gap. This thesis accounted for that difficulty by adopting a more qualitative methodological approach; a traveller will have an awareness of their information needs at the point at which they become aware of their gaps in knowledge, or when they are reacting to circumstances that require information to resolve. These two examples are the situations where the traveller will become sensitive to their direct travel information needs and gaps in travel knowledge that hinder their ability to form effective action. Lyons et al. (2007) found that travellers become aware of their information needs when they are searching for alternative routes to their typical familiar routes, or seeking options for journeys that are not familiar.

Researchers must not assume that travellers are in-tune with their information needs and know what they need to know and when they need to know it (Tinker et al., 1993). They must capture the traveller's travel information needs from travellers that have recently needed to use travel information. For example, during pre-trip journey planning where the traveller is drawing information from available information sources, or post journey drawing on the memory of the traveller about their in-trip experience through retrospective questioning.

The second research question was set to capture the travellers' travel information consumption behaviour during the pre-trip planning stage. It is at this point that the traveller will be most sensitive to their travel information needs, and able to draw reasoned conclusions as to the usability of present-day journey planners.

> **RQ2**: To what extent can current travel IT, e.g. a journey planner, meet the traveller's information needs according to the fourth rule of citizenship?

6.3 The application of travel information in journey planning

The key to travel information needs in journey planning is the traveller's enquiries about the journey that lead to a travel information point (data), such as:

> 'How and when should I best go from place A to place B?' (Spitadakis and Fostieri, 2012).

This statement suggests that the traveller will need travel information that establishes the 'how' of the journey regarding routing sufficiency and the 'when' the application of preferences, such as the best time to travel. Typically, travel information focusses on three core elements:[39]

1) Spatial details, e.g. road layout, routes and navigation;
2) Service details, e.g. frequency, service cost, comfort and security; and
3) Environmental transition, e.g. location services and real-time journey support.

The first element (spatial information) acts as a macroscopic level structure to travel information which covers the need to identify routes between the desired origin and destination; the how (Lyons et al., 2007). Following this, the traveller will start to evaluate the macroscopic level provision by the second and third elements (service and environment). These we can define as a microscopic level structure to travel information. These two elements in the microscopic level enable the traveller to evaluate the potential of the offered routes obtained at the macroscopic level either by using estimated travel information (service details) or live travel information (environment); the when (Lyons et al., 2007). Another way to see this relationship is that the traveller will only be able to evaluate and draw conclusions on the microscopic details when more than one route option can be investigated based on the macroscopic detail. In cases where the macroscopic details leads to a lack of fulfilment or a limited number of options, there is less room for the traveller to activate personal preferences which will apply at the microscopic level.

6.3.1 Macroscopic information needs: routing sufficiency

The macroscopic level of information needs corresponds to the traveller's wayfinding ability. The individual has known and unknown factors concerning their environment that determine how good their wayfinding ability is (Allen, 1999). The primary concern any traveller has in approaching a new or upcoming travel demand is the ability to map this journey (Bovy and Stern, 1990). They may not have the means of making this connection between the journey demand and the physical landscape, as they may lack exposure to the physical landscape and have limited local awareness. The traveller will become aware of and generate travel information needs relating to the geographical landscape by giving attention to this weakness (Caiafa, 2010) and then access the travel information available externally to modify the weak internal mental schema (Neisser, 1976).

Journeys could take place within an unfamiliar environment where the traveller has limited knowledge of the local landmarks area, and if they are unfamiliar with the area due to a lack of exposure, they will also demonstrate an inability to perceive environmental information (e.g. road

[39] As identified in Chapter 2.

signs, directions), inability to communicate their wayfinding issues to passers-by and will have difficulty relating to external information sources that provide for their wayfinding needs. They will also be unable to give attention to their journey planning preferences until they can satisfy this basic navigational requirement (Mc Ginty and Smyth (2001). However, according to Allen (1999), travellers that have a regular, habitual routine can move away from their spatial wayfinding needs and focus more on the journey characteristics by activating internal knowledge and personal preferences. This suggests that the traveller's familiarity towards the environment can either lead their travel information needs towards the journey details (the microscopic details) or more spatial and basic logistics concerns found in routing sufficiency (Spitadakis and Fostieri, 2012).

6.3.2 Microscopic information needs: activation of personal preferences

Due to the use of macro-level travel information, the traveller will be able to gain an awareness of whether the journey demand can be satisfied. In some cases, the outcome of macro-level planning will result in zero or more route possibilities, which may limit or enable the traveller to make more defined and personal decisions about how they want to travel. At this point, the traveller has the ability to evaluate the sufficiency of the route possibilities based on its micro-level, such as the service details (bus route, direction, and duration), daily variations, and the general complexity of the route such as the number of interchanges. For this reason, part of the skill in journey planning is the traveller's ability to process both the macro- and micro-level travel information (Todd, 2007). The purpose for considering both these levels is to address the traveller's confidence in what is available regarding routing sufficiency and which routes the traveller is confident in using (Caiafa, 2010). The connection to confidence when travelling is the ability to avoid wrong decisions or the inability to form effective action (Nyblom, 2014). As a result, the traveller may entertain feelings of doubt, such as regretting choosing one route over another,[40] which is likely to be amplified when they are unfamiliar with the suggest routes.[41]

> 'Suppose that [the traveller] has to choose between actions A1 and A2 in a situation of uncertainty. He chooses A1 and the jth state of the world occurs. He, therefore, experiences the consequence X1j. He now knows that, had he Chosen A2 instead, he would be experiencing X2j' (Loomes and Sugden (1982).

Chorus et al. suggest that travellers will approach the microscopic level evaluation by their concern of making wrong decisions (Lyons et al., 2007), indicating that the traveller may decide

[40] as described by Loomes and Sugden.
[41] Or parts of a suggested route.

to postpone any decision until they have obtained more information. They also called attention to this evaluation process by anticipated regret, suggesting that the traveller will adjust their preferences (micro level travel information) to reduce or increase the number of routing options available to gain more insight about both macro and micro level travel information (Chorus et al., 2006d, Chorus et al., 2006a).

In decision theory, the use of information is about the trade-offs between the ease of obtaining more information and the costs (time and cognitive effort) of obtaining that information to sway any notions of regret (Lyons et al., 2007). Typically, literature describes that this trade-off process is less about the rigor of seeking the 'optimal' route option, and more about the travellers' case based reasoning concluding that what has been learnt is good enough (Chorus et al., 2006c, Jones, 1998, Hansson, 1994).

6.3.3 Inter-relationships between the journey planning levels

The macro (spatial, geographical and routing) travel information and micro (service details, day-to-day service variation) travel information are closely linked to the traveller's propensity to evaluate journeys for optimal efficiency or to manage the anticipated regret (Chorus et al., 2006a, Chorus et al., 2006d, Todd, 2007). The traveller's knowledge of these two levels is also linked to their previous success in obtaining relevant macro- and then micro-level travel information. For example, service disruptions can inhibit the successful creation of a route, causing the traveller to consider micro-level details to address this by adjusting the time of travel to produce more route possibilities (Lyons et al., 2007). In this instance, the traveller may alter their origin or destination slightly to open up more routing possibilities (Zhu and Levinson, 2011). It is equally likely that a traveller's micro-level decisions (e.g. time or modal preferences) can reduce the viability of a suggested route (macro level) because of those decisions (Lyons et al., 2007). In such a case, the traveller will then be expected to consider route and modal alternatives to satisfy their journey at both the macro- and micro-level travel information needs (Zhu and Levinson, 2011). Network delays, cancelled services and strikes affect the traveller's routing options and due to the restrictions this places on preferences for suitable routes, there is an increase in demand for private transport (Klöckner and Friedrichsmeier, 2011). Consequently, this disrupts the travellers at both the macro- and micro-level (Zhu and Levinson, 2011). Any insufficiencies found in these areas will lead travellers to alternative solutions to remedy the difficulty.

Table 6-1: Analysis of (Southampton City Council, 2008) – Traveller Needs By Journey Stage

	Question	Detectable Information need
Pre-journey (planning)	Where is Southampton	Geographical layout considerations (local landmarks, street names and general structural hierarchy).
	How do I get there	Available Routes
Arrival (orientation)	Where am I? Where is my destination?	Local awareness (local landmarks, street names and general structural hierarchy).
	How far is it	Distance
	Where can I get information	Awareness of options, Awareness of information delivery techniques
	Which way from here	Routes, Direction
Getting around (direction)	Which way now	Routes, Direction
	What's the quickest way? How long will this take?	Temporal (Duration)
	Is this the right road?	Local awareness
	Can I walk there?	Local awareness, distance
Interchange (Planning)	Can I cat a bus from here	Service provision (routes)
	When will the bus arrive	Temporal (Waiting Time)
	How far is it from the bus stop	Distance, Proximity
	When's the last ferry	Temporal (Frequency), Service provision (availability).
Destination (Finding)	What is nearby? Where are the toilets? When do the shops shut? Is there a chemist?	Local Awareness

6.4 Areas of travel information that satisfy travellers' information needs

In travel literature, travel information types is a broad subject and often linked to specific areas of need such as getting around, or finding the destination as shown by Table 6-1. To account for this literature, the remainder of this chapter will collate the types of travel information into categories for the purpose of supporting the stage 4 summative usability evaluation in Chapter 7.

6.4.1 Supporting unfamiliarity

The first group refers to journey planning when the origin and destination are unfamiliar; this category focusses explicitly on TPT 1. This group of information needs is focussed on what is done to educate and support the unfamiliar traveller. Firstly, travel information needs in this category present a strong focus on the macro level detail, which focuses on route sufficiency. The travellers will need to establish the available routes that satisfy a specified origin and destination, or the means of obtaining this detail while managing the potential for information overload (Grotenhuis et al., 2007). An excellent example of conveying route availability are route summary maps that visualise the operating routes in the area in a standardised format (Transport for London, 2009).

Route maps help address in-transit orientation difficulties that this TPT has (Ishikawa and Montello, 2006), but they should avoid too much detail as this can distract the traveller from learning routes (Coxon et al., 2008, Transport for London, 2009, Schmitt et al., 2015). Journeys requiring interchanges or with an increased likelihood of in-trip difficulties need to be minimised to remove anticipated regret where possible (Todd, 2007, Molin and Timmermans, 2006), thus a means of controlling the number of interchanges is helpful to this type of traveller. Secondly, the traveller will focus on basic travel information needs that correspond to time and cost. These include the frequency of the route, the quickest route, the best time to travel, the next available service and ticketing information (Spitadakis and Fostieri, 2012). Thirdly, these travellers will have more difficulty putting the information that they have found into action, primarily because of a lack of experience interpreting the style of information offered while journey planning (Transport for London, 2009). Thus, a more subtle information need is the ease of interpreting available information and forming the confidence or trust in what was obtained (Schmitt et al., 2013, Schmitt et al., 2015).

Construct	Examples of information points
Supporting unfamiliarity	Ease of finding: quickest route, route frequency, all routes, best time to travel, how easy it is to travel, next bus, journeys without interchanges, if journey is affected by disruption, area coverage route map (by operator, all operators), ticket types (zoning). Ease to; action this information, interpret this information, trust this information.

6.4.2 Supporting travellers' basic needs

The next group refers to the traveller's basic travel information needs, such as time and cost. These two travel information needs are mandatory for all traveller types regardless of ability, as they control a traveller's willingness to change to public transport (Ajzen, 1991, Chorus et al., 2006c). Travel information literature frequently indicates the importance of time and cost to a traveller. Time is one of the most variable subjects linking to information needs and is undoubtedly the traveller's most essential travel information need. One factor that can increase time variability is the location of services, such as hospitals which may require longer journey times or the need to focus on route frequency because of the length of time needed to conduct that journey (see Figure 6-2).

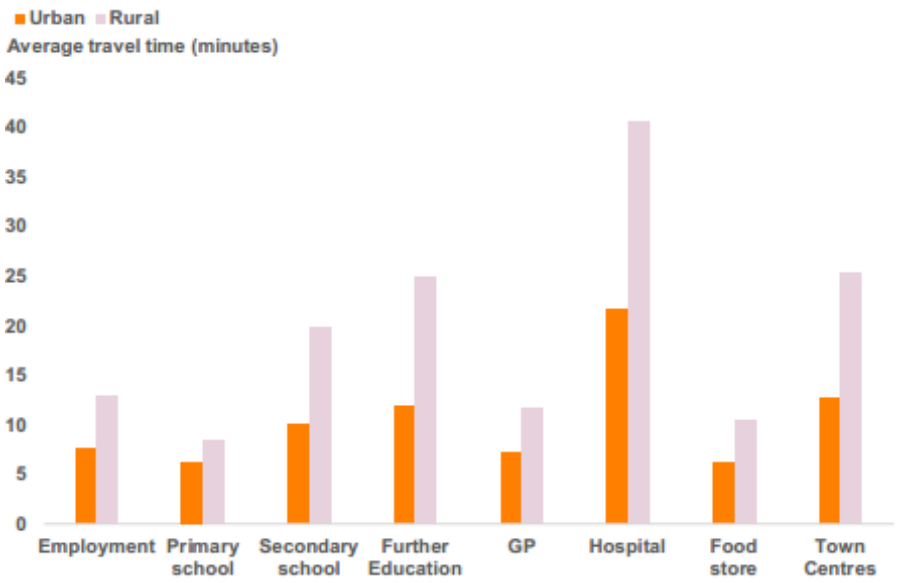


Figure 6-2: Average travel time by public transport/walking to reach nearest key service [England 2013] – (Department for Transport, 2014a)

Travel time covers many sub-categories such as: service headways (frequency of service); scheduled arrival times; journey time (planned duration); egress time (walking); actual arrival times; departure times; and journey progress (Tirachini and Hensher, 2011, Tirachini et al., 2014, Chorus et al., 2006c, Bottom et al., 2002, Golledge, 2002, Lappin and Bottom, 2001, Lyons, 2006, TCRP, 2003, Todd, 2007, Vipre, 2006, Bovy and Stern, 1990). These travel information needs are particularly relevant to the traveller when the journey has a ridged time frame stipulated by the journeys context (Lyons et al., 2007).[42] Therefore, service frequency is considered an essential piece of travel information as it can convey route flexibility clearly. Currie and Wallis (2008) and The TAS Partnership (2002) confirm that high frequency is important to the traveller by demonstrating that services with an optimal 10-minute headway increased a traveller's likelihood to leave their car behind (60%). This is because of the traveller's concept of time in pre-trip planning is different to in-trip planning, and frequency best conveys to the traveller the availability of a given service or route. They may be willing to accept a travel time of 20-30 minutes, but less inclined to accept travel times exceeding that (Transport for London, 2009). The cost of travel is another subject that produces travel information needs. It will not only cover the monetary value of travel, but also link subjects such as the means of payment. According to Molin and Timmermans (2006), the cost is related to ticketing where the traveller is expected to know where they can obtain tickets, the means or method of payment, the restrictions and the cost. Operators are also free to offer different ticketing price structures such as a distance-based or a flat fare

[42] Such as a fixed appointment that dictates the traveller's arrival time.

ticketing schemes that accounts for all operating service costs, affecting the price (Cairns et al., 2004). Travellers are also shown to care about whether the value of tickets they purchase is fair and not biased to favour habitual or non-habitual traveller (Trommer et al., 1995). Figure 6-3 shows that a traveller's financial circumstances can influence their modal decisions, further showing the importance of the cost of travel to a traveller.

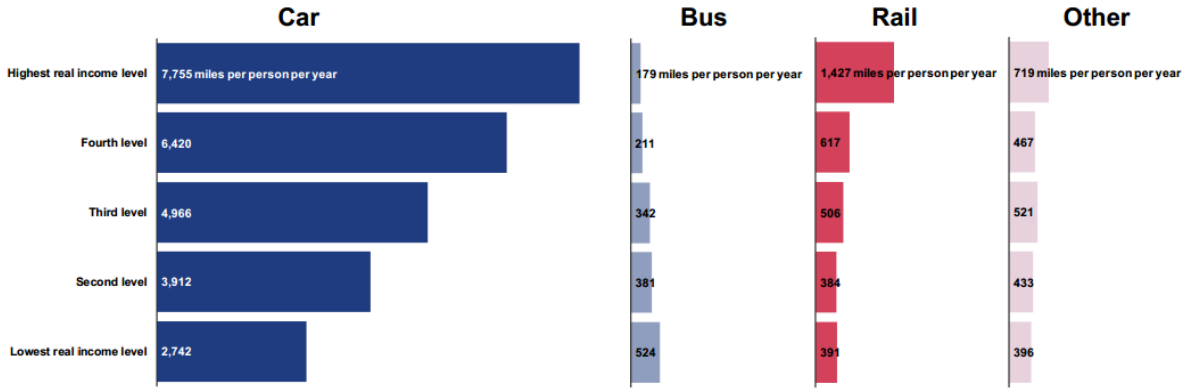


Figure 6-3: Average distance travelled by household income quintile and mode: England 2013 (Department for Transport, 2014b)

The final consideration is the ease of obtaining time and cost travel information. The lack of this set of information is, in effect, a failure to meet a travellers basic information needs. Therefore, the traveller will also need evidence that this information is easy to obtain.

Construct	Examples of information points
Basic information needs	Ease of finding: Arrival/departure times, first and last service times, service frequency, journey duration, fare price, ticket types, ways you can pay, compare costs, operator restrictions. Ease to; obtain this information and interpret this information.

6.4.3 Supporting travellers' advanced needs

The next group refers to the travellers advanced travel information needs, in essence, the traveller's personalised needs which go beyond the need for temporal or financial evaluation. This group can include travel information needs relating to traveller inclusion and additional details relating to service provision or locality. Firstly, in consideration of traveller types and personal preferences corresponding to a physical or cognitive processing disability. Molin and Timmermans (2006) broke this down into travel information about; toilets, access to trained staff, boarding assistance (trained staff and low curb access) and at-stop/set down details (crossing places, paths, seating, elevators, smoking, and telephones). In addition to this, aspects such as boarding services are a crucial travel information need as not all services hold Public Service Vehicles Accessibility Regulations (PSVAR) certification (Department for Transport, 2014a).[43] Other travellers more

[43] 83% compliance within urban city centres and 78% in rural areas.

prone to anxiety will tend to avoid full services, especially when this impacts the scheduled service running times (Tirachini and Hensher, 2011), regardless of the benefits of fully used services (Jara-Díaz and Gschwender, 2003). Some travellers can be subject to this concern particularly during peak times as examples exist of oversubscribed services (Anderson, 2014).[44] Such as Rail Executive (2014a) review of the ten worst overcrowded trains arriving at or departing from major cities in England and Wales during the morning and afternoon peaks, which can run between 148% and 201% of the services stated capacity. Therefore, the pre-planning traveller may be interested in the future reliability of routes across these daily travel cycles. Other types of advance travel information can include; luggage space, pushchair space, at-stop shelter space from inclement weather, catering facilities, air conditioning, leg room and cash machines (Molin and Timmermans, 2006, Currie and Wallis, 2008, Passenger Focus, 2010, Passenger Focus, 2011, Department for Transport, 2011). In addition to those, personal security concerns also act as another advanced preference including; CCTV monitoring, lighting and availability of staff (Currie and Wallis, 2008).

Construct	Examples of information points
Advanced information needs	Identify; busy periods, pram space offered, low curb access services, extra facilities offered, where to find trained staff (autism, mobility constraints), where to access essential needs (cash machines, ticket machines, toilets), security provision (lighting, staffing, CCTV). Confirm; planning support available in-trip (maps, announcements, inductive loop), arrival location layout (e.g. crossing places and paths), future reliability of route (during a day, over different days, during busy times).

6.4.4 Supporting travellers requirement for information reliability

The next group refers to the traveller's need for information reliability, especially in light of the frequent planned and unplanned disruptions affecting the accuracy of macro- and micro-level information. Chorus et al. (2007) concluded is the weakest in the overall category of travel information and often viewed as 'reliably' unreliable. Pre-trip journey planning does not adequately prepare travellers for the experiences of in-trip travel as services will not always replicate estimated travel information, as with the difficulties with changes to train timetables seen in 2018 (BBC News, 2018). Managing this difficulty is an important part of travel information needs. Molin and Timmermans (2006) identified 54 piecemeal travel information points that drew the traveller's attention, and the ability to have real-time information for in-trip difficulties was the highest priority.

A traveller's response to such difficulties will either be a general acceptance of the circumstances, or a change of location, departure time and modes to satisfy the journey (see Table 6-2).

[44] 3% of standard rail class train users are in excess of the train's capacity, a fact that has remained constant over the last decade.

Table 6-2: Reaction to service disruption by mode of travel (Zanni and Ryley, 2015)[45]

Reaction by method of trip.

Reaction options	Air/public transport 828 trips		Car 297 trips	
	Trip no.[a]	%	Trip no.[a]	%
1. I travelled as planned without any major changes to my original plan, apart from those caused by the disruption	271	32.7	142	47.8
2. I delayed the departure time but travelled on the same day	116	14.0	32	10.8
3. I travelled on a different day	232	28.0	39	13.1
4. I cancelled the trip	76	9.2	28	9.4
5. I changed the route	69	8.3	56	18.9
6. I changed the destination	19	2.3	5	1.7
7. I changed the departure point	36	4.3	8	2.7
8. I changed the method of travel	69	8.3	14	4.7
9. I decided to travel on my own rather than with other people	15	1.8	4	1.3
10. I decided to travel with other people rather than on my own	5	0.6	5	1.7
11. Other	34	4.1	16	5.4

[a] Given the multi-code nature of the answer these figures do not always sum to the total of trips and 100%.

Zanni and Ryley (2015) using a stated preference survey of 2,000 respondents and found that 1,125 reported journeys had been disrupted in some way by a natural event, and the degree of disruption was correlated to the importance of conducting the journey itself. They reported that some travellers were influenced by their access to close family and friends, available staff and access to travel information sources. At first, this observation seems to portray an arbitrary list of influential factors. However, it is likely to be indicative of a traveller expressing a reliance on external sources to address the difficulty, through a personal lack of exposure.[46] A traveller's familiarity with the origin, destination and routing sufficiency was not fully explored in Zanni and Ryley's study, which only raised familiarity as a concept and not the effect of unfamiliarity in service disruption. Other recent publications concur that the impact and experiences of unfamiliarity are not as explored as other areas such as the distribution of travel information itself (Schmitt et al., 2015).

Service disruption can be linked to a traveller's desire for service punctuality over service frequency in the real transit environment where daily variance occurs (Rail Executive, 2014b). This supports the groupings for 'supporting unfamiliarity' and 'basic needs'.

Thus, this group focuses on the confirmation of information reliability by offering clear, explanatory details regarding disruption, defining its type, source and the key strategies to resolve it.

Construct	Examples of information points
Information reliability	Ease of confirming; planned disruptions, compare disruption suggestions, remedial action for disruptions, bases for presented information (estimated, live), alternative locations, alternative travel times, alternative modes.

[45] 1125 reporting of short/long distance journeys effected by service disruption out of 2000 observed travellers.
[46] As explored in Chapter 4.

6.4.5 Supporting travellers form accurate travel decisions

The final group refers to the fourth rule of citizenship. A traveller needs the right level of support in processing the macro level details for journey planning, with recommendations on routing. As time plays a particularly important role in making decisions, the use of filters is helpful to the traveller enabling them to work with route suggestions (Currie and Wallis, 2008, TAS Partnership, 2002). Finally, and addressing a traveller's lack of familiarity (TPT 1) from the TPT framework, proactive assistance can be offered by the travel information source to enable personal preferences and comparison of options. When more than one routing option is available, it should be presented in such a way that promotes easy comparison for those with limited travel knowledge. According to the TPT framework, this is best done regarding routes and route frequency when pre-planning, and clear and timely information when in-trip.

Construct	Examples of information points
Supporting decisions	Ease of; finding route recommendations, applying journey time limit, applying personal preferences to find routes, comparing the available options.

6.5 Summary

This chapter drew attention to the structure of travel information that different TPTs will encounter as they plan an upcoming trip by discussing the preferences or types of travel information that they might seek, and that not all travel information types have equal importance. However, all important to some degree as they allow the traveller to exercise preferences through known decision theory principles. This links closely to the discussion (see Chapter 4) surrounding CBR that travellers need to process information in a structured way, perhaps focusing initially on routing, to promote future credible recall that will help the traveller as they conduct their trip.

To use this knowledge of the different levels of travel information generally, all the travel information types that have been discussed in literature as either valuable to the traveller or important in the process of trip planning were categorised (see Table 6-3).

Table 6-3: Full list of metric to measure the effectiveness of present-day travel information sources

Construct	Summary of travel information points within the stated construct
Supporting unfamiliarity	Ease of finding: quickest route, route frequency, all routes, best time to travel, how easy it is to travel, next bus, journeys without interchanges, if journey is affected by disruption, area coverage route map (by operator, all operators), ticket types (zoning). Ease to; action this information, interpret this information, trust this information.
Basic information needs	Ease of finding: Arrival/departure times, first and last service times, service frequency, journey duration, fare price, ticket types, ways you can pay, compare costs, operator restrictions. Ease to; obtain this information and interpret this information.
Advanced information needs	Identify; busy periods, pram space offered, low curb access services, extra facilities offered, where to find trained staff (autism, mobility constraints), where to access essential needs (cash machines, ticket machines, toilets), security provision (lighting, staffing, CCTV). Confirm; planning support in-trip (maps, announcements, inductive loop), arrival location layout (e.g. crossing places and paths), future reliability of route (during a day, over different days, during busy times).
Presentation style	Ease of finding; detailed journey breakdown, list of route options, compare options, find all routes available.
Information reliability	Ease of confirming; planned disruptions, compare disruption suggestions, remedial action for disruptions, basis for presented information (estimated, live), alternative locations, alternative travel times, alternative modes.
Supporting decisions	Ease of; finding route recommendations, applying journey time limit, applying personal preferences to find routes, comparing the available options.

Table 6-3 shows that six categories were identified, each providing a purpose in the process of supporting the traveller's plan. For example, 'supporting unfamiliarity' addresses a traveller's desire to make sense of macro level travel information (routing) by finding the least complex route for the trip, such as finding journeys without interchanges. This is because their lack of skill and limited awareness of travel options leaves them open to vulnerabilities when the in-trip experience deviates from a pre-trip estimated travel plan. The main objective of this categorisation was to support the usability study reported in the two following chapters.

Chapter 7. The effectiveness of current travel information technology

7.1 Introduction

The discussion so far, explored the traveller's dependency on travel IT as a result of a lack of autonomy. This was done by defining what certain TPTs will expect and need a travel IT system to provide. In this latter part of this thesis, attention turns to travel IT and its response to this dependency by measuring its ability, or lack thereof, to meet it.

7.1.1 The need for customer centricity

Since the early 2000s, there has been a recognised interest in improving IT for usability and customer centricity (Kaushik, 2007) which can cover a range from the aesthetic to the functional (Garrett, 2002). For public transport, there is a lack of guidance in the literature about designing travel IT for either aesthetic or functional usability. This research has attempted to link the stipulations of the fourth rule of citizenship to travel IT, and explore the data democracy of general information technology. Data democracy is understanding and offering relevant and timely data and information to support effective decision making, by understanding the differences between the skill of autonomously using data and needing someone or something else to translate that data externally (Kaushik, 2007). This means that to provide an equal opportunity as a basic requirement of general information technology, it must work for both types of individual – the practised and the unpractised.

7.1.2 Accommodating wayfinding demands

The difference between general IT and travel IT is that it requires the design to support two forms of wayfinding. The first has already been explored: the traveller's ability to autonomously identify local landmarks, street names and general structural hierarchy, perceive environmental information and link this to available public transport services (Hochmair, 2005). This means that a travel related IT solution will be expected to accommodate a traveller that may or may not have this ability, and support that need appropriately. The second form of wayfinding is linked to the traveller's objective when using travel IT, and this needs to be facilitated with clear navigation and information design (Garrett, 2002). This objective is to obtain and understand travel information to plan and conduct a public transport whilst enabling the traveller to query a journey and become aware of all the relevant solutions for that journey (Spitadakis and Fostieri, 2012). Thus, the dual-wayfinding demands of travel IT need to incorporate a clear design, or workflow, that serves to communicate the process of using travel information (design-based wayfinding), while also

successfully supporting the traveller to address the navigational form of wayfinding. However, this is not discussed in the literature.

According to Garrett, good wayfinding design gives the user 'a mental picture of where they are, where they can go, and which choices will get them closer to their objectives' (Garrett, 2002 - Page 134). Therefore, if a journey planner's design has considered dual-wayfinding, it will be able to demonstrate this under lab usability testing when travellers are given both a familiar and an unfamiliar trip demand to plan.

7.1.3 Conducting lab-based summative usability testing

The final stage of the research methodology, a summative usability evaluation using data triangulation, explored a journey planner's ability to cater for customer centricity, dual-wayfinding and travellers' information needs according to the fourth rule of citizenship. The experiment invited 30 participants to attend a lab usability experiment of three selected journey planners to participate in three core activities related to each (see Figure 7-1 and Chapter 3), and the data collected was used for a variety of tests, as laid out throughout the rest of this chapter and the following one.

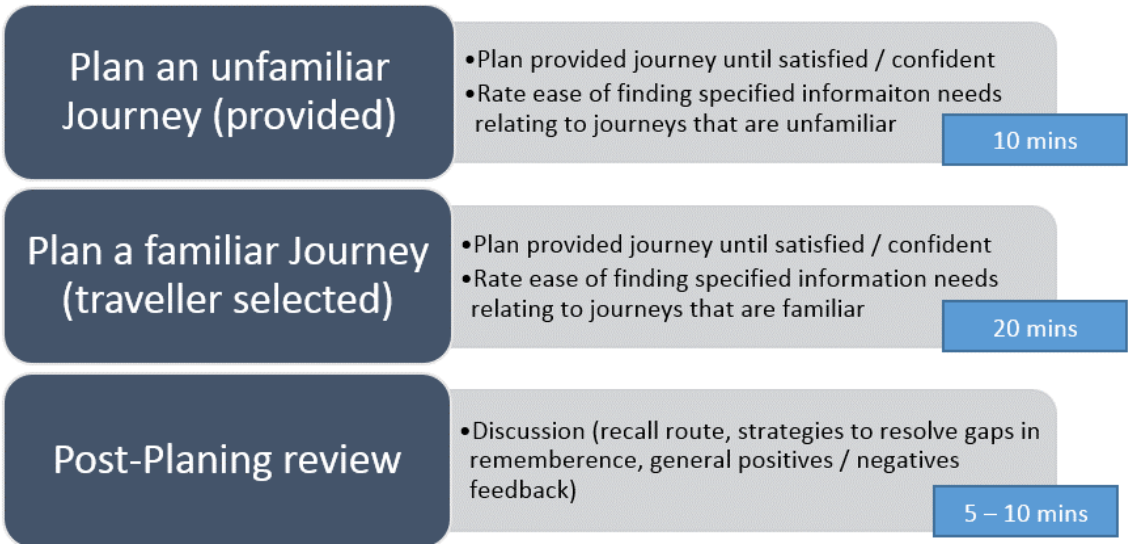


Figure 7-1: HCI Trial Procedure – repeated for each journey planner under review

7.2 Presentation of dual-wayfinding.

Travel IT that attempts to offer travel information to travellers in relation to the journey planning activity has to accommodate dual-wayfinding. This is designing it for how people think and navigate in a designated space, which can be applied to both physical space in terms of the geographical space in which public transport services operate, or to virtual space in terms of how a website is designed to obtain and make use of information about the physical space (Whalen,

2019). There is an inherent structure to travel information (see Chapter 6), and its macro- and micro-information should form the structure of the dual-wayfinding process. To express this dual-wayfinding consideration, the analysis of the 90 planned trips were reviewed and converted into a set of elapsed time data that described the length of time the traveller spent on localising their trip (macroscopic level planning), followed by the length of time they spent planning their trip (microscopic level planning) before declaring confidence. Table 7-1 shows the judgement criteria used in timecoding these two stages.

Table 7-1: Timecoding judgement criteria

Stage	Judgement criteria when reviewing video logs for timecoding
Localising	The amount of time that was taken for the journey planner to offer one viable route for the traveller's journey and for the journey planner to offer relevant travel information.
Planning	The amount of time between the journey planner offering one viable route option and the traveller declaring confidence that they could conduct that trip. This is the part of the trip where travellers were seen evaluating their travel options and seeking further travel information.

In the case of the three journey planners that were reviewed, two forms of dual-wayfinding design was observed. In the first type, using Google Maps, the localising stage consisted of the traveller submitting origin and destination details which resulted in route recommendations. In the second type, using MyJourney and Traveline, the localising stage consisted of the traveller submitting origin and destination details along with preliminary trip details which would also result in route recommendations.

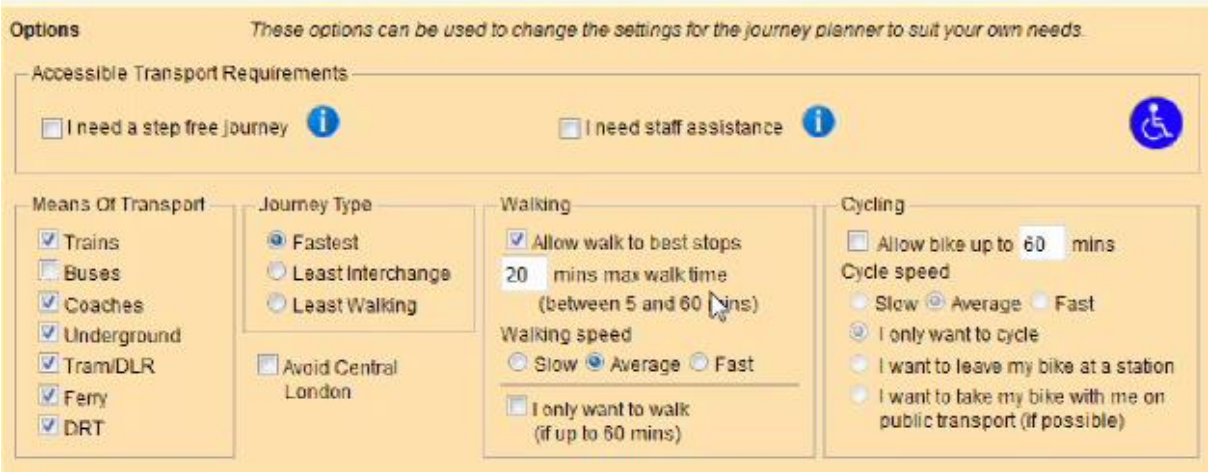


Figure 7-2: Traveline (original) pre-route options (participant 6)

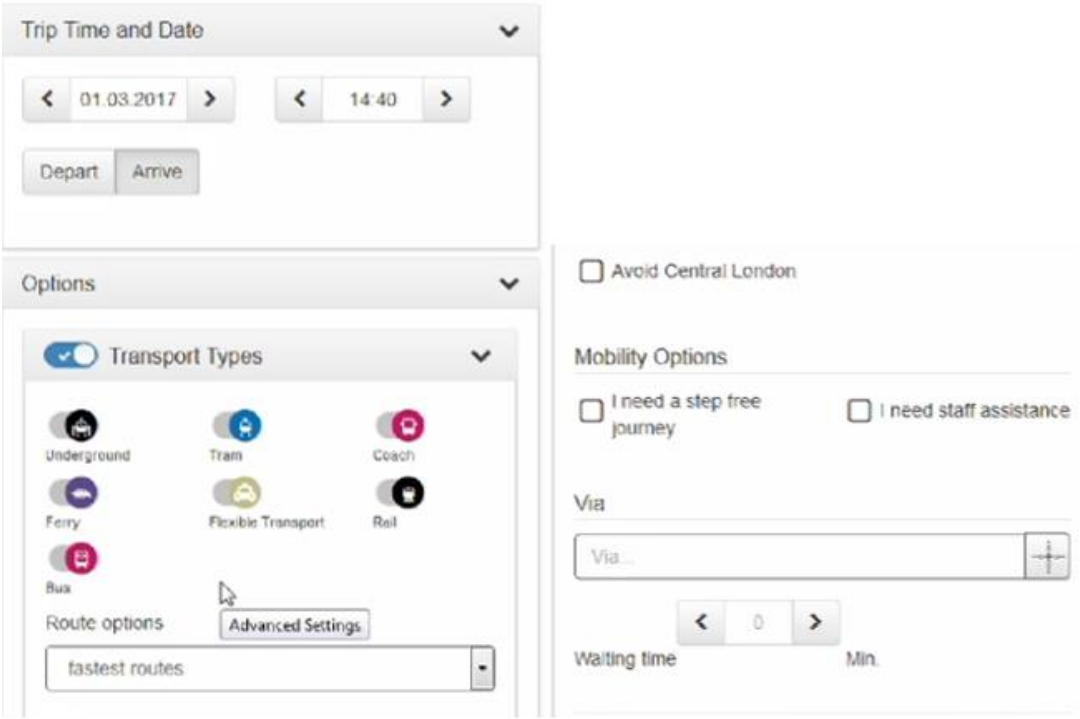


Figure 7-3: Traveline (updated) pre-route options (participant 17)

This main difference between the two was that the latter introduced pre-recommendation questions that incorporated microscopic level travel information, a blend of the two identified levels of travel information (see Figure 7-2 and Figure 7-3). The resulting recommendations were thus filtered and accommodated both the macroscopic level routing options and the variable constraints that the traveller had applied. It was clear during the timecoding process that the relevance of those recommendations was reliant on the traveller possessing the relevant macroscopic-level insight. The flaw in this design was that for many travellers who planned the unfamiliar trip ended up preventing the journey planner from producing a single recommendation, instead finding routes that ere unfeasible requiring correction (see Table 7-2) or crashed the journey planner by producing a catastrophic error (see Figure 7-4).

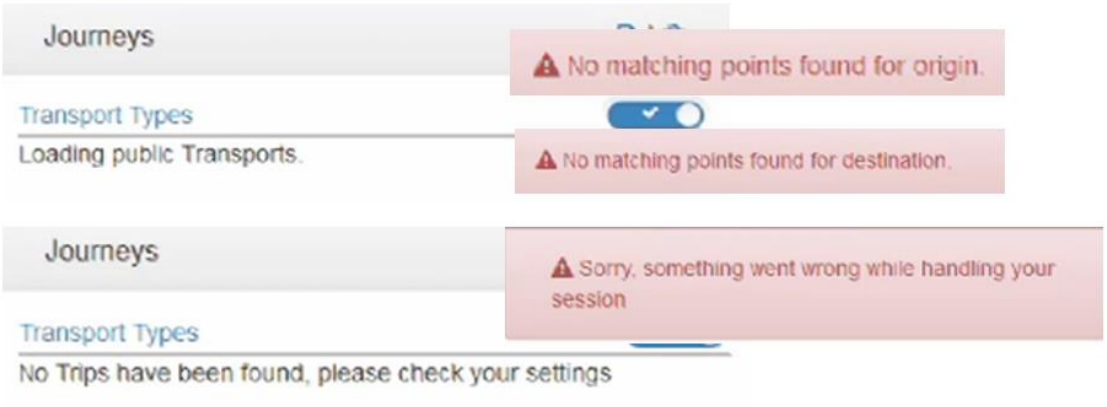


Figure 7-4: Error messages from Traveline Southwest, participants 17, 18, 20, 21, 22, 23, 25, 27 and 29

Table 7-2: Example correction process as observed from participant 22 (unfamiliar journey)

	**(localising stage)** Traveller wanted to travel by bus, but clicking on this deselected bus.
	**(planning stage)** The traveller is presented with public transport options that include a mixture of trains and coaches
	**(planning stage)** Corrects their mistake
	**(planning stage)** Uses the knowledge they gained from the erroneous options to make smarter choices
	**(planning stage)** Traveller now can see the options for the journey that they wanted to see from the outset.

This confirmed that the traveller must have an underlying comprehension of macroscopic level travel information to create a connection with public transport services that operate within that space and show that, for a journey planner to effectively structure dual-wayfinding, it needs to take responsibility for the inherent structure of travel information. A traveller may not know how to successfully navigate between their origin and destination or make logical decisions about that journey's microscopic level details. When the unfamiliar traveller faced this blend of macro- and micro-level choices pre-recommendation prior to its visualisation, they made judgements about its meaning and applied them based on random choice or personal whim, see Table 7-3.

Table 7-3: 'speak/think' aloud extracts – Handling pre-route questions in the localising stage

> **(LOCALISING STAGE) '**Obviously, I want to try and establish how I want to – what options I want to see to be able to get there. So, 'Remember to deselect any modes you don't want', so that's handy. I can't see many ferries getting me through town though'
>
> **Participant 24 (Male/ 30-49) –MyJourney (Unfamiliar – Medical) – Chose Public Transport**

> **(PLANNING STAGE) '**I'll leave today at 11:00, and I'll leave all options, because I don't know exactly where I'm starting from?'
>
> **Participant 13 (Female/<30) – Traveline original (Unfamiliar – Leisure) – Chose Public Transport**

> **(LOCALISING STAGE)** ''Maximum walking time', all right, we will include walking. 'Avoid central London' (Laughs) I don't think I need that on this journey. 'Assistance', Okay so that's alright. So I'm going to walk, walking speed normal… So, it's not actually… I'm not sure what that means… (Clicking). Take a bus, oh, so it's not suggesting I walk all the way at all is it? despite the fact that I tried to put that in. Okay, so…I don't want any more detail about that, so… transport types, include bus… Does that…? Ah, that didn't give me that first of all, so let's see whether that does anything – submit -' (**PLANNING STAGE**) 'ah, there it is… right… so, where would I – what? (Laughs) I've got Basingstoke in here somewhere, it's saying – no, I don't want to go there, thank you very much! Why are you telling me I want to go there? (Laughs) I have no idea what this is telling me at all!' **(PLANNING STAGE)** ''Options', let's go – I've got my journey in correct… yes – correct address… I've put the date and the time in, I've put when I want to arrive – what I don't know is whether this means I have got to switch all of those off or put them all on?'
>
> **Participant 29 (Female/ 50+) – Traveline updated (Unfamiliar – Medical) – Unable to declare confidence**

> **(PLANNING STAGE) '**I'll look at the map first. SO16… there it is, Bassett Green… I know that that's not going to be far away… I don't think I'll be getting a train from there, maybe a bus out on that main road (clicking). The airport is just over here… so that's either a taxi or a bus ride…it's hardly worth getting on a train to get there I think. What buses do we have? is it going to show me how I get there?'

Participant 9 (Male/50+) – Traveline original (Unfamiliar – Business) – Unable to declare confidence

(PLANNING STAGE) 'Put in the postcode (typing) … not seeing a map now for the moment. Right, pretty sure there is no train up there, so get rid of that (clicking), tram (clicking)… you're joking? Ferry, seems irrelevant, not sure what DRT is – perhaps, rapid transit maybe. Anyway… leave it in… options…step free journey…seems to give taxis as options for use only… Go

Participant 6 (Male/50+) – Traveline original (Unfamiliar – Business) – Selected Public Transport

(PLANNING STAGE) 'Ooh, got something up. Oooh. Right. So, 11:32, get me in at 12 o'clock. Yay! Max journey time 41 minutes. Trip, Ah…, that's not a bus symbol. It's a boat. Try that one. ...Details'. … 'Ah.. ...So, that to the city centre, walk about. Hey? That's…Oh, I, let's see. I Think I got a bit stuck with the destination and am going the wrong way'.

Participant 6 (Female/50+) – Traveline original (Familiar) – Unable to declare confidence

(LOCALISING STAGE) 'Remember to deselect the modes you don't want. Do I know? Hmmm. Right, we don't want that, don't want that, don't want that, don't want that… …'.Show advanced options', what does that mean? Start again. Right click on the map to select your journey, oh… 'Add return trip', Hang on, I want to go from where?'

Participant 6 (Female/50+) – MyJourney (Unfamiliar – Medical) – Unable to declare confidence

(LOCALISING STAGE) 'I have to arrive at the airport by 9am, let's say for 8.45am for safety reasons and then I will select no walking'…'. Options, and yes I want a step free journey' … 'It's loading now… let's see… 'No trips have been found – please check your setting'. There might be something wrong in my setting; let's do it again'

Participant 21 (Male/<30) – Traveline updated (Unfamiliar – Business) – Unable to declare confidence

(LOCALISING STAGE) 'The graphics and colouring don't seem so pleasing, but then I see that I've got walk, cycle, drive, bus, train and ferry (laughs) all selected. Do I need to deselect them?'….

(**PLANNING STAGE**) 'What were my options? What have I got? What have done wrong here?'

Participant 17 (Male/50+) – MyJourney (Unfamiliar – Leisure) – Unable to declare confidence

(**LOCALISING STAGE**) 'Need to click 'go' to get it to give me some sort of idea on the map where I'm going'

Participant 17 (MALE/50+) – MyJourney (Familiar) – Decided to drive

(**LOCALISING STAGE**) 'I have no idea about the places of these two so I'll just keep all the different modes selected, I can't make any choices. Click 'go''

Participant 7 (MALE/50+) – Traveline original (Unfamiliar – Leisure) – Chose public transport

(LOCALISING STAGE) 'It's identified which ways I would assume, you probably don't want to cycle or walk, but maybe you can drive or get the bus. I can't imagine getting the train in this area would be a good idea'….

(**PLANNING STAGE**) 'It is a little bit interesting, because you have said that you don't really want to walk, but it is making you walk for almost half an hour'

Participant 18 (Female /<30) – MyJourney (Unfamiliar – Business) – Chose public transport

(LOCALISING STAGE) 'Yes, so I've clicked on Debenhams on Queensway and it took me to Scotland (laughs) so… (Typing), I think if I just type in the postcode this time, it might understand it better (laughs). Okay, so it's got – it's found it there in Southampton on Queensway (clicking)'

Participant 18 (Female /<30) – Traveline updated (Unfamiliar – Business) – Unable to declare confidence

(LOCALISING STAGE) 'It's giving me a lot of options and I don't know how fast I walk so it does not really bother me (laughs). I suppose it's to tell you how long it will take but I'm not sure many people know how… how fast they walk'.

Participant 18 (Female /<30) – MyJourney (Familiar) – Decided to get a bus

(LOCALISING STAGE) 'Right, it's not going to be a tram or a ferry – or it could be a tram I suppose, it won't be a ferry, could be underground… DRT(?) possibly, don't know, let's see – 'go' -'

Participant 3 (Male/50+) – Traveline original (Familiar) – unable to declare confidence

(LOCALISING STAGE) 'I know I can't take a ferry anyway, there is no tram, I still don't know what DRT is so leave that in… bus, coach… interesting, interesting, interesting'.

Participant 4 (Female/30-49) – Traveline original (Familiar) – decided to drive

The number of examples is quite large, but it shows that in some of these cases travellers were not able to declare confidence in travelling that trip as a consequence of negotiating with the journey planner to produce meaningful recommendations. This shows that the responsibility for success was entirely on the traveller's ability to autonomously plan this trip. However, the discussions surrounding the data democracy of information technology and the fourth rule of citizenship indicate that it is the responsibility of the journey planner to enable meaningful recommendations.

7.2.1 Conversion point

The production of route-based recommendations is one aspect that dual-wayfinding facilitates. The second part is linked to the actual objectives that the traveller and the journey planner set (see Table 7-4) in which the traveller makes a decision or consequential action.

Table 7-4: Expectations from the traveller and the journey planner[47]

	Objective
Traveller	To obtain and understand available travel information, to plan and potentially conduct a public transport trip (National Consumer Council, 1977).
Journey planner	To enable a traveller to query a journey and become aware of all the relevant solutions for that journey (Spitadakis and Fostieri, 2012).

This is known as the conversion point – the point at which a user takes a desired action (Nielson, 2013). In the case of this experiment, the conversion point is the point the traveller accepted an offered route option and declared that they would be confident to conduct that route option if they needed to conduct that trip. In this experiment, the actual success of conducting the planned trip was not tested, so the adequacy of the information was assessed on the travellers 'mental picture' and confidence in that knowledge. As Table 7-5 shows, the conversion rate for unfamiliar trips planned using MyJourney and Traveline was particularly low, with just over half the trips planned leading to a successful conversion, a planned trip.

Table 7-5: Conversion rate, (number of conversions/total trips planned)[48]

	Unfamiliar trips		**Familiar trips**	
	Confidence declared	**Rate**	**Confidence declared**	**Rate**
Google Maps	27	90%	30	100%
MyJourney	16	53%	28	93%
Traveline	17	57%	22	73%

The low conversion rate is perhaps an indicator of the issues highlighted around the blurring of the two types of travel information. The timecode analysis, of all the trips collated the points of interest such as the offering of an initial set of relevant recommendations ending the localising stage, and the declaration of confidence ending the planning stage and an average was taken, see Table 7-6.

[47] As set out in Chapter 1, "Context and Guidelines"

[48] Confidence declared is in reference to 30 potential unfamiliar and 30 potential familiar trips that were observed that could have led to a successful conversion.

Table 7-6: Average time taken to localise and plan a journey, by journey planner.

Journey Planner	Planning a journey:		
		My Journey	
		Unfamiliar	Familiar
	Localizing time	0:03:30	0:01:31
	Planning time	0:04:19	0:02:53
	Confidence declared at	0:07:32	0:04:23
		Traveline	
		Unfamiliar	Familiar
	Localizing time	0:04:40	0:02:33
	Planning time	0:03:41	0:03:50
	Confidence declared at	0:07:24	0:06:02
		GoogleMaps	
		Unfamiliar	Familiar
	Localizing time	0:01:08	0:00:57
	Planning time	0:03:45	0:03:01
	Confidence declared at	0:04:57	0:03:58

As Table 7-6 shows, travellers planning using Google Maps online journey planner spent less time in the localising stage, and that after an average of one minute using the journey planner the traveller was in possession of one or more options to consider. This was also shown to be the case regardless of whether the trip was familiar or unfamiliar. The average times for MyJourney and Traveline shows that there was a longer period of time taken for the traveller to obtain a viable route option, and familiarity appeared to influence their length of time in the localising stage.

To assess the statistical significance of these observations, the timecoded data was used in a repeated measures ANOVA to identify whether the point of conversion was influenced by the journey planner used, the familiarity of the trip and other factors such as the age and gender of the participant. There was an statistically significant difference between the familiarity of the trip ($F(1, 86)=37.737$, $P<.05$) but not from the application of a journey planner ($P=.172$). These findings confirm that familiarity with the trip was important in successfully resulting in conversion. This indicated that the traveller's knowledge, or lack thereof, influences their success when using a journey planner. The other factors tested in the repeated measure ANOVA did not reveal a

significant result: familiarity * age (P=.825); familiarity * gender (P=.387); familiarity * employment status (P=.443). None of the other collected participant variables linked to modal choice or travel options influenced the resulting conversion rate.

7.2.2 Primary reason for using a journey planner

One of the advantages of a summative usability evaluation is that it enables information to be gathered about what users of an IT system do with it, and their revealed goals in using it (Kaushik, 2007). To achieve this, the video logs for each trip were analysed for data such as the number of modes (bus, train etc.) and number of route alternatives considered. This was a proxy for the depth of the journey planning activity. The data is shown in Table 7-7 showing the cross-over between these two variables for both the familiar and unfamiliar journeys.

Table 7-7: Analysis of planning activity – investigation of optimal route efficiency by journey type[49]

		Modal Investigation (Familiar)					Modal Investigation (Unfamiliar)				
		1 mode	2 modes	3 modes	4 modes		1 mode	2 modes	3 modes	4 modes	
Level of investigation	Summary details only	13			1	14	5	3	1		9
	1 detailed route	40	5	1	3	49	27	6	5	2	40
	2 detailed routes	9	4	1		14	7	11	1		19
	3 detailed routes	3	1	1		5		2	2		4
	4 detailed routes							2			2
	5 detailed routes								1		1
		65	10	3	4		39	24	10	2	

As Table 7-7 demonstrates, some travellers sought to confirm that the route was clear and understandable (confirmation purpose) by only reviewing one route option, whereas others took more time to investigate their options (research purpose). However, the favoured choice was to seek one detailed route that was often provided by one mode, e.g. a bus. It is possible that this data evidences confirmation bias and that some travellers did not consider the route options provided in a critical way, but instead focused on the information that confirmed their beliefs (Belsky and Gilovitch, 2010). There is an element of realism to consider this as a primary reason for using a journey planner, because wayfinding itself is linked to the traveller's 'mental picture' that is influenced by beliefs built through exposure.[50] The biggest hindrance to counteracting

[49] Omits the travellers that were unable to plan or declare confidence in the allotted time give for each planning activity. Total out of 90 possible journeys conducted (30x journey planner).
[50] See Chapter 4 for a discussion of how situational circumstances can influence the mental picture.

confirmation bias is that it requires the individual to deliberately question their formed beliefs, which is contradictory to the actual premise of confirmation bias (Mills, 2017).

To assess the statistical significance of these observations, the number of modes and routes investigated were used in a similar repeated measures ANOVA with the same factors to identify whether the number was influenced by the journey planner used, the familiarity of the trip or other factors. According to the identified statistically significant results, the familiarity of the trip was important to the traveller when considering mode (P=.031) and route (P=.021) options. Other factors were also shown to be significant when linked with the familiarity. For example, travel as a car passenger (P=.020) and owning a smartphone (P=.049) were significantly linked to the number of modes that the traveller considered. Similarly, travel as a car passenger (P=.005), owning a car (P=.018) and the frequency of bus use (P=.045) when combined with the familiarity of the trip were significantly linked to the number of route alternatives that the traveller considered. This indicates that the traveller's knowledge, or lack thereof, of the trip being planned influences their level of criticality when journey planning and that certain trip options (e.g. possessing a smartphone) or travel behaviour (e.g. bus use) encouraged more criticality towards the number of modes or routes investigated.

7.3 Travel information needs

If the traveller was able to reach the conversion point, they were asked to measure the provision of travel information using the provided questionnaire (see Appendix D), which asked the traveller to rate the provision of travel information according to two criteria: firstly, the ease of finding specified information points which would reveal, from the traveller's perspective, the journey planner's performance providing continuous access to set categories of travel information; and second, the importance of providing specified information points which would reveal, from all the possible trips planned, the benchmark for providing continuous access to the same categories. Travellers who did not reach a conversion point did not complete the questionnaire.

7.3.1 Integrity of the categories

A test of the categories as a measured scale was conducted to ensure that the data collected within that scale consistently measured that category. This test, known as Cronbach's Alpha test for reliability (Cronbach, 1951) and is the most common method of testing the inter-item covariance to total variance that explains the internal variability of the scale using a collected dataset (Banjanovic and Osborne, 2016, Field, 2005). It measures the internal consistency reliability of the scale to show whether the items in that scale will consistently measure the same thing regardless of who measured it, when they measured it, how frequently they measured it or

what they used to measure it (Salkind, 2016). A score of .70 or higher indicates that a scale's internal consistency is reliable. The Cronbach alpha ratings are shown in Table 7-8.

Table 7-8: SPSS Reliability Analysis Results[51]

Representing information provision for…	**Summary of travel information points within the stated scale**	**Cronbach alpha rating** (N=number of questions in scale)
Supporting unfamiliarity	**Ease of finding**: quickest route, route frequency, all routes, best time to travel, how easy it is to travel, next bus, journeys without interchanges, if journey is affected by disruption, area coverage route map (by operator, all operators), ticket types (zoning). **Ease to**; action this information, interpret this information, trust this information.	**.852 (n=18)**
Basic information needs	**Ease of finding**: Arrival/departure times, first and last service times, service frequency, journey duration, fare price, ticket types, ways you can pay, compare costs, operator restrictions. **Ease to**; obtain this information and interpret this information.	**.883 (n=16)**
Advanced information needs	**Identify**; busy periods, pram space offered, low curb access services, extra facilities offered, where to find trained staff (autism, mobility constraints), where to access essential needs (cash machines, ticket machines, toilets), security provision (lighting, staffing, CCTV). **Confirm**; planning support in-trip (maps, announcements, inductive loop), arrival location layout (e.g. crossing places and paths), future reliability of route (during a day, over different days, during busy times).	**.897 (n=22)**
Presentation style	**Ease of finding**; detailed journey breakdown, list of route options, compare options, find all routes available.	**.811 (n=6)**
Information reliability	**Ease of confirming**; planned disruptions, compare disruption suggestions, remedial action for disruptions, basis for presented information (estimated, live), alternative locations, alternative travel times, alternative modes.	**.893 (n=15)**
Supporting decisions	**Ease of**; finding route recommendations, applying journey time limit, applying personal preferences to find routes, comparing the available options.	**.746 (n=9)**

The findings show that all the categories were above the 0.70 cut-off, suggesting that no changes to the identified set of information points within the scale need to be made. In regards to the underlying variation, all of the information points were considered to reliably measure the overall category. Thus, no changes needed to be made to the category, e.g. a removal of a certain information point, to improve the scales overall reliability.

[51] The first scale 'supporting unfamiliarity' was asked after the traveller completed the provided unfamiliar journey and declared confidence. The remaining scales were asked after the traveller completed planning the familiar journey and declared confidence. For an example of the script for each trial, see Appendix D. See Chapter 6 for the collation of these categories.

7.3.2 Visualising the travellers' access to relevant travel information

To visualise the performance of providing continuous access to information in these set categories, the overall composite rating for each category and an average was taken and plotted on a radar diagram. A similar process was taken for the benchmark scores and the importance of each information point rating was collected, and this was also averaged and plotted on the radar diagram (see Figure 7-5, Figure 7-6, Figure 7-7) based on the way that the journey planner's performance score (coloured) cross the benchmark boundary line (dashed).

In cases where the journey planner's performance crosses the benchmark line, it can be assumed that the travellers felt that their information needs were met to a reasonable level, and vice versa. The following tables and figures correspond to:

- Overall benchmarking diagram: All journey planners see (Figure 7-5, and Table 7-9);
- Split benchmarking diagram: Male traveller's (Figure 7-6, and Table 7-10); and
- Split benchmarking diagram: Female traveller's (Figure 7-7 and Table 7-10).

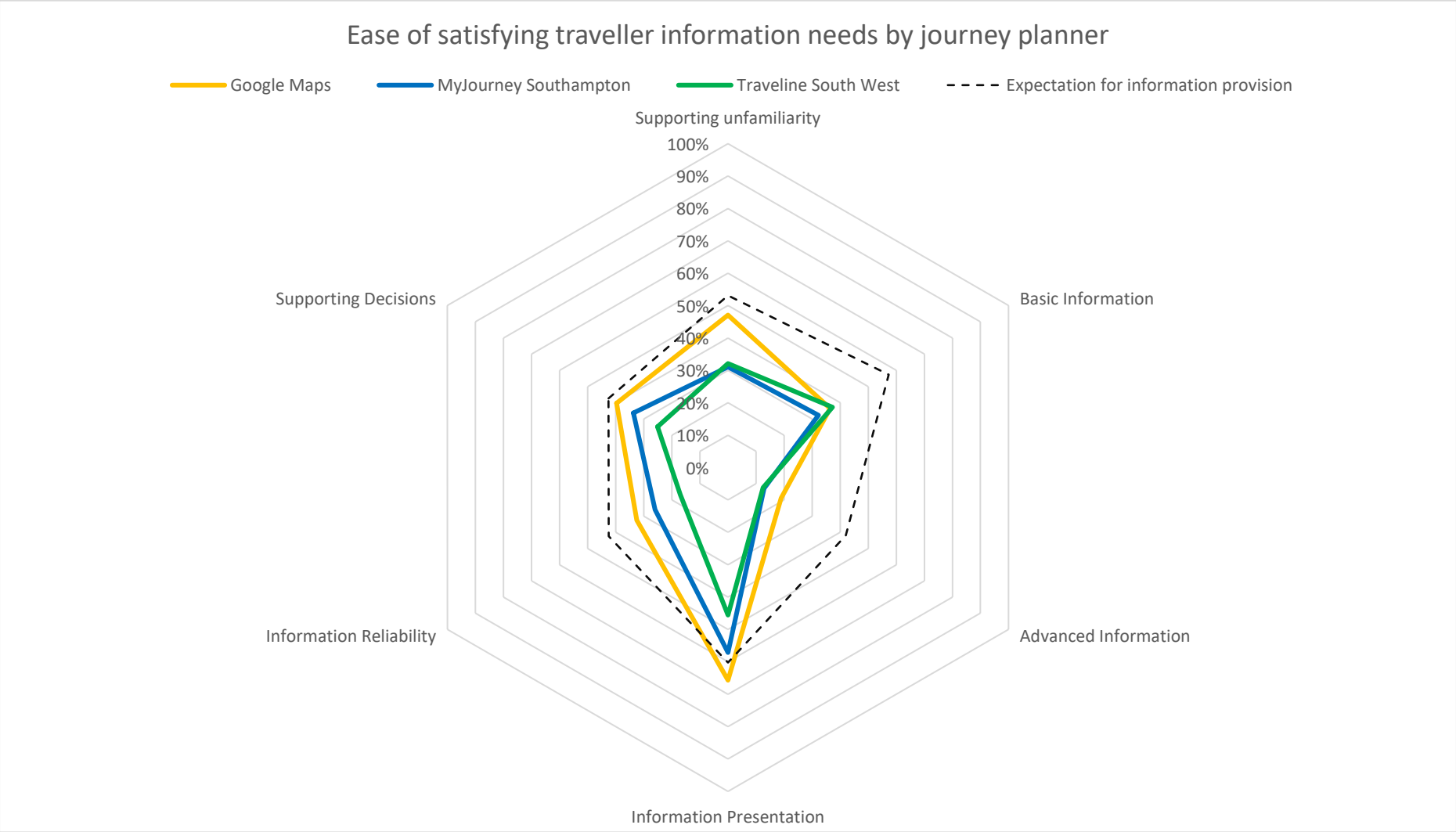


Figure 7-5: Benchmarking Radar Chart – All Participants

Table 7-9: Ease of satisfying traveller information needs by journey planner (Composite score) data

	Google Maps		MyJourney Southampton		Traveline South West			The expectation for information provision[52]	
Construct	Average Rating	Percentage	Average Rating	Percentage	Average Rating	Percentage	**Maximum rating**	Average Rating	Percentage
Supporting Unfamiliarity	42.4	47%	28.0	31%	28.9	32%	90	47.8	53%
Basic information	29.1	36%	25.8	32%	29.8	37%	80	45.8	57%
Advanced Information	20.8	19%	14.2	13%	13.7	12%	110	46.2	42%
Information Presentation[53]	19.7	66%	17.1	57%	13.7	46%	30	18.1	60%
Information Reliability	24.4	32%	19.5	26%	12.7	17%	75	31.9	42%
Supporting Decisions	17.9	40%	15.2	34%	11.3	25%	45	19.2	43%

[52] The preferences boundary was formed by the travellers rating the same information needs by its importance. The overall preference score is the average rating given across all three journey planners.

[53] Across all constructs measured, only Google Maps was able to exceed the traveller's expectations for information presentation.

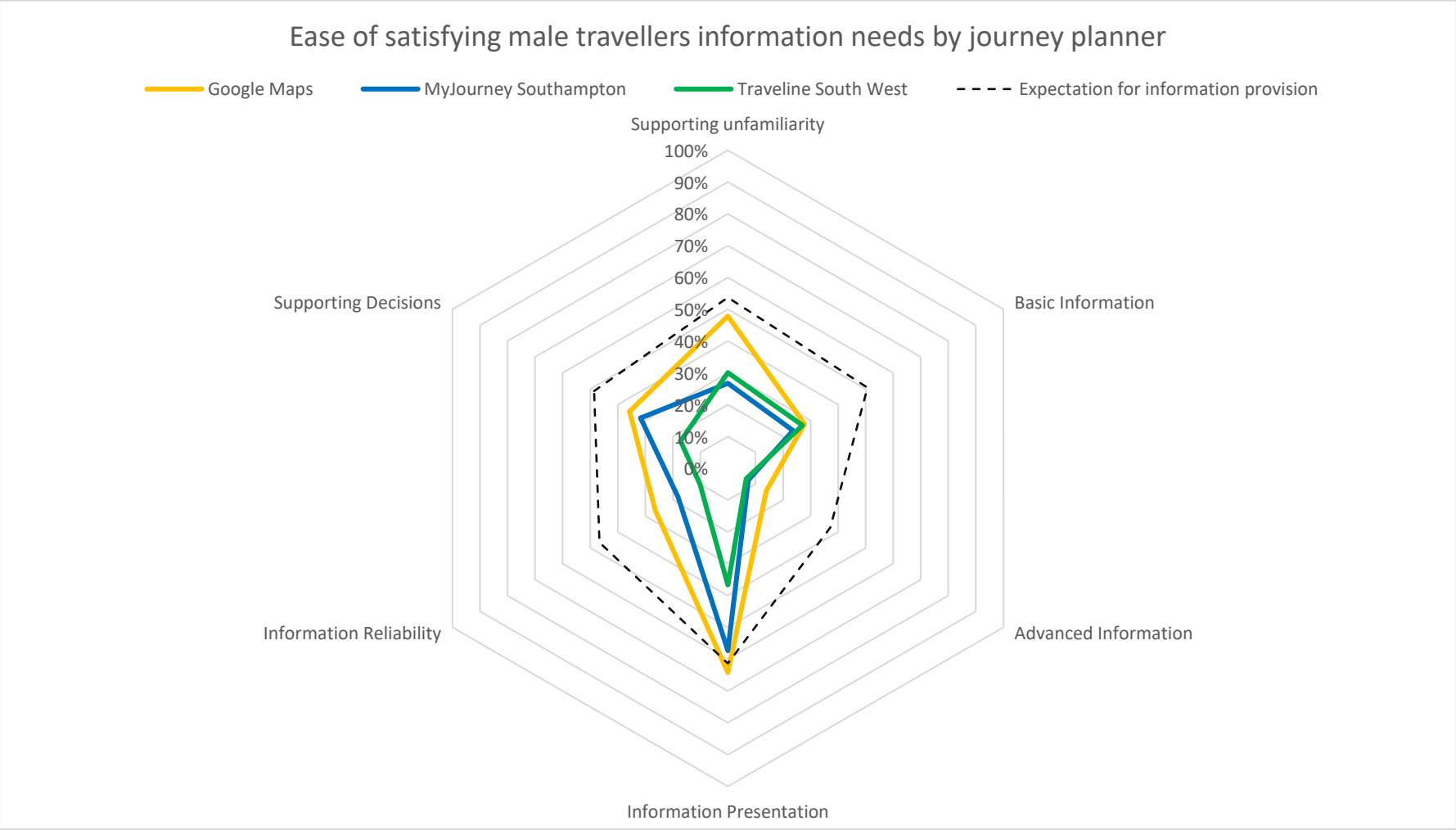


Figure 7-6: Benchmarking Radar Chart – Male Participants

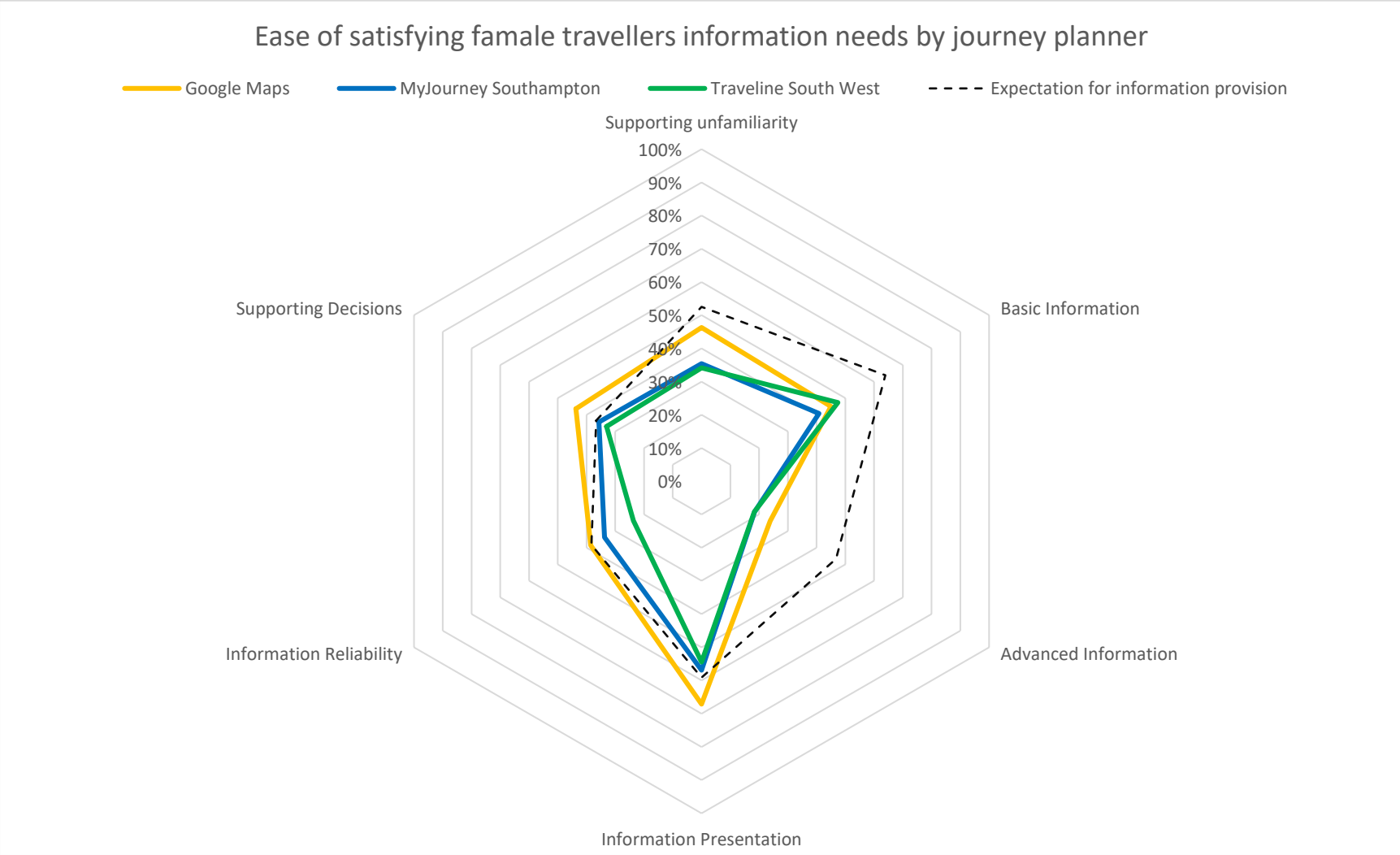


Figure 7-7: Benchmarking Radar Chart – Female Participants

Table 7-10: Ease of satisfying male and female traveller information needs by journey planner (Composite score) data

		Google Maps		MyJourney Southampton		Traveline South West			The expectation for information provision	
Construct	**Gender**	Average Rating	Percentage	Average Rating	Percentage	Average Rating	Percentage	**Maximum rating**	Average Rating	Percentage
Supporting Unfamiliarity	All	**42.4**	**47%**	**28.0**	**31%**	**28.9**	**32%**	**90**	**47.8**	**53%**
	Males	43.1	48%	24.1	27%	27.1	30%	90	48.3	54%
	Females	41.7	46%	31.9	35%	30.7	34%	90	47.3	53%
Basic information	All	**29.1**	**36%**	**25.8**	**32%**	**29.8**	**37%**	**80**	**45.8**	**57%**
	Males	22.3	28%	18.9	24%	21.7	27%	80	40.5	51%
	Females	36.0	45%	32.7	41%	37.9	47%	80	51.1	64%
Advanced Information	All	**20.8**	**19%**	**14.2**	**13%**	**13.7**	**12%**	**110**	**46.2**	**42%**
	Males	15.3	14%	8.1	7%	7.3	7%	110	40.9	37%
	Females	26.3	24%	20.3	18%	20.2	18%	110	51.4	47%
Information Presentation	All	**19.7**	**66%**	**17.1**	**57%**	**13.7**	**46%**	**30**	**18.1**	**60%**
	Males	19.3	64%	17.2	57%	11.0	37%	30	18.4	61%
	Females	20.1	67%	17.1	57%	16.3	54%	30	17.7	59%
Information Reliability	All	**24.4**	**32%**	**19.5**	**26%**	**12.7**	**17%**	**75**	**31.9**	**42%**
	Males	19.8	26%	13.6	18%	7.6	10%	75	35.0	47%
	Females	28.9	39%	25.3	34%	17.8	24%	75	28.7	38%
Supporting Decisions	All	**17.9**	**40%**	**15.2**	**34%**	**11.3**	**25%**	**45**	**19.2**	**43%**
	Males	16.1	36%	14.3	32%	7.7	17%	45	21.9	49%
	Females	19.7	44%	16.1	36%	14.9	33%	45	16.5	37%

These findings indicate that Google Maps was the only one to cross the boundary of what the travellers themselves set as reasonable, for only one of the categories (see Figure 7-5). This shows that Google Maps was able to present travel information in a clear and understandable way, offering summaries and breakdowns of all available route options. This may be linked to the earlier comments regarding dual-wayfinding. However, other points of information, particularly around unfamiliar journeys, was not supported to a sufficient level by any of the journey planners. This suggest that the slower or unsuccessful trip conversions for unfamiliar trips may have links to a lack of travel information around easily identifying suitable routes and understanding basic service operation details (e.g. ticketing, service route maps and interchanges). As the familiarity of the journey was shown to have a significant impact on the ease of leading to a conversion and the potential application of confirmation bias, this lack of information provision is an important observation.

As can be seen in Table 7-10 and Figure 7-6 and Figure 7-7, there is an observable difference between male and female travellers and the ratings awarded, indicating that Google Maps might have a more favourable position in terms of information provision for female travellers. The female participants appeared to be more satisfied by the provision of information in other categories such as information reliability (e.g. basis for presented information 'real-time/estimated', alternative locations, and alternative travel times) and supporting decisions (e.g. applying preferences such as a time limit). The data appears to suggest that female travellers were more satisfied with the level of information provision as they had a lower boundary set for the 'reasonable' level of information provision. Male travellers had a higher boundary set, implying that they had a higher expectation for the provision of travel information. To assess the statistical significance of these observations, the composite category score was used in a mixed factorial analysis on gender which revealed that there was a statistically significant difference between the ratings given by female and male travellers (P =.012), which confirms the differences shown in the radar diagrams. Therefore, it can be concluded that male and female travellers are likely to have different expectation levels for the provision of travel information.

7.4 Building a robust mental picture that travellers can use post-planning

After the journey planning activity is concluded, it is expected that the traveller will have been prepared to conduct the trip. Their preparation is linked to the mental picture they have of that trip through personal experience and collected during the journey planning activity, therefore evidence should exist of the long-term effects of travel information in terms of its retention for latter recall, unless travellers maintain a permanent reliance on external information sources.

In the last part of this experiment, the travellers took part in a 10 minute one-to-one interview to reflect on the travel information that they had processed during the planning activity, and were probed for the details of recall, the trust in the recall and the subsequent sources of travel information they would use prior to travel if insufficiencies in the mental picture were detected by the traveller. All of the details produced during this part of the experiment were accepted on the traveller's judgement and even if logical errors in thinking were present (e.g. trusting in erroneous recall with no further information gathering intervention needed), this decision was acceptable.

7.4.1 Recall of selected trips macro- and microscopic details

As the main way that travellers carry knowledge with them in the transition (TPT 3) and in-trip (TPT 4 and TPT 5) is through their memory, the first part of the interview asked the traveller to explain the selected routes to the interviewer. It was assumed that if the dual-wayfinding design of the journey planner was good, it would have boosted the traveller's comprehension of the route they were taking through continuous access to relevant travel information and support to translate that information (National Consumer Council, 1977). It is expected that a good journey planner will successfully communicate to the traveller where they can go and how to do it.

The travellers' recall was quantified based on the ranked recall descriptions (see Table 4-1) which were:

1. **No recall –** No retained or accessible knowledge of the planned journey.
2. **Guess ('guesstimation')** – The traveller guesses, with no confidence, some elements of the journey.
3. **Know –** Ability to recall, with confidence, two or more elements of the journey such as; travel time, bus number, stopping points.
4. **Remember –** Ability to recall, with confidence, elements of the journey and the feelings that conducting that journey would invoke.

(Moran and Goshen-Gottstein, 2015, Schmitt et al., 2015)

The data in Table 7-11 shows that those that planned their familiar trip was able to recall two or more travel details linked to that trip's microscopic details, such as bus operator, service number, frequency, direction of travel, key stopping points, departure times, and the starting point of the journey. Unfamiliar trips led to weaker associative recall often leading the traveller to realise that, despite declaring confidence, they needed further support prior to travel.

Table 7-11: Analysis of transcripts – Range of post journey planning public transport information recall[54]

		No recall	Guess	Know	Remember
MyJourney	Unfamiliar	**22**	**2**	**4**	
	Familiar	**11**	**1**	**11**	**3**
Google Maps	Unfamiliar	**3**	**9**	**8**	**6**
	Familiar		**6**	**14**	**7**
Traveline South-west	Unfamiliar	**13**	**7**	**6**	**3**
	Familiar	**4**	**9**	**8**	**8**
All	Unfamiliar	**38**	**18**	**18**	**9**
	Familiar	**15**	**16**	**33**	**18**

One potential reason for the ease of recall regarding the familiar trip may be linked to the controls regarding the planned trip, in that the travellers freely chose their familiar route while the unfamiliar journey was provided to them at random. A traveller will have the strongest associations and will recall more relevant information about journeys that they conduct on a regular basis. Journeys that have an increased number of repetitions, such as a daily commute, build an understanding of that route which reduces the need to rely on external travel information sources to produce relevant travel information.

The participant led choice of familiar trip types included:

- Leisure trips – shopping, visiting friends/family or other leisure based activities (n=53);
- Business trips – work trips or daily commutes (n=33); and
- Medical trips – travel to pharmacies, GP's and hospitals (n=4).

Table 7-11 also shows that the application of a journey planner, in this case Google Maps, led the traveller planning an unfamiliar trip to demonstrate easier associative recall for that trip type. A potential reason for this ease of recall could also be linked to the dual-wayfinding design that Google Maps adopted compared to Traveline and MyJourney.

To assess the statistical significance of these observations, quantified associative recall scoring was used in a repeated measures ANOVA. The results indicated that the familiarity of the journey (P=.390) or the application of any journey planner (P=.434) independently did not significantly

[54] This table is formed of the discussion portion of the HCI trial after the journeys were planned, if the traveller was unable to plan, this was omitted. Additionally, if the traveller opted to drive this was also omitted because of the focus on public transport specifically.

influence the resulting recall. However, the interaction of both the familiarity of the trip and the application of a journey planner was shown to have an influence on resulting recall (P=.025). This shows that the recall of the trip could be linked to the way that the journey planner structures the dual-wayfinding aspect, which can support planning familiar and unfamiliar travellers. Therefore, it is likely that Google Maps design for dual-wayfinding, structuring the journey planning activity with a boundary between the macro and micro travel-related decisions enabled better recall after a conversion. None of the other collected factors related to the travellers' options or travel behaviour was shown to influence the resulting recall outcome.

7.4.2 Trust in autonomy

With these results in mind, the journey planners design for dual-wayfinding for familiar and unfamiliar trips could hinder post-planning recall which means that TPT 3 (transitioning) 4 (in-trip and unfamiliar) and 5 (in-trip and familiar) may lack the ability to conduct their trip autonomously. Therefore, the second aspect of the one-to-one interview was to get the traveller to critically evaluate whether they trusted in their autonomous ability, or whether they believed they needed to seek more travel information.

The initial responses showed that there were participants that expressed, with and without confidence in their autonomous ability, that they would still seek confirmation that the journey was still possible. This seems to indicate the variability of travel information between the estimated pre-trip and variable in-trip stages.[55] The earlier definition for the TPT 3 traveller stated that this type was 'exclusively for re-affirming learnt travel information gained through pre-trip journey planning (TPT 1 and TPT 2) or re-affirming beliefs or expectations that the traveller has formed through personal experience (TPT 2)' which means that this external dependency suggests that travellers require a means of confirming what they know to be true, before entering the real transit environment, further showing the case for confirmation bias linked with travel information use.

Travellers who suggested that they had an external dependency described which sources they would use (see Table 7-12), and this data was used to quantify where the external dependency was likely to be placed for further multivariate analysis tests. The spread of data for each journey planning is shown in Table 7-13.

[55] See Appendix B for a breakdown of the different perspectives on travel information use.

Table 7-12: Coping mechanism suggestions made by travellers

Estimated (Est)	Maps, timetables, operator website directly, plan for extra time, print Information found, use a smartphone to take pictures of information from the information source used (the journey planner in this instance), information from other travellers/friends.
Mixed	Google maps for real-time and journey planning support
Live	Apps, Google Maps (on smartphone), displays, announcements, observations in transit, travellers in transit, drivers or available staff.
Alternative (Alt)	Friend to drive them, use internal knowledge or use a taxi

Table 7-13: Transition information source[56]

	Familiar Journeys					Unfamiliar Journeys				
	None	**Est**	**Mixed**	**Live**	**Alt**	**None**	**Est**	**Mixed**	**Live**	**Alt**
Google Maps	9	-	-	20	1	10	4	4	11	1
MyJourney	14	1	-	7	7	5	6	9	4	6
Traveline	7	3	4	14	2	-	-	-	30	-
Overall	30	4	4	41	10	15	10	13	45	7

To assess the statistical significance of these observations, the quantified measure to represent the reliance on external information provision was used in another repeated measures ANOVA. The results indicate that the familiarity of the journey (P=.013) did significantly influence the resulting source for the external dependency, but the journey planner did not influence the traveller's source for that external dependency (P=.199). Table 7-13 shows that, after planning an unfamiliar trip, 50% of the travellers placed their dependency on sources that could respond more effectively to the variable nature of travel information in-trip, which further echoes the initial impression of the data. Whereas, the familiar trips were split between autonomy (33%) and a similar dependency on live travel information sources (46%). This is also reflected in the ANOVA results, indicating that being smartphone-enabled also influenced the source of external dependency (P=.020).

7.5 Summary

Initially, the literature review presented in Chapter 2 showed that the most attention towards the design of travel IT was to a journey planner, building smart algorithms to produce relevant routing options. However, this literature lacked discussion about customer centricity and how the use of a journey planner, or travel IT, supported the travellers overall dependency on external travel

[56] This table represents the type of information sources that travellers would use when they get closer to actual transit travel. Each subject breakdown represents a total of 90 unfamiliar journeys and 89 familiar journeys (30x each journey planner). One familiar journey planned using MyJourney was not included because of technical difficulties.

information. The first part of this thesis has gone part way to address this gap in understanding by describing the traveller's dependency and the information they need to address this dependency.

In this chapter, using a summative usability experiment, evidence about the journey planner's ability to respond to this external dependency was collected, particularly in reference to dual-wayfinding considerations. Through this usability evaluation, the point of conversion, the depth of the journey planning activity, the provision of travel information, the post-planning recall of travel information and the traveller's trust in autonomy all indicated the journey planner's ability to prepare travellers for the in-trip activity.

In regards to the dual-wayfinding design of the reviewed journey planners and the activity that it facilitates, two methods was present which had an influence on the traveller's ability to recall their trip details after planning. Google Maps, which mimicked the natural structure of travel information by placing a boundary between macro level routing and micro level preference related decisions, enabled the traveller to stagger their journey planning process. However, the journey planner was not shown to influence the point of conversion, and this is believed to be due to the responsibility being placed on the traveller to produce relevant trip options instead of the journey planner. Thus, conversion was driven solely by the traveller's familiarity with the trip, which was reflected in the experiences that were observed by the traveller.

In regards to using a journey planner for the purpose of preparing travellers for the in-trip activity, the findings linked to the traveller's depth of journey planning and post-planning dependency indicated that the traveller's primary reason for using a journey planner was for confirmation of what was possible, and not research or comparison as had been previously stated in literature (Esztergár-Kiss and Csiszár, 2015). Travellers using a journey planner will typically consider one route that could satisfy their trip, often provided by one mode, however, certain factors were shown to influence the number of modes and routes that a traveller would consider. This is believed to be linked to the traveller's increased awareness of route choices because of these options (Chorus et al., 2006b, Lyons et al., 2007).

As the main reason for using a journey planner is for confirmation of route possibilities, the traveller may not be able conduct their trip independently and present with a further external dependency, as was shown to be the case in this study. Here, the source for the dependency included travel IT that represented the variability of in-trip travel information, and not necessarily to return to the journey planner. This further evidences that a journey planner's primary purpose is to educate the traveller and confirm route possibilities. As familiarity with the trip was the most significant factor influencing conversion, the depth of journey planning and further external

dependency on travel IT, it stands to reason that travel information sources that address the latter stages of information use will also need to consider the traveller's familiarity. These findings demonstrate that the journey planners had little influence on the end outcomes for this sample of travellers in preparing them for actual in-trip travel, other than to increase their external dependency because of the resulting information recall.

Chapter 8. Recommendations to improve the clarity of travel information in a journey planner.

8.1 Introduction

This chapter focuses on what could be done to improve a journey planner's ability to meet the traveller's dependency on it when planning a familiar or unfamiliar trip. Its aim is to unify the themes discussed throughout the thesis including:

- the traveller's dependency on travel IT as a result of a lack of autonomy (Chapter 4);
- what they expect travel IT systems to provide (Chapter 5);
- the types of information they need to address this dependency (Chapter 6); and
- the travel IT systems' response to those needs (Chapter 7)

It will draw these themes into a suite of identified gaps and opportunities to improve travel information clarity for travellers based on the review of speak/think aloud video logs and post-planning interview.

8.2 A clear and coherent journey planning workflow

One of the main principles of the fourth rule of citizenship is that individuals are appropriately supported through the process of planning and conducting a journey. Therefore, the first recommendation set for designers of travel IT is to adequately consider dual-wayfinding design and how that workflow supports or limits inclusivity.

Recommendation 1: Have a clear and coherent journey planning workflow

As shown in Chapter 7, the style of this workflow influences the ability to obtain relevant travel information. In some cases, where the journey planning workflow style incorporates traveller unfamiliarity, as unfamiliar travellers were able access route-based travel information much faster than the a workflow that lacked clear dual-wayfinding design. This recommendation is important because the style of workflow that fails to consider the unfamiliar traveller, [57] naturally excludes them and consequently fails to meet their needs according to the fourth rule of citizenship.

Looking more deeply into the differences of those two identified workflow styles, it was apparent that the issue stemmed from a lack of a boundary between macro-level travel information (routing sufficiency) and micro-level travel information (route details).[58] In essence, a journey planning workflow that mixes micro-level travel information decisions (such as limiting walking or

[57] Such as Traveller Planning Type 1. An Unfamiliar traveller, planning a journey pre-trip
[58] See Chapter 6 for the explanation and Chapter 7 for the structure of these in journey planners.

interchanges) while the traveller is establishing the geographical nature of their journey, led to poor decisions because of route-based unfamiliarity. As a direct consequence of that mixture, travellers spent more time considering their bespoke information needs before validating the route as feasible, setting criteria that could not be satisfied by the available routes. This showed that this type of workflow could only satisfy TPTs with the relevant travel knowledge and awareness of their options. Therefore, in the interest of inclusive design and to cater for all levels of travel knowledge, it is recommended that this boundary is considered and managed in separate stages. A good example of this working in action is Google Maps, which did successfully separate these two levels of travel information and led the travellers to feel that the presentation of travel information did meet their needs to a reasonable level.

Recommendation 1a

A clear and coherent journey planning workflow:
Ensure that there is a clear boundary between macro-level travel information (routing) and micro-level travel information (route details)

8.2.1 Help the traveller understand the geographical nature of a trip

The need for a clear distinction between the levels of travel information demonstrates that travellers require clarity about two types of considerations: the geographical nature of their journey and their bespoke travel information needs. In considering the geographical nature, it is clear that the traveller requires a means of comprehending the journey's path through the local environment. The discussion in Chapter 7 concluded that adopting a workflow that initially identifies a high level summary of available routes enabled instant visual feedback, allowing the traveller to consider using default route suggestions (see Figure 8-1).

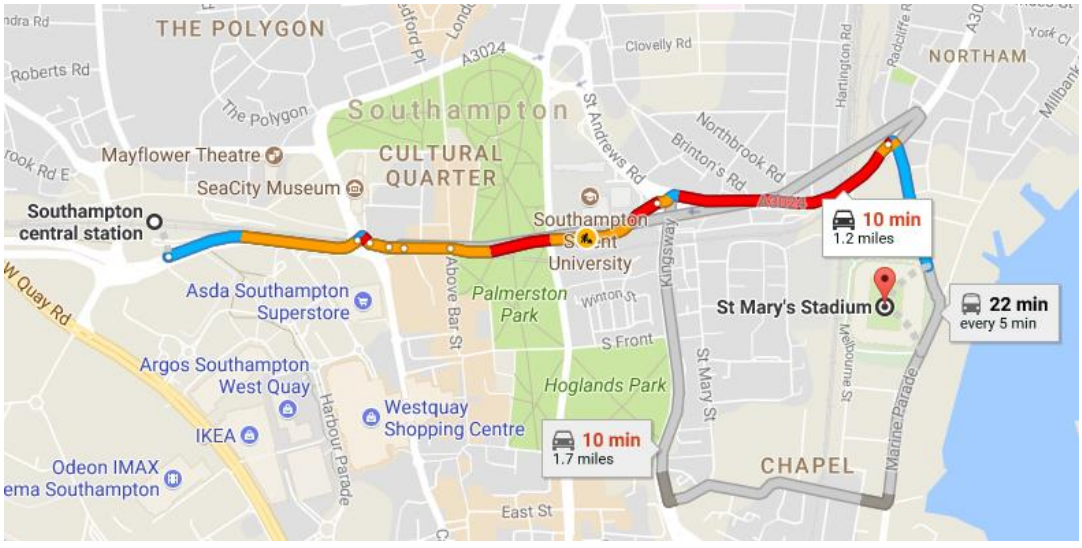


Figure 8-1: Google Maps presenting three default journey options

Figure 8-1 shows how Google Maps, adopting a more controlled workflow, was able to take the traveller's origin and destination details and form an instant picture with the three fastest routes, demonstrating the feasibility of that journey. Journey planners that adopted a mixed macro/micro workflow did not convey the same level of clarity and often required the traveller to select routes before seeing any visualisation (see Figure 8-2). This observation was also made by one participant during their planning activity (No. 12, female, 50+), saying that the lack of initial visualisation limited her ability to understand the feasibility of the searched journey and the expectation that she had to take that responsibility, even when only one route satisfied her journey criteria:[59]

> 'that's really not good, I can see where A and B is but it's not a clearly defined map, there's dots but the dots don't track where you end up because there's dots everywhere. Are those dots bus stops? Presumably, they are. I don't like this, so basically it just says A and B but it does not track it on the map for you. You could work it out quite easily but it's not particularly helpful'.

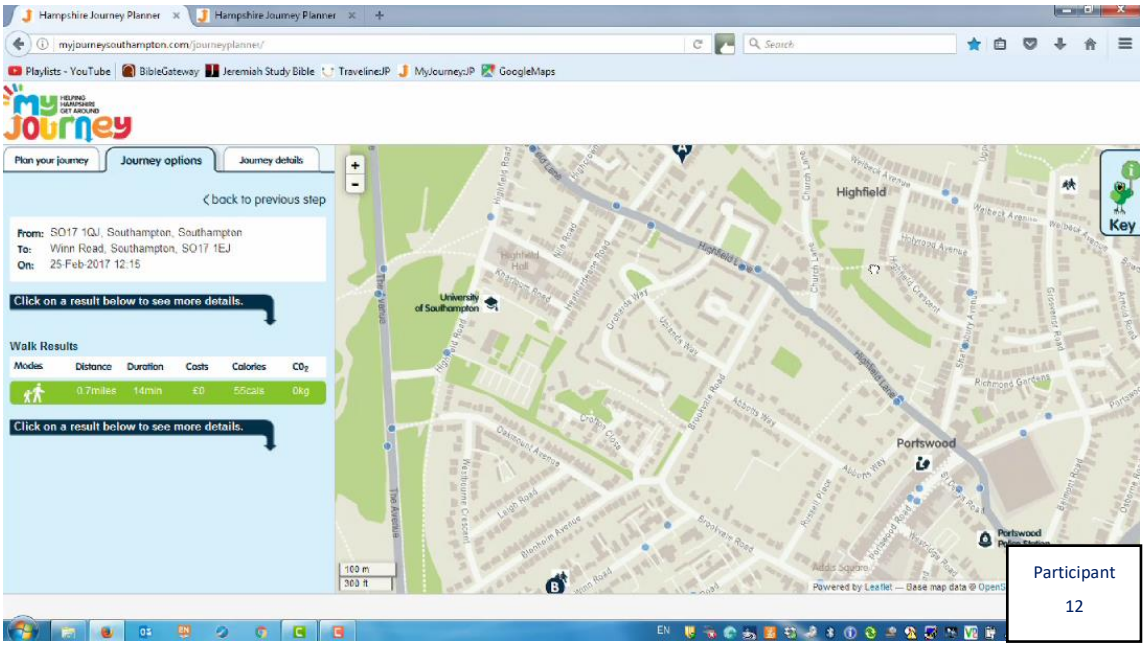


Figure 8-2: Example of MyJourney presenting available routes as observed by participant 12[60]

The methods represented by Figure 8-1 and Figure 8-2 work well for the familiar traveller that can make sense of the presented information and judge which options to use to find more route-based travel information. However, travellers that lack the relevant travel knowledge will spend longer trying to understand the geographical considerations of their route because of this lack of visual representation. Similarly, it makes it harder for unfamiliar travellers to diagnose the cause

[59] Because of restrictive preliminary choices relating to micro level travel information.
[60] The display in this instance shows walking as the only travel option as this traveller misinterpreted the pre-search options and deselected bus as a method of travel, thinking that they were selecting it.

for limited route options because of the restrictive micro level judgement. These factors are likely to be the cause for Google Maps faster conversion time because this designs for confirmation bias.

In Chapter 5, a crucial part of the NUDGE model was to use characteristics about an individual in a positive way, such as overcoming the individual's inertia when they do not know what choices they can make by offering default options. This means that travel IT that establish a coherent workflow and enables default routes to be identified and selected, as exampled by Figure 8-1, achieve this principle. With this in mind, default routes should be offered to travellers.

Throughout this thesis, the observation of the traveller's depth of pre-trip journey planning shows that travellers typically seek detailed information about one journey unless the journey is more unfamiliar to them. This suggests that developers would be able to satisfy more travellers more quickly if a default route is offered which enables quick access to that route's detailed information. This would allow developers to spend the rest of the effort on information presentation that focuses on travellers that lack local knowledge and need the developer to cater more to route-based unfamiliarity.

Recommendation 1b

A clear and coherent journey planning workflow:
Help the traveller to understand the geographical nature of a trip by making the visualisation of a default route a key priority

8.2.2 Offer default recommendations that communicate route availability.

According to the TPT framework, the pre-trip planning travellers are likely to adopt TPT 3 closer to their actual travel time (see Section 7.4.2). This means that the default routes offered by a pre-trip journey planner should convey the ease of conducting that route more coherently through the use of precise route details, such as route frequency. In the post-journey planning discussion one participant (No. 20, Male, 30-49) did observe that Google Maps could improve the way they offer default route suggestions and raised the need for the last and first service times on that route, which also convey route availability:

> 'So, one thing which tripped me up and I didn't realise it didn't do it was when I wanted to look at the last available time, I knew that Google had a last train or latest available option, but it only did it for today; I didn't have an option to select the last available time on a day, so I had to work around that'.

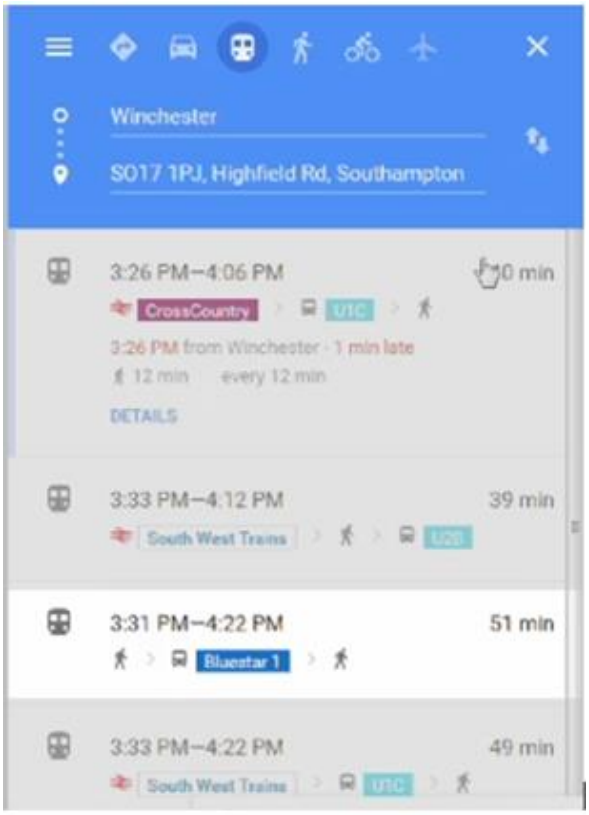
Participant 22 (Male, 30-49), when asked what he would suggest as an improvement to Google Maps also agreed that default options need to convey routing sufficiency: 'Default options for finding routes, the first bus and last bus of a service'.

Recommendation 1c

A clear and coherent journey planning workflow:
Help the traveller to understand route sufficiency by displaying route availability information (frequency, first and last service times) a part of the default option.

8.2.3 Set default routes that meet the traveller's journey needs

Google Maps, an example of offering default routes, presents the three available and fastest routes that could satisfy the journey between the origin and destination. Its default route selection is connected to the way that it presents travel information, using travel time as the critical travel information point that organises all the available travel options. However, there are other ways that a developer could filter, select and present default routes. For example, one participant (No. 9, Male, 50+), conducting a familiar journey using Google Maps, choose public transport but struggled with time-based route suggestion as he wanted the most direct route over travel time. This need was observed during their familiar journey planning activity and their desire to find the most direct route:



'Well, its got me confused because I just want to use one bus and it seems to be telling me I've got to use a train, or both a bus and a train. I know that you can do it by bus, by train and by car I realise that, it is a familiar journey to me. I could walk there if I had to, but I cannot negotiate this ... because it is telling me… I'm clicking on this thing that looks like a bus, but… I do not know what these are, to be honest. Why is it telling me I've got to go by train? I would probably just give up and throw the computer at the wall'

spoken while seeing Figure 8-3

Figure 8-3: Difficulty finding the ideal route as observed by participant 9[61]

[61] This image shows what the traveller was looking at when trying to find their typical familiar route, but were unable to spot it in the list. This figure also shows the traveller struggling to interpret iconography without descriptive text.

This shows that default route options need to be based on fundamental decision points that the traveller considers valuable, and the travellers has been shown to value the less complex or the most convenient routes which explains why direct routes or route frequency are critical communicators of those needs (see Chapter 4). According to Caiafa (2010), the complexity of a route increases with the increase of interchanges as it further amplifies the considerations a traveller has to make about an upcoming journey demand.

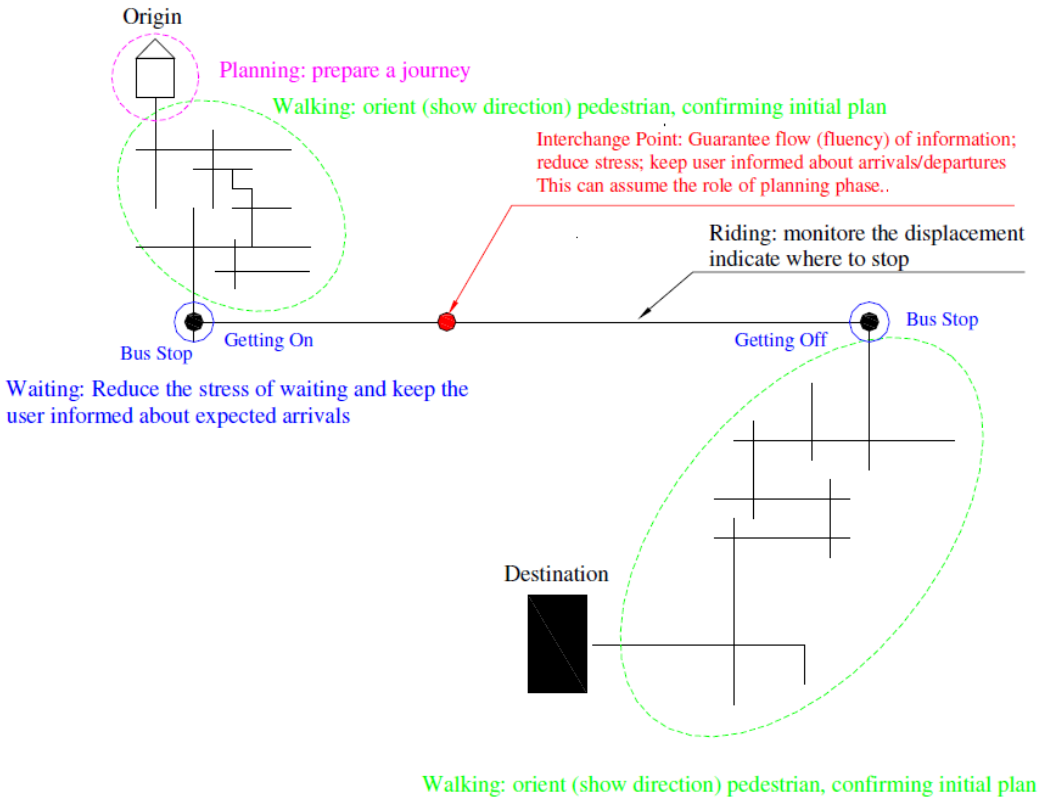


Figure 8-4: The hidden complexity behind travelling a journey (Caiafa, 2010).

Figure 8-4 shows that the complexity involves finding bus stops, safe crossing places, identifying arriving services and getting off which is potentially repeated multiple times, while also observing the directions of travel and finding the desired destination. Therefore, the developer should not underestimate the difficulty of conducting a journey for a traveller that may not have the necessary knowledge to handle that complexity successfully. It means that the selection of default routes should have a connection with addressing this complexity for a traveller unfamiliar with

their travel options. Similarly, targeted default suggestions also enable a traveller to transition from the macro level travel information that focuses on geographical routing to the micro level that focuses on the traveller's bespoke travel information needs fluidly, see Chapter 6. In addition to this, it is recommended that the developer has an awareness of the level of sway that certain types of default route suggestions have on influencing uptake. If the developer does not understand those needs, default route suggestions may serve no purpose, see Table 8-1.

Table 8-1: Route frequency's influence on route selection (TAS Partnership, 2002)

Route frequency	Willingness to adopt public transport routes
'frequent', e.g. every 10 mins	60% would consider changing to public transport
two buses an hour	40% would consider changing to public transport
Longer than 30 mins	No travellers would consider changing to public transport

As can be seen from Table 8-1, the TAS Partnership (2002) found that there is a limit to what the travellers are willing to accept, such as a wait of longer than 30 minutes. The decrease in selection rate further confirms that travellers care about the relative ease of conducting a journey and their desire to feel confidence to conduct that journey. A traveller feels more confident about routes that are frequent because of the common perception that public transport services are unreliable (Chorus et al., 2007). Therefore, default routes should be formed using simplifying routes that meet a traveller's journey needs.

Recommendation 1d

A clear and coherent journey planning workflow:
Ensure that the default route suggestions based on factors that meet the travellers need such as the desire to find routes that reduce interchanges or are most frequently available. Similarly, consider the uptake impacts of the default route selection criteria to ensure that they offer relevance to the traveller.

8.3 Appropriate management of errors

The next issue a designer of travel IT should consider is to address errors that emerge because of failing to properly establish the clear workflow, described in the previous section. When a workflow fails to consider the traveller's lack of travel knowledge and places responsibility for using the journey planner in a travellers hands, it results in errors. Therefore, the next recommendation set suggests that the designers and developers of such travel IT anticipate user error, and thus build smarter solutions that address expected user error.

Recommendation 2:	Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors

8.3.1 Plan for user error caused by a lack of travel knowledge

Participant 11 (Male, under 30) was aware that the responsibility for using the journey planner successfully fell into the hands of the traveller, stating in the post-journey planning discussion of Traveline that: 'It's hard to use… you'd have to, kind of, work that out for yourself using this journey planner'. Similarly, during the post-journey planning discussion of MyJourney, Participant 10 (Female, 30-49) revealed that they would have benefited from the journey planner working with the travellers set constraints and offering more intelligent route suggestions when a lack of routes are identified.

> Interviewer: So, the final part of the trial is to ask you how the experience went and I noticed that you were unable to plan the unfamiliar journey, what things were you trying to do to plan the business trip?
>
> Participant 10: 'Okay... usually I've got the options of buses or trains and it should be going earlier than the time that I want to be there, for example by two or three hours. But, I can't find a journey for this trip. So I start considering getting a taxi or something like that but I would need a cheap journey for a business trip. If I have any friendly neighbours, I can ask them, 'Would you drop me in that place?' If they said it's Okay, that's Okay for me but I think we should be able to go by buses and trains and travelling three or four hours before the flight'
>
> Interviewer – probing based on participant indicating that they were not offered a viable journey for their trip: 'One of the things you were saying as you were looking at the journey planner was that the buses started later than when you were planning to travel; would you have liked to have seen say for example, 'We can't match your criteria but if you travelled half an hour later, you could catch this bus'?
>
> Participant 10: 'Yes, but the website didn't show me that,'
>
> Participant 10 (Female, 30-49) – MyJourney (Post-Planning Discussion)

This discussion indicates that the traveller would benefit from the journey planner taking more of the proactive responsibility to produce route options, working with the traveller's information to maximise route possibilities, especially when few routes meet the original criteria. The key finding from Chapter 7 was the extent that unfamiliarity influenced the success of planning a journey, and so designing for a traveller's lack of knowledge is an important consideration. Participant 10 (Female, 30-49) was acutely aware of their present lack of local travel knowledge stating that:

> 'it's hard here because this is not my country, so it's hard for me to get around by foot or by cycle because I do not know so much about it here, I would ask for a lift'.

This traveller's lack of knowledge coupled with a journey planner's expectation that travellers have detailed knowledge directed this traveller's decision towards a taxi or private transport

alternatives. This demonstrated that MyJourney, in this instance, failed to inform this traveller about the public transport possibilities that were available to her, and resulted in a failure to successfully plan her unfamiliar journey. This issue is intrinsically linked to the recommendations made in the previous section that aimed to raise the awareness about the way that the workflow is designed and the need for an intelligent design that appropriately considers a traveller's lack of travel knowledge. Therefore, two recommendations are made to target handing over responsibility from the traveller to the journey planner to sufficiently engage with travellers lacking local knowledge.

Recommendation 2a

Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
Design capabilities that make sense of traveller entries and convert them into successful journey planning outcomes, such as suggesting minor alterations to improve route possibilities.

Recommendation 2b

Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
Design capabilities that are on the same level as a significant wayfinding traveller that aims to support and educate a reduced wayfinding traveller.

The first recommendation expects that developers design capabilities that use the traveller's inputs in a proactive way, such as the suggestions previously described. The second expects that these capabilities are also to the same level of a traveller with in-depth local travel knowledge who can spot erroneous suggestions and to correct those issues in a meaningful way. In essence, the travel information distribution system is effectively facilitating a journey planning discussion between the familiar traveller (the system) and the unfamiliar traveller (the user). This type of capability is available in the form of recommender systems that presently target the tourism market, which can be successfully applied to this market.[62] Similarly, the discussions in Chapters 4 and 5 demonstrate that in the in-trip travel environment, knowledgeable travellers are often found offering support to less-knowledgeable travellers when in-trip difficulties occur. Therefore, these two recommendations are reasonable expectations to have in a present-day journey planner.

8.3.2 Maintain information clarity and consistency

Fu et al. (2013) collated user ratings on mobile app stores to identify what concerns users had about each of the app categories, finding that travellers desired information accuracy, reliability and overall system stability from local travel applications (see Chapter 2). This indicates that travellers would naturally expect the designer of any travel IT to ensure these concerns are

[62] See Chapter 2, Section "2.2.1.1 Assisting Choice: Recommender Systems".

properly addressed. To identify whether this need was satisfied, a part of the qualitative analysis considered errors that were not produced because of user-error. The findings of the qualitative analysis revealed that all three journey planners used in the trials demonstrated flaws in maintaining information continuity or application stability because of how session data was managed. To reflect a consistent view of non-user errors, they have been broken out by the type of issue and journey planner that produced them.

8.3.2.1 Data loss – observed by Google Maps

Some of the travellers planning on Google Maps found that they would lose travel information when they interacted with certain elements on the site such as the map and menus. This loss of route information required the traveller to re-enter their journey enquiry to retrieve the lost information. For example, participant 12 (Female, 50+, planning familiar journey) had managed to obtain route options for their familiar journey, but when she attempted to modify the map to show cycling information using the left-hand menu (see Figure 8-5), the route information was lost. She did not notice the loss of travel data, and subsequently began to plan the route completely independently with their own knowledge of cycle pathways.

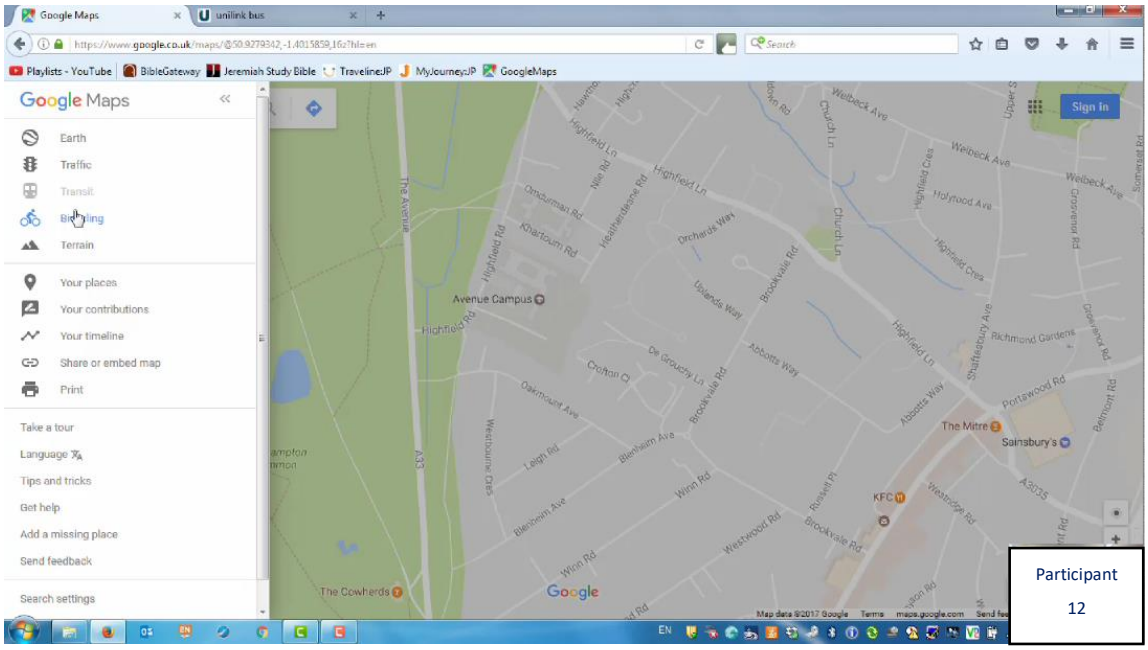


Figure 8-5: Participant 12 interacting with a menu and losing attained travel information

Participant 11 (Male, under 30, planning unfamiliar journey) also experienced a loss of routing information when he interacted with the map and pulled up real-time departure information for a bus stop (see Figure 8-6).

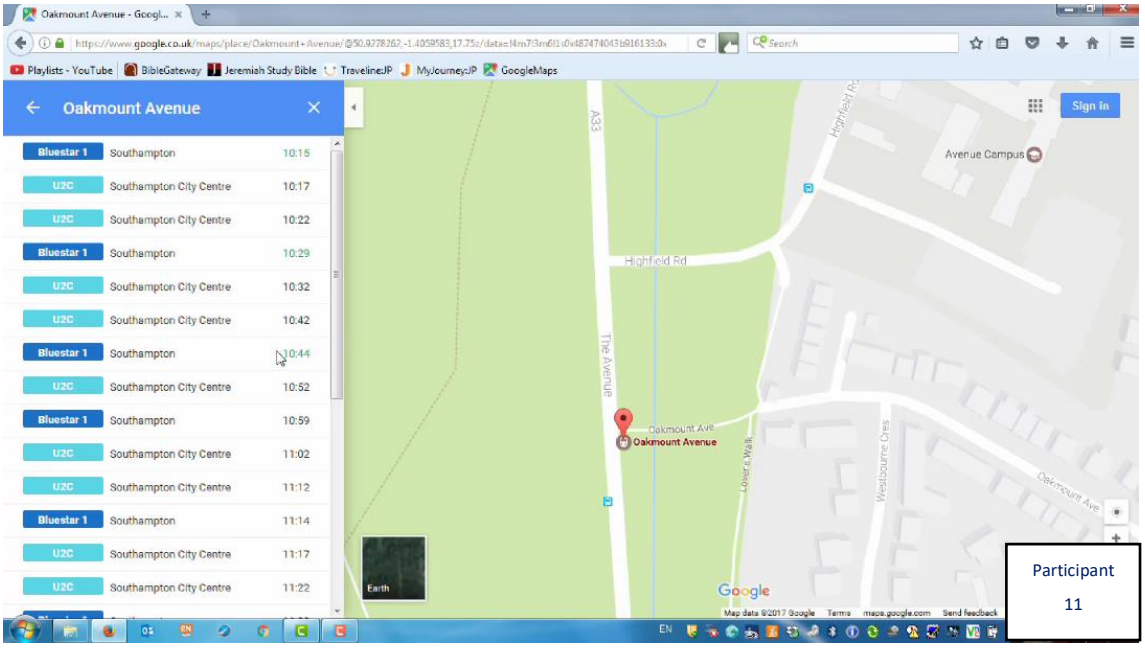


Figure 8-6: Participant 11 interacting with the map and losing attained travel information

These observations are not necessarily a flaw in the process of journey planning if the change of travel information supports the traveller's needs, but if the traveller has not finished with the information that they lost it can cause a delay in building confidence and also limit the memorability of relevant travel information (Deffenbacher, 1980). Designers should consider what actions remove presented travel information and have methods to recover a previously searched journey.

Recommendation 2c

Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
Have an awareness of how traveller's interactions with the site remove attained travel information about a current journey enquiry and provide ways of quickly recovering a past journey enquiry in the event of data loss.

8.3.2.2 Data inconsistency – observed on MyJourney Southampton

A similar issue with data management is the presence of outdated information that related to a previous search and no longer matches the present journey enquiry. With MyJourney Southampton, when a traveller modified or altered journey settings using the 'plan your journey' tab the other tabs did not reflect the new modifications. One participant (No. 12, female, 50+) was particularly adept at routing out usability errors[63] modified the 'plan your journey' tab to reflect

[63] Due to her low level of technical ability. She stated during the study that 'this is probably quite a good learning curve for me because this is just the sort of thing I do and then I call my husband and he says, 'What have you done now?' and he usually takes over'.

only cycle route options and then re-clicked onto the 'journey details' tab, which showed the previously selected and no longer relevant public transport route (see Figure 8-7). She seemed to forget that she had changed her mind to look exclusively for cycle routes and decided that she would take the displayed route in this tab, seemingly confident enough to travel this route if asked.[64]

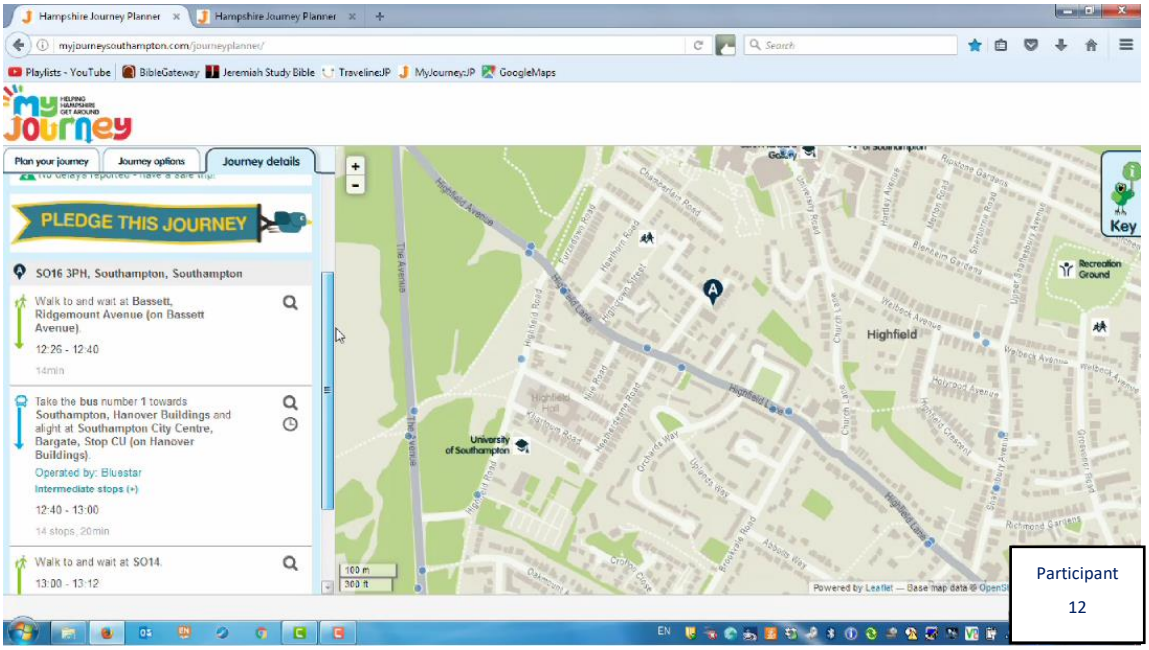


Figure 8-7: Data inconsistency as observed by participant 12

In this instance, participant 12 was satisfied with the level of travel information despite its poor functionally; the tab did not reflect the recent journey enquiry. However, other travellers did have issues with this tab reflecting outdated information when it was coupled with the initial route recommendations that reflected poor pre-route decisions. Designers should consider the longevity of presented information on tabs and windows and have a clear understanding of the situations that modify, or should modify, that information to ensure that it remains relevant to the actual search criteria.

Recommendation 2d

Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
Have an awareness of where travel information related to past journey searches is to ensure that new search enquiries remove outdated travel information.

[64] In the post planning interview this traveller was unable to recall any pertinent travel information.

8.3.2.3 Search enquiry inconsistency – observed by Traveline South West

A similar issue is data inconsistency with the whole site in relation to a journey enquiry. Traveline South West was shown to work well without this search enquiry error when the traveller planned one journey enquiry without modifying their original pre-route decisions. However, when they did, it resulted in significant user error because of pre-route decisions due to traveller unfamiliarity. Therefore, travellers making one or more enquiries resulted in the observed issue with handling multi-search enquiries, see Figure 8-8.

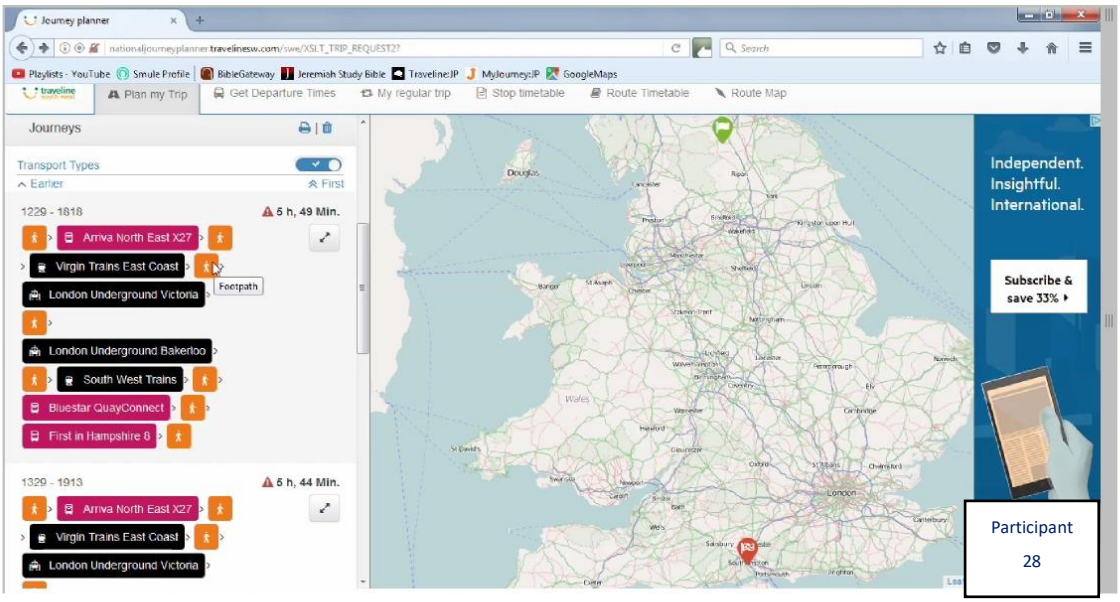


Figure 8-8: Multi-search journey enquiry error as observed by participant 28

Figure 8-8 shows that participant 28 (Female, 50+, planning familiar journey) was offered travel options for the previous unfamiliar journey which was also subject to a destination error by Traveline. Her previous unfamiliar journey was a workplace commute between Sandell Court and Debenhams in Queensway, in Southampton. The map in Figure 8-8 shows that the journey planner confused the Debenhams in Queensway, Southampton with the Debenhams near Queensway, Glasgow. The issue in question is that, as the traveller planned their familiar journey from Holy Hill, Southampton to West Quay Shopping Centre, Southampton, they were presented with route options for the previous Debenhams journey. It was also apparent that it was not possible for her or other participants to resolve this session-related error, which resulted in the journey planning activity being abandoned. The error was resolved when session data such as cookies and web history was removed, enabling a new search enquiry to be made. Due to the significance of this issue, the final recommendation in this set is for designers to account for errors such as these in their design, and properly establish the effects of session-related data to ensure that old search enquiries do not interfere with current search enquiries.

Recommendation 2e

Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
Ensure that session related data about a past search enquiry does not interfere with new search enquiries.

8.4 Information presentation and style

The final consideration for the designers is to consider the way that travel information is presented to the traveller. This covers elements such as the use of notifications, minimising information overload and reducing peripheral information.

Recommendation 3:	A clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey.

8.4.1 Use of positive notifications

Chapter 5 presented the NUDGE model as a means of slowing down or stimulating the way an individual processes information to influence choice. In it are strategies that a designer can use to increase selection; for example, setting defaults is a useful method of communicating route sufficiency to the traveller. Other strategies within the NUDGE model, such as giving feedback, are also valuable to the traveller. For example, MyJourney Southampton applies both positive and negative feedback about detailed routes. It includes a banner that states if that route would be affected by service disruption (negative feedback), and indicating when that route was unaffected (see Figure 8-9).

Figure 8-9: Positive notifications as observed by participant 24

Throughout this thesis, the subject of service disruption has been presented as a key concern that travellers have when deciding to travel. The public transport network has also been described by researchers as 'reliably unreliable' in offering travellers accurate travel time estimates because of the inevitable effects of planned and unplanned service disruption (Chorus et al., 2007). The presentation of such notifications, both positive and negative, helps address these areas of concern that travellers have. Participant 24 (Male, 30-49) stated in the post-journey planning discussion of Google Maps that the lack of positive and negative notifications led to him feeling unsupported in regards to service disruption expectations:

> ‘The other thing that I have marked poorly on the questionnaire is disruptions, it might just be that these routes do not have any disruptions, and so I would not know how they would be presented if there were any, but I did not get the sense I could find out that information particularly easy’.

Although the use of notifications is valuable, what the NUDGE model suggests but which are largely absent in the journey planners is the notification source which can either be estimated or live. Therefore, the notifications must convey the reliability of the information itself based on its source material, especially if the traveller is about to begin the journey.

Recommendation 3a

A clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:
Consider the use of positive and negative notifications especially about subjects of importance to the traveller (e.g. planned and unplanned service disruption) while also conveying the source of that notification (e.g. estimated or live)

8.4.2 Succinctly represent route sufficiency by banding route options

Travellers require a clear representation of the route options[65] along with the need for default route suggestions (see Section 8.1). Therefore, designers should consider how they list these route options to increase clarity. In all three journey planners, that results of a search enquiry consisted of a list of routes that were available at different times of the day, implying that one route possibility could be listed multiple times because of the times that route runs (see Figure 8-10). This is also an observation made by the participants as one (No. 17, male, 50+) stated in the post-journey planning discussion of MyJourney that:

> ‘There was a large choice of bus journeys, some of which were a duplicate. The routes were the same … so, it was ordered by time. It was not easy to know that at first if you did not know anything about those routes. To do anything other than click on each one in turn and find that they were taking you the same way’.

[65] Especially simple, non-interchange routes

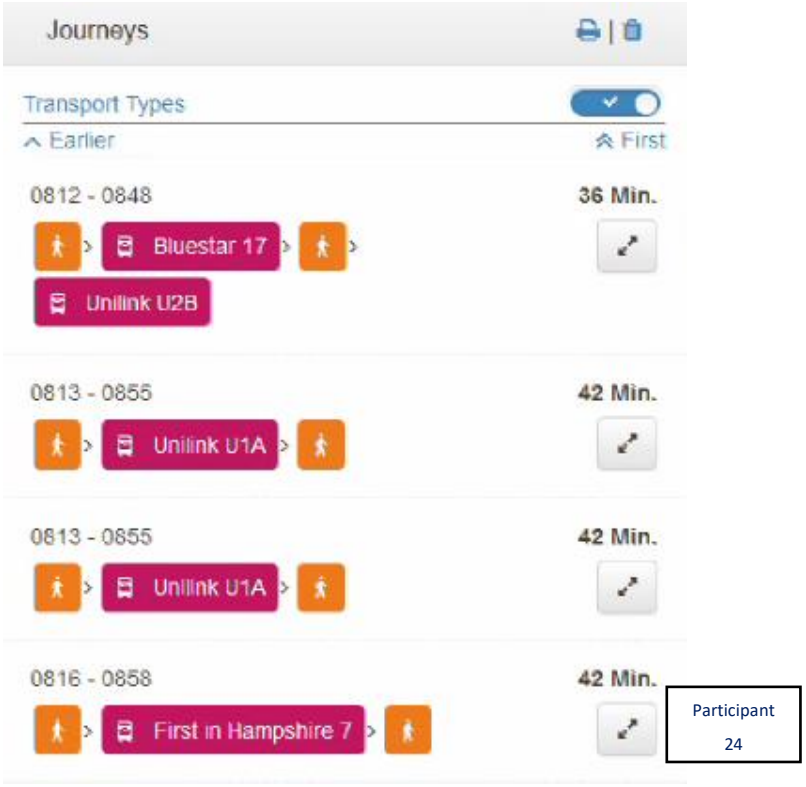


Figure 8-10: Journey planner recommendations – Duplicated U1A route listed

Figure 8-10 shows that the suggestions are presented in time order, according to the traveller's arrival or departure needs. This method of information presentation is not necessarily a bad way to convey route information, especially in cases where the journey needs involve explicit time constraints. Based on the evidence obtained in this experiment, the journey planning behaviours of the participating travellers indicate that they do not investigate their route options deeply, typically reviewing one detailed route. As a result of this, they seek to confirm route details such as service times closer to the time of travel using alternative information sources such as real-time enabled journey planners and applications. These behaviours suggest that there may be an alternative method of presenting travel options that simplifies the list of travel information into a clear and concise representation of the available routes. To use an example, the Portsmouth and Southampton Bus Pro App summarise an available service, the next departure and its repetition, condensing the arrivals list into one band:

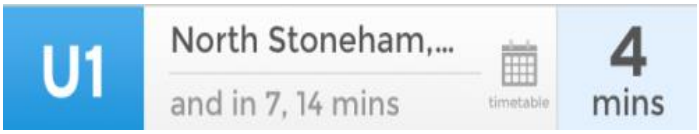


Figure 8-11: Example of journey based summary by Portsmouth and Southampton Bus Pro App[66]

Figure 8-11 shows that it is possible to reduce the list of route duplications into one summary that that can succinctly convey a route and its frequency. This presentation style would make it easier for travellers to see the literal route options that a traveller has and the risk. Clearly, this style also has other potential benefits for unfamiliar travellers as there is less information for them to process and this simplifies their learning process. Organising routes in this way establishes the physical provisions for that origin and destination, which is something that matters to the traveller. One traveller (No. 4, female, 30-49) commented on the difficulty of journey planning, stating that:

> 'The pain with travel is twofold; one is the physical provision, the other is the tool that helps you search for options that are in the physical provision but isn't responsible for this physical provision. So, it's a bit unfair to blame the tool for what isn't there'.

Recommendation 3b

Offer clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:
Consider offering travellers a more unobstructed view of route sufficiency by banding multiple journeys into one descriptive band that describes a route and its frequency.

Some of the journey enquiries will result in more complex route suggestions that are greater in distance and number of interchanges. These routes need to be ordered based on the number of interchanges and presented separately to non-interchange route options to help establish the complex nature of these longer route options. These journeys should maintain their focus on frequency, not only for the availability of that route suggestion but also the separate elements of the journey so that the traveller can clearly establish the risk of missing certain parts of the multi-service route.

Recommendation 3c

Offer clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:
Ensure complex routes, such as multi-modal or interchanges, are expressed clearly as a travelled route with the frequency of each part of the journey to identify interchange reliability.

[66] This observation of presentation style was made during a functional review, which targeted how in-trip travel information offered by smartphone devices catered to the needs of travelling travellers, prior to conducting the thesis research itself. Of the sources reviewed, this presentation style was considered to have merits and was noted for future reference in this study.

Designers should be aware of the complications of banding routes together and how they may be interpreted if they are not related to one service or route direction. For example, Google Maps offers route banding which presents several routes that cater to a journey (see Figure 8-12).

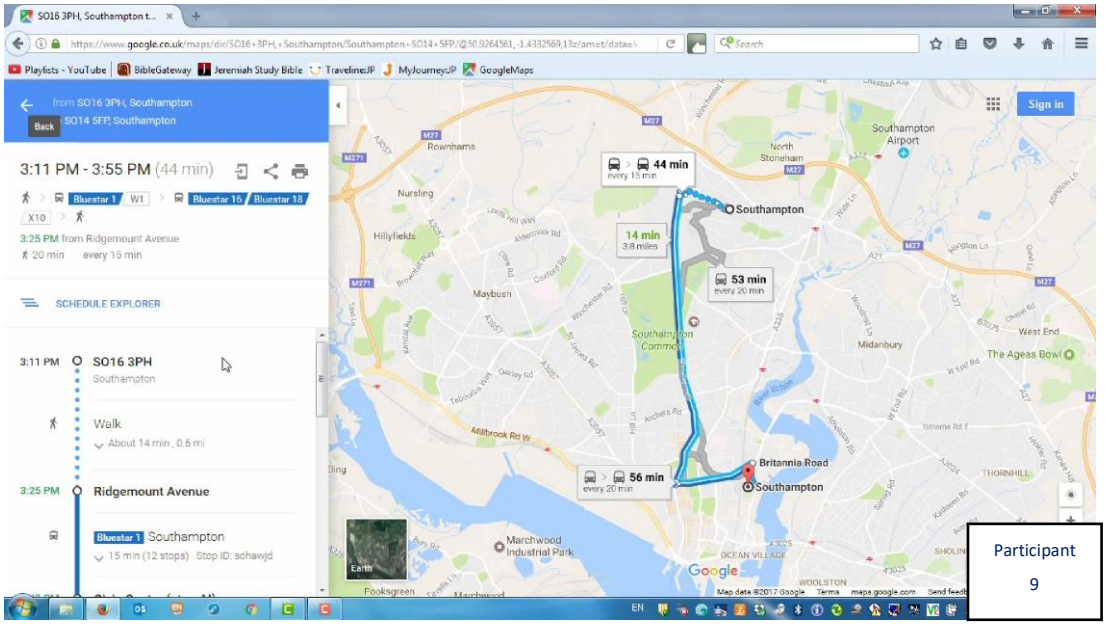


Figure 8-12: Route banding by direction of travel as observed by participant 9

This type of banding is not what this recommendation is intending to advocate as it is not clear to the traveller what service results in which direction of travel. Participant 11 (Male, <30) was familiar with the local routes possibilities and detected shortcomings in this type of banding, explaining that:

> 'I know there's a problem there because I think it's even showing that the U6C will follow the same route as the 2 and it does not, so that's wrong. It comes down here and goes down the bottom of the High Street and goes in to town, so this is confusing'.

This recommendation is that one service should consist of one banded route as one potential method of completing that journey. In Figure 8-12 it clearly shows five service route possibilities, and each should have its own descriptive band and route breakdown summary to clearly explain to the traveller the details of that service and its feasibility. Except in cases where that service follows the exact same route and acts the same as its banded partner, if there is deviation such as following a different direction or stopping at a different destination then this should be considered as a separate route with its own banded description and breakdown.

Recommendation 3d

Offer clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:

Ensure banding is explicit to one route and direction of travel to maintain information clarity.

8.4.3 Reduction of peripheral information

Mitsche (2016) opined that travel IT must maintain clear information that matches the individual's needs which will improve the traveller's familiarity and information recall about unfamiliar transit journeys. This final set of recommendations acknowledges this need by using the journey planning observations to identify areas where information clarity can be improved.

The first recommendation is the presence of unrelated travel information that unfamiliar travellers will not know how to interpret until more familiarity is gained about their local environment (see Figure 8-13).

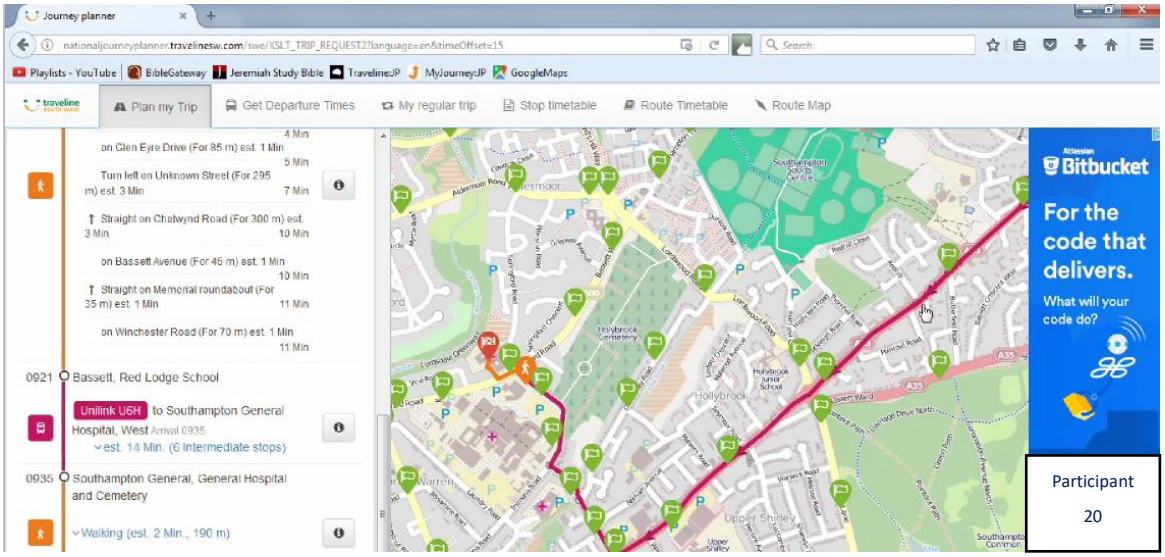


Figure 8-13: Peripheral information in the form of adjacent stops and advert banners as observed by Participant 20 while using Traveline

Figure 8-13 shows that when participant 20 (Male, 30-49) checked a detailed route for his unfamiliar journey, and saw a busy map. The screen is full of different symbols on coloured pointers, some of which are directly relevant to the journey, such as the red flag pointer indicating the destination, while others were unrelated or peripheral information, such as stops which were not along the way. In theory, this level of information could advise travellers of other nearby locations near to their destination and allow them to seek an alternative route. However, based on our findings it was clear that travellers struggled to understand the purpose of these additional and unrelated flags when looking at a detailed route. Participant 21 (Male, <30) stated during the

post-planning discussion that, in addition to the earlier problems with navigating pre-route decisions, he found the additional details on route maps unclear:

> 'It's a bit slow when I try to submit my setting, also not being as familiar with the map, because of the symbols, I'm not sure what all the green flags means'.

Participant 29 (Female, 50+) also struggled with this additional information by stating during the post-planning discussion that:

> 'I managed to locate the hospital in the end but that took me a while. The map is quite confusing to see these symbols because I didn't – I wasn't sure what I was looking for. I wasn't sure whether I was looking for a pin with an A and a B on it'.

Participant 29, who typically travels 5+ days a week by car, deduced that the pointers matched an in-car satellite navigation systems presentation style and thus enabled her to interpret some of the pointers on the route map:

> 'Then I realised in the end that it's like the satnav isn't it, it gives you a chequered flag for the end, but since it does not tell you that on the search thing, how do you know that that's what you're looking for, you don't, do you?'

This statement indicates that she benefited from being exposed to a similar presentation style which enabled her to process the presented information. However, participant 21, who typically travels 5+ days a week by bus, indicated that they would have preferred less information to make the relevant information stand out:

> 'Actually, there is a little bit too much here. I mean, if they can, maybe, expand and minimise the detail, I would prefer them, I would prefer they have the minimised version for me first'.

This suggestion links to Chapter 2, Table 2-4 regarding the way that information is shared, either by offering the full picture (unbounded rationality) or a more selective/restrictive view (bounded rationality). In this example, participant 21 suggested that in this case, that this information (bus stops) was valuable but should be hidden behind a toggle that offered an initial bounded view. This concurs with the discussions in Chapter 2 and Chapter 4, that unfamiliar travellers need methods that provide shortcuts to relevant travel information; this fits with the initial need for bounded rationality. The initial reduction of peripheral information will also bring more clarity to individuals that have other difficulties in interpreting on-screen information because of visual impairments:

> 'It had colours – the colours were slightly different I think, depending on which service I was going to use although I'm colour blind so I'm never one to let that influence me because I don't know what's going on' (No. 24, male, 30-49).

Therefore, it is recommended that designers consider a toggle on/off option for certain types of unrelated peripheral information to help travellers maintain their focus on learning details such as in-trip mapping and direction of travel (Preece et al., 1994).

Recommendation 3e

Offer clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:
Ensure that when presenting detailed travel information, it initially restricts the level of presented travel information, for example, initially hiding nearby bus stops. Alternatively, you can provide a toggle on/off feature for extra travel information such as nearby stops be offered to allow the freedom to focus initially on relevant information and conduct a more detailed investigation of their route options.

Another observation regarding peripheral information that came from Figure 8-13 was the presence of advertising on the journey planner and the resultant distraction from relevant travel information (Rosenkrans, 2009). Any form of peripheral information is likely to divide the individual's level of attention (Fisher and Geiselman, 1992). Li et al. (2002) review of individuals' awareness of on-screen peripheral information such as banner adverts found that they were seen either a minor distraction or a significant 'forced' distraction that deliberately interrupts processing activity. In a study by Google (2011), 82% of the 5,013 interviewed participants were able to detect and were distracted by the presence of adverts, confirming its ability to interrupt the absorption of key information. It also showed that participants were drawn to further interactions such as clicking on the advert (42%), visiting the website linked to the advert (35%), looking for more information (49%), directly contacting the retailer (27%), visiting that retailer (33%), or making a purchase from that retailer (49%). As an individual attempts to identify the information that is relevant to their objective, peripheral information produces cues that interfere with that central thought process and sometimes leads to action that negates the original objective (Appelbaum, 2012). The individual's ability to manage this depends on the cognitive loading that the individual can maintain at any one time. According to Cognitive Load Theory (CLT), the effectiveness of working memory to maintain a central thought for prolonged periods is linked to the type of processing and the task's familiarity (Sweller, 1988). Thaler and Sunstein (2009) refer to this type of processing as 'duel-processing theory' (see Table 8-2). They conclude that habitual travellers are more likely to use the automatic type of processing when planning journeys because of their familiarity with the public transport network.

Table 8-2: Analysis of Chapter 4 and Chapter 5 alongside the NUDGE model by Thaler and Sunstein (2009): Types of central/peripheral stimuli processing.

Automatic System (Type 1)	Reflective System (Type 2)	
Uncontrolled	Controlled	Type of processing
Effortless	Effortful	
Associative	Deductive	
Fast	Slow	
Unconscious	Self-aware	
Skilled	Rule-following	
Describing a traveller with significant wayfinding ability	Describing a traveller with reduced wayfinding ability	

The more the individual processes both task-relevant (central) and task-irrelevant (peripheral) stimuli, the more it adds to the individuals cognitive processing space limiting the processing space within working memory (Fisher and Geiselman, 1992). Individuals that are skilled and familiar with the task they are conducting will be able to identify relevant information and respond to peripheral information in a similar way to automatic processing (see Table 8-2). Individuals that lack this ability process much more slowly and are subject to more interference from the peripheral information. These individuals, represented by 'reflective processing', will struggle to retain working memory because of the handling of both task-relevant and task-irrelevant stimuli, and are likely to forget decisions, actions or processes because of information overload (Bevilacqua et al., 2016).

In the study of chromatics, an individual's multi-tasking ability is their cognitive processing ability to operate with either a polychromic or monochromic focus (Norgate, 2006). Polychronicity (P-Time) is the process of doing more than one activity at any given time, ordering those activities simultaneously (Norgate et al., 2014, Mohammed and Harrison, 2013, König and Waller, 2010). In this time pattern, the individual is more flexible in responding to peripheral stimuli and will have maintained some partial memory of what they did prior to the disruption (Hall, 1983). These individuals will not necessarily restart from where they left off, instead, recommencing the central activity from different points of entry based on the element of memory that was maintained (Preece et al., 1994). Monochronicity (M-Time) is the process of undertaking tasks in a sequential manner, focusing and dedicating time to that task before moving on (Norgate et al., 2014, Mohammed and Harrison, 2013, König and Waller, 2010). In this time pattern, the individual is rigid in their processing and therefore will struggle to accept forced distractions from the central activity as all their cognitive effort is spent on one activity at a time (Hall, 1983). It is likely that these individuals will forget what they were giving attention to, and need to duplicate the steps taken before the interruption (Preece et al., 1994). However, more often than not individuals will

continually switch back and forth from the central and peripheral thoughts and activities which means that their return response is driven by the strength of working memory rather than the multi-tasking focus style (Preece et al., 1994).

Forgetting information because of distraction was observed throughout the experiment, especially when travellers were affected by poor pre-route decisions. This resulted in forgetting the pre-route settings they applied or what they had previously decided. For example, one participant (No. 12, female, 50+) chose to take a bus route when wanting a cycle route. The impact of the interruption is dependent on the type of interaction that is required or perceived by the individual from the peripheral stimuli. According to a study of individuals who use adblocking services, interruptions from interactive adverts are the most disliked because of their intrusive nature, whereas, static banners are considered more acceptable (Blanchfield, 2017). However, static banners are capable of distracting an individual because of the marketing strategies used to increase high involvement (relevance to the individual) and high persuasion to promote a response (Petty et al., 1983) through observations of the individual and system, such as operating system, browser, browsing habits, country and internet service provider. This may be the reason for the growth of adblocking services by 30% between December 2015 and December 2016, representing 11% of online users, and 600 million devices (Langheinrich et al., 1999, Blanchfield, 2017). Li et al. (2002) suggested that websites that use a lot of advertising monopolise the site's functional space that offers relevant services, limiting the site's overall relevance. These issues are important concerns in supporting information clarity in travel information distribution, as the participants were shown to be distracted by adverts, in some cases to a significant degree, because of decreased functional space and highly interactive advert and targeted adverts increasing relevance and involvement.

Figure 8-14 shows that participant 28's (Female, 50+,) familiar journey planning activity was significantly interrupted by the presence of an interactive advert. She interacted with the advert by her mouse entering the advert space, launching it to full screen and monopolising the functional space where travel information was. She responded with frustration by stating:

> 'It's gone back to the other one … oh that's (laughs), that's a completely different route. Oh dear, what's going on now? Get rid of this thing! edit I would think, seriously edit!'.

Her comments echo the earlier issue regarding Traveline session issues and her frustration at the advert taking control of the screen at that moment. Similarly, participant 26 (Male, 30-49)

expressed concerns about the use of adverts in the functional space and the amount of space that it took up:

> 'Yeah, I wasn't particularly keen on the fact there is adverts all over the place. They pop up in the middle of the information bar on the left and your map on the right, they get in the way a bit'.

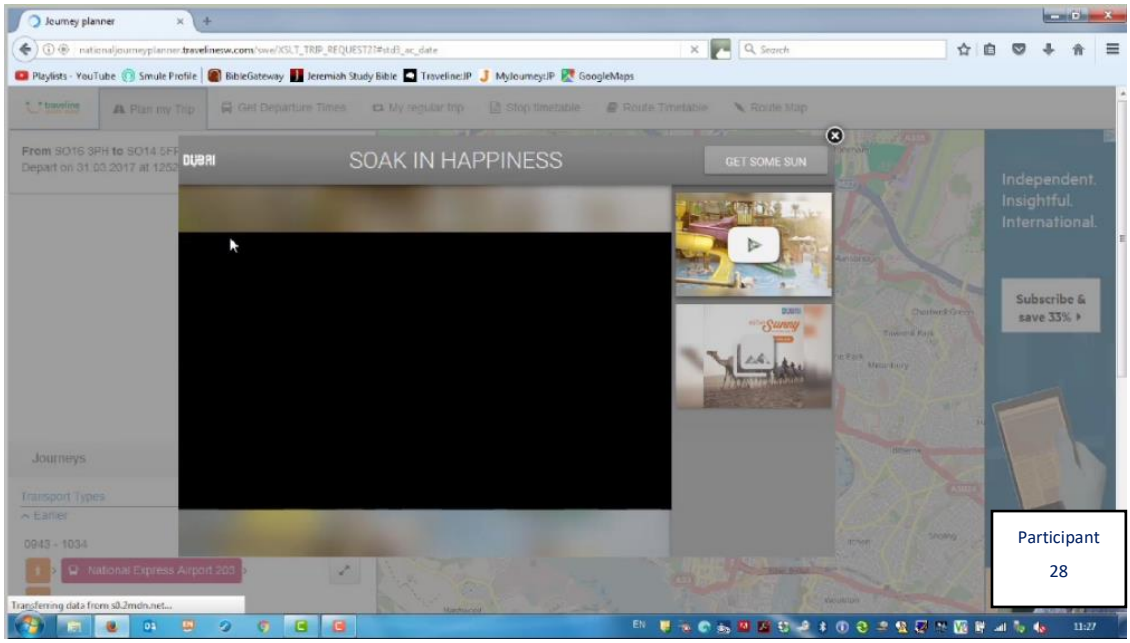


Figure 8-14: Responsive advert interruptions as observed by participant 28

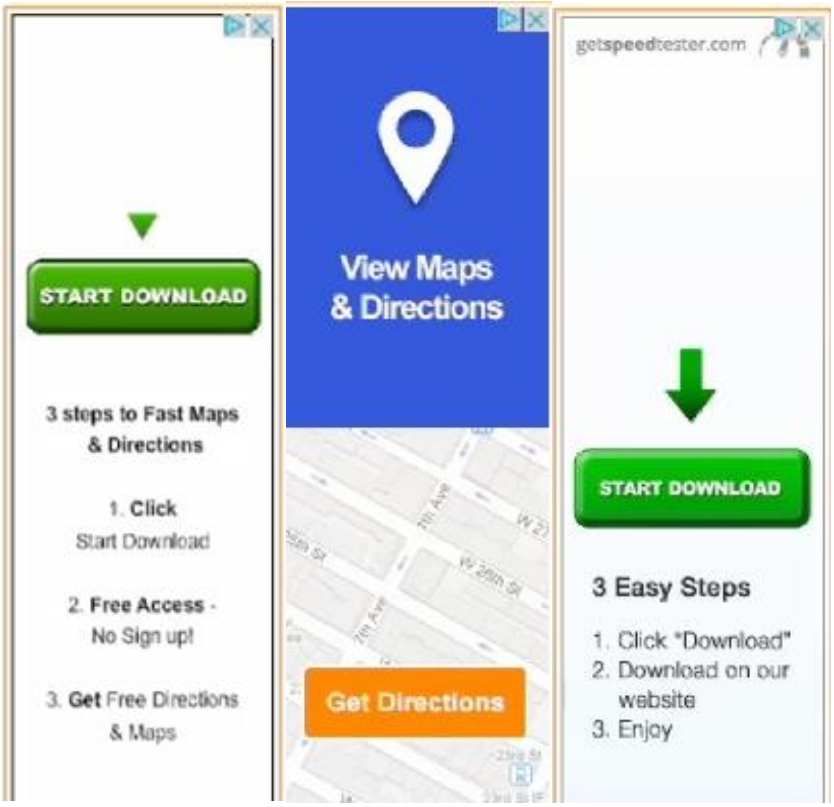


Figure 8-15: Targeted adverts as observed by participant 12

These travellers would benefit from the removal of these types of adverts from key parts of the journey planning process. For example, route summary pages are designed to describe the intricacies of a route and therefore, distractions at this stage will interfere with travellers processing ability.

Figure 8-15 shows some of the static banner adverts that were presented during the experiment. These were travel-based adverts that were presented because the browser history indicated the use of journey planning sites. Their placement enabled them to be presented to the user in the same context – planning a journey – to increase their relevance. These types of adverts are designed to resemble icons such as a clickable button to indicate that interaction is required, and when the advert matches the subject of the current site, it is easy for users to assume that it's a part of the functionality of the site (Preece et al., 1994), especially the less tech-enabled users who are less likely to identify that it is a static banner advertisement (Blanchfield, 2017). This was particularly the case for the participants over 50 who would occasionally engage with these banner adverts because of their high relevance and the participant's lack of skill in identifying them as adverts. For example, participant 12 (Female, 50+) was presented with all three of the adverts shown above, and in each case she clicked on them:

> ' [First banner selected] Click here to install Maps Galaxy on my homepage in new tab' (reading quietly)… I don't really want that but maybe I have to. Free download, no?' [Second banner selected] ''Easy steps', 'get directions', 'view maps and directions', 'start download'. So, I'm not sure whether I'm supposed to be doing the start download or view maps so I'll just start download to get directions'. [Third banner selected] 'Enter start location – free install? So, that's a bit annoying because I feel like I've done that already. 'Access directions now'. Let's have a look… Okay, 'Enter start location', SO16 3PH, 'Enter destination', Queen's Way Southampton, do I install'.

In each of these cases, participant 12 required the invigilator to explain that these were banner adverts and not part of the site functionality. However, she responded to the 'call to action' messages that were similar to the activity she was focused on despite the invigilator's explanation. This is consistent with targeted advertising (Lewandowska-Tomaszewska and Jankowski, 2017, McCoy et al., 2004). Therefore, it recommended that targeted advertising is removed so that less-technically abled travellers planning unfamiliar journeys can maintain directed attention towards the task of journey planning.

Recommendation 3f

Offer clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:

Removal of all targeted static banner adverts, or where this is not possible, prevent banner adverts that relate to the activity of journey planning.

8.5 Summary

Using the video recording taken during the summative usability experiment, 15 gaps and opportunities for improving a journey planner's ability to support customer centricity were identified covering three areas of interest. These are summarised in Table 8-3. Of these 15 recommendations, the first four address the way that dual-wayfinding should be supported. The remaining 11 are intended to reduce the level of miscommunication that arises through poor information communication and error management that interrupts the traveller's ease of learning relevant travel information.

Table 8-3: Recommendations

1		A clear and coherent journey planning workflow:
	A	Ensure that there is a clear boundary between macro-level travel information (routing) and micro-level travel information (route details)
	B	Help the traveller to understand the geographical nature of a trip by making the visualisation of a default route a key priority
	C	Help the traveller to understand route sufficiency by displaying route availability information (frequency, first and last service times) a part of the default option.
	D	Ensure that the default route suggestions based on factors that meet the travellers need such as the desire to find routes that reduce interchanges or are most frequently available. Similarly, consider the uptake impacts of the default route selection criteria to ensure that they offer relevance to the traveller.
2		Take responsibility for guiding the travellers through complex decisions by anticipating traveller error and reducing system errors:
	A	Design capabilities that make sense of traveller entries and convert them into successful journey planning outcomes, such as suggesting minor alterations to improve route possibilities.
	B	Design capabilities that are on the same level as a significant wayfinding traveller that aims to support and educate a reduced wayfinding traveller.
	C	Have an awareness of how traveller's interactions with the site remove attained travel information about a current journey enquiry and provide ways of quickly recovering a past journey enquiry in the event of data loss.
	D	Have an awareness of where travel information related to past journey searches is to ensure that new search enquiries remove outdated travel information.
	E	Ensure that session related data about a past search enquiry does not interfere with new search enquiries.
3		A clear and concise representation of travel information to convey a clear message about the search enquiry to foster confidence in conducting the journey and remembering that information post-journey:
	A	Consider the use of positive and negative notifications especially about subjects of importance to the traveller (e.g. planned and unplanned service disruption) while also conveying the source of that notification (e.g. estimated or live)
	B	Consider offering travellers a more unobstructed view of route sufficiency by banding multiple journeys into one descriptive band that describes a route and its frequency.
	C	Ensure complex routes, such as multi-modal or interchanges, are expressed clearly as a travelled route with the frequency of each part of the journey to identify interchange reliability.
	D	Ensure banding is explicit to one route and direction of travel to maintain information clarity.

Table 8-3: Recommendations (Continued)

3	E	Ensure that when presenting detailed travel information, it initially restricts the level of presented travel information, for example, initially hiding nearby bus stops. Alternatively, you can provide a toggle on/off feature for extra travel information such as nearby stops be offered to allow the freedom to focus initially on relevant information and conduct a more detailed investigation of their route options.
	F	Removal of all targeted static banner adverts, or where this is not possible, prevent banner adverts that relate to the activity of journey planning.

Chapter 9. Critical review of the thesis process and outcomes

This thesis aimed to examine travellers' travel information comprehension and how this influences or alters the term 'effective action', understood as: enabling the traveller to, at any time or place, access the relevant trip options that can be applied to a specific journey and successfully understand, navigate and complete that trip, including the IT designed to facilitate this. This chapter gives a detailed critical review of this research project accounting for the steps taken to achieve this aim, which includes; (1) the research direction; (2) the emerging methodological challenges; (3) thesis objectives; (4) adoption of mixed-methods triangulation; and (5) the research questions.

9.1 The research direction

From the outset of this thesis, literature demonstrated that for the purposes of planning public transport trips, the collation and distribution of specific travel information were important because of the backing of technical innovation (Filippi et al., 2013, Nunes et al., 2014, Duncan et al., 2009). Common threads throughout travel literature were: its technical stance towards supporting the provision of travel information such as 'open data' channels (Department for Transport, 2012, The Parliamentary Office of Science and Technology, 2014); the collation of new types of travel information through sensory 'real-time' tracking; comprehensive behind-the-scenes algorithms that were capable of filtering and splicing that information into reasoned travel suggestions (Esztergár-Kiss and Csiszár, 2015, Spitadakis and Fostieri, 2012, Todd, 2007, Trewin, 2000, Gavalas et al., 2014, Pazzani, 1999). However, there was a limited focus towards the use of travel information, particularly relating to the travellers' comprehension needs, and a gap in literature investigating how IT should be designed to support these travel information comprehension needs. Therefore, this thesis intended to respond to that gap in knowledge by exploring, from the traveller's perspective, their dependency upon supportive travel IT and by proxy, the response of travel IT to that dependency.

9.2 The initial methodological stumbling blocks

For this reason, a survey was devised based on certain assumptions that were made through the exposure to the literature. These assumptions were; (1) that the most common method for conducting travel information related research was through a quantitative survey to obtain traveller stated or revealed preferences; (2) that the traveller was capable of understanding what types of travel information they need to plan a public transport trip; and (3) that they would be capable of identifying where to get it from. However, after conducting that survey an error in these assumptions was identified – the survey relied on the traveller's awareness of their travel

information comprehension ability. It became clear that this thesis was subject to certain methodological challenges, often found in research, linked to the investigation of one's skill or information use, known as 'self-insight', and the point an individual becomes aware of their information needs.

A study by Dunning (2005), which examined the western theological psychology of 'knowing thyself', highlighted the limitations of self-insight. He showed that the surveyed individual does not have an accurate reflection of self or a skewed impression of their ability to perform in certain situation. Therefore, a person's views, whether humble or arrogant, often are revealed to inaccurately reflect their actual skill. This meant that it is harder to properly gauge the truth from a participant from one source, and evidenced that mixed methods were needed. In regards to the individual's point of awareness, Simpkins (1994) described that when conducting research linked to information needs, the researcher will need to counterbalance their findings with an understanding that, typically, individuals only become aware of their information needs at the point they are presented with a need for information. Therefore, the clarity with which a participant will relate to information use is affected by their awareness of their need for information (Tinker et al., 1993). This set restrictions on the type of methodological approaches that would be suitable for this thesis, and thus, forced a change in the methodological approach. This rapid level of learning led to an understanding that information comprehension is a skill and that this skill was a complex topic to explore generally through common research methods. This also led to the fourth rule of citizenship being included to give more context as to what the measurements for information provision should be; access to information and support to translate that information - which accounts for the comprehension ability, or lack thereof.

9.3 The thesis objectives

A shift change was then made regarding the entire research project using the identified gap in knowledge, methodological challenges and discovery of the fourth rule of citizenship as the means to define this change. The general aim of this thesis was modified slightly to understand how travel IT needed to be designed to accommodate the varied needs of different traveller types and whether travel IT can meet that dependency. This meant that the objectives for this thesis became;

- **To conduct a review of the literature behind information comprehension, case-based reasoning (CBR) to structure the traveller's ability towards travel information.**

Due to a lack of analysis into behind-the-scenes psychological processes, this literature review was needed to consider how travellers respond cognitively to a new trip demand. This extended literature supported the first triangulation study and was reported in Chapter 4.

- **To obtain qualitative and quantitative data towards travel information use and the dependencies/opportunities that a strong or weakened information recall ability (CBR) produce.**

This objective aimed to respond to the need for a mix of data to offset the difficulties the travellers had reporting their information comprehension and needs with clarity. This data was used in a mixed methods triangulation to enable cross-comparison. The specific nature of the analysis for the two triangulations is explained in Chapter 3.

- **To identify and catalogue the elements of data that form "travel information" to identify its structure and intent in the process of forming an effective action**.

This was already partially produced through the initial literature review, however, to provide further clarity and depth of information, a specific chapter on covering terminology and methodological difficulties was added. This was reported in Chapter 6.

- **To conduct a usability study with travellers as the "evaluator" of present-day journey planners functional usability.**

This objective was included into the research plan because of the need to evidence whether travel IT is capable of responding to the traveller's dependency upon it based on the set traveller planning types that were constructed in Chapter 5. The findings for a journey planner's response to this dependency is reported in Chapter 7.

- **To collate the findings from the overall process into clear guidelines/recommendations to improve the quality and sufficiency of existing travel IT.**

The final step of the research plan was to aid the continuous improvement of travel IT, in this case, a journey planner. By consolidating the usability findings into a suite of recommendations, this would guide other like-minded external stakeholders responsible for the design and maintenance of travel IT. These recommendations were reported in Chapter 8.

9.4 The adoption of mixed methods triangulation

The structure, fully outlined in Chapter 3, clearly shows that the research relied on mixed methods, using triangulation as the means for mixing the methods. There were two triangulations relating to the two research questions;

RQ 1	What is an appropriate representation of the traveller concepts that represent travel information comprehension, and influence effective action?	Used as the foundation to produce the traveller planning types
RQ 2	To what extent can current travel IT, e.g. a journey planner, meet the traveller's information needs according to the fourth rule of citizenship?	Used as the basis of testing travel IT's ability to respond to the traveller planning types dependency

Running the initial intercept survey too early in the research process may have necessitated the use of mixed-methods. However, the benefit of doing this was to gain greater knowledge about self-insight and to provide deeper analysis into travel information concerns, than a single method would have produced. Therefore, it may also be a valuable lesson for other researchers to consider in the future. This is because the ability to cross compare the views of travellers through the lens of different methodological approaches (e.g. a literature review, focus group and through contextual enquiry) was able to draw out consistencies in how the skill played out through learnt experience, beliefs and actions. Similarly, the second triangulation enabling the traveller's views to be seen through the lens of actual information consumption, beliefs about consumption and post-recall sufficiency also clarifies the long term value proposition of travel information from a more comprehensive standpoint.

9.5 Identifying the dependency on travel IT (Research Question 1)

For research question one, the purpose was to obtain qualitative and quantitative data towards travel information use and the dependencies/opportunities that strong or weakened information recall ability produce. The gap in literature clearly showed a lack of design intent towards users of travel IT, and their direct needs on that system. In line with the principles of promoting customer centricity, information technology should be designed with the consumers or users of that system in mind (Kaushik, 2007) and in order to draw any conclusions from this thesis, that basis needed to be properly established.

In contrast, the body of literature emphasised the emotional responses (e.g. anxiety) and level of cognitive effort required due to strong or weakened habituation with public transport. From these findings a series of keyword-based terminology was produced which formed the analytical direction of this study in seeking and validating such keywords. During the course of the analytical process of deep diving each source in the triangulation, frequently recurring terms to build a representation[67] of key themes such as subject matter familiarity (Chapter 4) and stages of information use (Appendix B). Further refinement identified a degree of cross-over, most likely caused by osmosis through the researcher's in-depth analysis and exposure to the material.

To test the rigour of the findings they were presented to 13 experts who were involved in supporting information provision for travellers with strong or weak habituation profiles. Generally, the findings were largely positive and that the terms, definitions and individually identified traveller planning types were appropriate. The intent of this study was not to ascertain whether the experts had total confidence in the definitions but that they believe that they were sufficient to define the key travellers they would need to support as part of their own day to day operations. On the whole the specific robustness of the analysis behind the Delphi itself was limited as over-concern for anonymity (event to the researcher) meant that participants were not tracked round by round. It was not possible therefore to confirm whether these people are influenced by the feedback from each round. This limited the types of statistical tests that could be applied. Despite these limitations, the Delphi study itself was looking to confirm that the five personas produced through the Traveller Planning Types (TPT) framework was reasonable and this was able to be verified.

Looking at the methodological approach after the fact, and the alternative research paths that could have been taken, such as taking on a more theoretical approach or emphasis on the psychology of making decisions e.g. decision theory, there were some insufficiencies and this was most likely due to what was considered in/out of scope in the two literature reviews that were conducted. In regards to adopting a more theoretical approach and/or adopting more emphasis on the psychology of making decisions, as this research was driven by key stakeholders, Southampton City Council, the thesis direction was driven by their goals and their desire for a practical outcome either in the form of a new travel IT system or the recommendations to improve their present journey planner, MyJourney. Therefore, for the most part, the choices made and what was possible to achieve was due to time, resource and project stakeholder limitations. This

[67] In the form of definition.

is also the reason why the TPT framework does not fully encapsulate the movement from one segment to another or the range that habituation has on comprehension. In addition to this, it was not possible to investigate these details because of the change in research direction, the first triangulations deep-dive and the effort required for the second research question.

The outcome of this research question was a clear framework that could be used to represent the concepts that influence the conversion of travel information into effective action, and subsequently, the standard traveller planning types that need to be taken into account when designing travel IT.

9.6 Identifying travel IT's response to that dependency (Research Question 2)

For research question two, the purpose was to conduct a usability study with travellers as the "evaluator" of present-day journey planners to assess the functional and aesthetic usability of travel IT. In order to conduct this evaluation, certain preparation activities needed to be conducted to enable the second mixed methods triangulation to comprehensively evaluate the selected travel IT.

The first step was to define which travel IT would be the focus of the study and understand that particular system's present and expected design intent. The choice to use a journey planner was driven by the key stakeholder's needs and the findings from the initial literature review that revealed a lot more design intent relating to journey planners. However, that design intent was predominately behind the scenes support and not specifically surrounding the travellers who would use it to plan their trip. This meant that the literature was not able to provide any direct guidance for dual-wayfinding design. *Dual-wayfinding* design is a term produced in this thesis and it is used to emphasise that travel IT actually has to support two forms of wayfinding. The first is well known in travel literature and it is linked to the person's ability to navigate from place A to place B (Spitadakis and Fostieri, 2012, Bovy and Stern, 1990, Iseki and Taylor, 2010, Schmitt et al., 2015, Caiafa, 2010). Secondly, wayfinding is also a term used in user research and in the field of Human-Computer-Interaction which implies how information is presented and navigated within a system to achieve a goal. This kind of wayfinding is not covered in travel literature demonstrating a lack of understanding how the functional and aesthetic design of a journey planner facilitates the action of planning a journey (Garrett, 2002). This topic was introduced at the beginning of Chapter 7.

The second step was to establish exactly what role the actual travel information plays in supporting the traveller to plan a trip and to uncover its inherent structure. This step was separate

from establishing the traveller's information comprehension needs, as the previous research question was about the traveller's ability to understand and use travel information autonomously without intervention to understand their dependency on travel IT. This second step was to identify which types of travel information are of more value to the traveller when planning a trip and identify as part of dual wayfinding, which parts needed to have more prominence throughout the journey planning process to support comprehension. This was reported in Chapter 6.

The final step was to design a suitable summative usability evaluation to measure the performance of the selected journey planners that would also work in a triangulation format to ensure that the lessons learnt through self-insight were not overlooked a second time. This step also outlined the number of journey planners that would be feasible[68] within the remaining time limit of the research project. In this step three journey planners were selected that were relatable to the sample of travellers that were invited to participate and where possible, also represented the wider field of journey planners. The number of journey planners was a limitation in terms of the wider application of the findings, and the results could also be viewed as findings specific to Southampton journey planners. In actuality, one of the three selected journey planners was unique to Southampton and the other two, Google Maps and Traveline, were reflective of popular UK wide travel planning journey planners. This means that the scope of applicability is limited to UK wide public transport travel planning, despite the MyJourney planner being included in the study at the request of the key stakeholders. Furthermore, all three selected journey planners had equivalent features and functionality to assist the traveller plan a trip and their differences were mainly stylistic interpretations towards the provision and presentation of travel information.

The findings from the summative usability evaluation concluded that there was a present lack of design intent towards supporting traveller comprehension in favour of enabling access to specific types of travel information, a view consistent with the prior identified gap. In that evaluation, Google Maps seemingly showed strong signs for influencing conversion and information retention. However, the factor driving these findings was comprehension linked to familiarity and not the application of any one journey planner. The verbatim feedback confirmed that the participants responded favourably to Google Maps stylistic presentation of travel information because of it mimicking its natural structure, but remained dependent upon their familiarity to be successful. In response to the low overall conversion[69], other aspects of the journey planning

[68] Feasible in terms of length of study for the participants, and in terms of the amount of time it would take to process and conduct all the qualitative and quantitative analysis.
[69] Successfully planned trips.

activity were considered such as the participant's route-based scrutiny. This revealed that the participant's journey planning behaviour had a bias for confirmation, something contradictory with the present literature about the use of a journey planner (Esztergár-Kiss and Csiszár, 2015, Chorus et al., 2006a, Lyons et al., 2007). Descamps et al. (2018) suggest that reduced search-based activity by an individual, as a result of confirmation bias, is not an effective method for preparing the individual for the activity they are searching for information about. This means that there are strong concerns towards the journey planner's ability to prepare travellers for their trip because of their lack of hesitation and imperfect understanding of the payoffs of different choices (Oxera, 2018, Warner et al., 1973, Ajzen, 1991, Jones, 1998, Caiafa, 2010, Hansson, 1994) and later successful recall of important information (Fisher and Geiselman, 1992, Shepard, 1964, Shepard, 1974).

The outcome of this research question produced a clear understanding of the present performance capabilities of journey planners and their ability to satisfy the traveller's travel information comprehension dependencies based on their support for dual-wayfinding. It also showed that there is a reason to believe that a journey planner at present supports the information needs of familiar travellers to a large extent because of their strong habituation built knowledge and unfamiliar travellers to a limited extent because of their lack of experience.

9.7 The contribution

In response to the gap in knowledge and the outcomes of research questions one and two, the final step of the research plan was to consolidate the techniques of travel information presentation for a journey planner, accounting for all the fields that this thesis considered.[70] In Chapter 8, a clear and informative breakdown was produced identifying areas where journey planners could improve their ongoing travel planning support to a much wider selection of travellers, not limited to those that are familiar with their trip. To increase the ease of understanding these recommendations, and to reach the key stakeholders interested in improving their travel information technology, an informative animation accompanied these recommendations to adequately convey the importance of effectively meeting the travellers travel information needs. This animation may be found at http://www.cdt-sis.soton.ac.uk/research-community/.

[70] To be specific, public transport, psychology, information needs, and user experience (UX) design

Figure 9-1: Effective presentation of travel information animation[71]

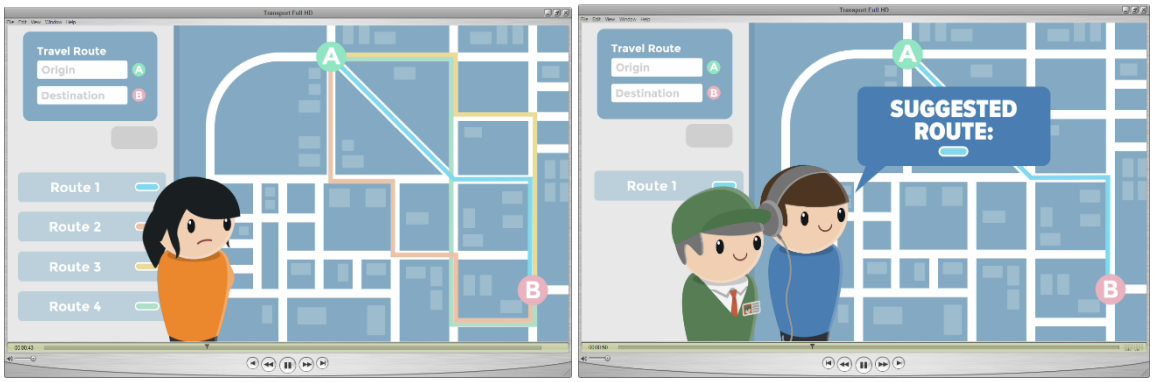


Figure 9-2: Example of animation flow – Unfamiliar traveller requiring route suggestions that a regular traveller or staff would be able to recommend.

Due to time constraints, the recommendations were not able to be tested and it is a limitation of the end outcome. It is recommended that A/B testing be used in this instance, as it enables the observation of difference in the end conversion rates from one design to another. Despite this limitation, the initial feedback regarding the contributions (the TPT framework, recommendations and informative animation) demonstrated that the target audience and stakeholder, in this case, Southampton City Council, responded favourably to the findings:

[71] Morph's animation project page: https://morph.co.uk/work/southampton-transport/
Centre for Doctoral Training (research page): http://www.cdt-sis.soton.ac.uk/research-community/

> ‘Amanda has produced some really significant and insightful research that will help us to shape how we go on develop the journey planner and online user experience for the My Journey sustainable travel brand and supporting website. This research will be used in conjunction with other insight work related to brand engagement and the ultimate experience we provide to our customers. The journey planner is vital in helping us to achieve travel behaviour change. In addition to the research, I found the animation particularly useful when sharing the findings with senior management and key stakeholders’.
>
> Marketing Coordination Manager – Sustainable Travel and Air Quality
>
> **Southampton City Council**

Southampton City Council’s feedback clearly shows that the aim of establishing the user experience (UX) as set out by the recommendations is valued, and indeed the key to the continued improvement of their online travel IT. Furthermore, the use of the informative animation enabled them to understand and share these insights with other colleague’s further fostering empathy for the traveller’s needs and organise future funding to enact on the identified recommendations.

9.8 Other general limitations

Beyond what has already been discussed, this study had other limitations; which were;

- Potential participant/expert recruitment insufficiencies to represent both the regular and infrequent public transport users adequately.

Participants that have a stronger relationship or interest in public transport may have been more willing to participate in public transport related studies than those that rarely use public transport limiting a balanced view of opinions. To address this limitation, key areas of the research plan specifically planned to recruit, select or invite travellers/experts based on other factors, like location or experience, to widen the scope. In addition, the final experiment directly controlled this by setting the unfamiliar journey enabling any traveller to participate and offer their views when planning an unfamiliar trip.

- Researcher/reader bias.

As with any travel-related research, the researcher conducting the research is subconsciously biased towards a particular outcome because of their relationship with public transport, a pattern that is also likely for any person who reads this thesis. Similarly, other forms of bias may exist linking to the researchers own processing skills and/or abilities. In this case, it is possible that the research was skewed in favour of the unfamiliar or infrequent traveller as this is descriptive of the researcher’s travel profile. Similarly, there may have been certain bias towards information processing, contextual learning and routine-based anxiety issues. That being said, even if personal

bias was a limitation, in this case, the researcher's travel profile is certainly not remarkable or unique in comparison with other travellers of similar skills, abilities or patterns. This is an acknowledgement of the fact that these biases may have limited the end outcomes. To address this limitation, and indeed any other form of bias, the research methodology consisted of more than one method, e.g. a triangulation study or alternative views from peers and the target populations, such as experts in the field and travellers.

- Prior knowledge of the field of study

Another limitation is what was known by the researcher at key decision points in the process. As the researcher's background was in business software development a lot of the concepts discussed in this thesis were completely new. Therefore, certain methodological decisions were based on the lessons learnt through trial and error and guidance from literature. In hindsight, the use of the mixed-methods triangulation was the most appropriate means of addressing the complex overlap of concepts and research topics and produced practical outcomes that are valuable to the key stakeholders of the research.

- Time and resources

Another constraint was the limit on time and resources as the mixed methods approach is a lengthy and time-consuming process. During this study a lot of fresh analysis was done on existing sources (e.g. the focus group transcripts), managing multi-round methods (e.g. the Delphi) and over 51 hours of data from videos, transcripts and surveys produced from the summative usability evaluation. All of the planning, design, approval, moderation and analysis was conducted predominately by the researcher. There was initial support during the intercept study and the use of transcribing services for the summative usability evaluation. This had been identified as a part that slowed down the process of the Delphi results because this was all transcribed by the researcher. Therefore, many of these factors limited the number of participants that could be recruited forcing the studies to use the minimum sample sizes needed to conduct research of this type. This also affected the number of journey planners that could be included in the final experiment.

9.9 Future work

Some identified opportunities for further work include;

- The final experiment, HCI trial of information distribution methods, focused primarily on the use of travel information in pre-trip journey planning. Therefore, the bottom segments of the Traveller Planning Type (TPT) framework was not investigated. It is

recommended that two further studies be considered to account for those stages of information use,

- Transition planning – it is recommended that this study focus on the sufficiency of information travellers obtain during pre-trip journey planning. One potential way to structure this would be to ask the traveller to conduct a diary study and capture both their familiar and unfamiliar trips with questions that express how well information needs were met in the transition.
- In-trip journey planning – it is recommended that this study focus more on the traveller's effective wayfinding abilities when in the transit environment. It would be recommended that a safari type survey is used where the researcher: accompanies the traveller on one familiar trip and one unfamiliar trip; observes the travellers interactions with the system; monitors the information they obtained pre-trip (if any) and available in transit information that supports the successful navigation. In this case, it is recommended that the traveller review the 2009 Customer Touchpoints Typology produced by Transport for London that employed a similar approach.
- In addition to this, the subject of what information, in itself, should deliver for the familiar and unfamiliar traveller could be further explored regarding its prominence in nudging choice as the freedom to choose is made possible to both the frequent and infrequent traveller.
- This study has not focused on the impacts of demographics to a great extent and considers predominately the general and able users and certain travel information needs can and will differ by demographics. Therefore, it is recommended that this is further explored, in this case, it is recommended that the researcher consider the Caiafa's thesis to understand how to apply set demographic evaluations to studies linking to public transport unfamiliarity.
- Finally, it would be useful for other domains interested in supporting the information needs of their consumers to consider bringing attention back to the fourth rule of citizenship and identifying where individuals information needs could be met in light of subject familiarity, as the concerns expressed in this thesis are not specifically exclusive to transport related information needs.

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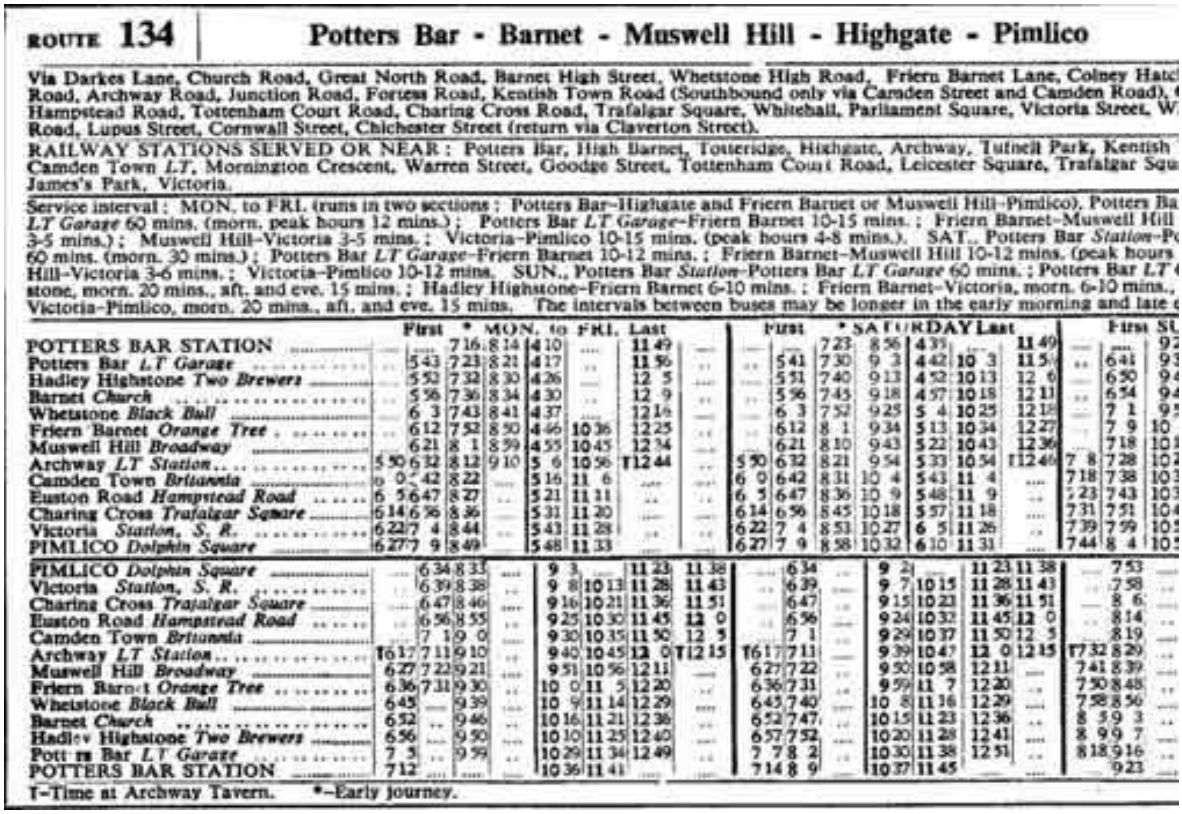
APPENDIX A: SUPPORTIVE IMAGES



ROUTE 134 | Potters Bar - Barnet - Muswell Hill - Highgate - Pimlico

Via Darkes Lane, Church Road, Great North Road, Barnet High Street, Whetstone High Road, Friern Barnet Lane, Colney Hatch Road, Archway Road, Junction Road, Fortess Road, Kentish Town Road (Southbound only via Camden Street and Camden Road), Hampstead Road, Tottenham Court Road, Charing Cross Road, Trafalgar Square, Whitehall, Parliament Square, Victoria Street, Wilton Road, Lupus Street, Cornwall Street, Chichester Street (return via Claverton Street).

RAILWAY STATIONS SERVED OR NEAR: Potters Bar, High Barnet, Totteridge, Highgate, Archway, Tufnell Park, Kentish Town, Camden Town *LT*, Mornington Crescent, Warren Street, Goodge Street, Tottenham Court Road, Leicester Square, Trafalgar Square, St. James's Park, Victoria.

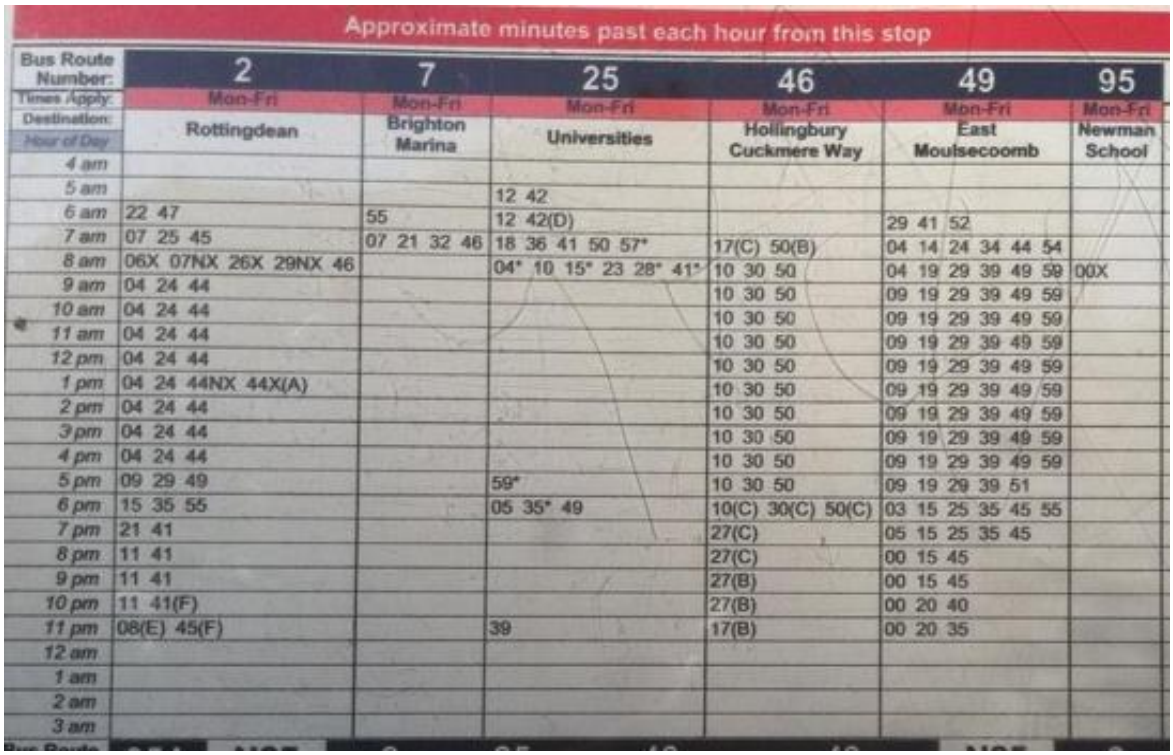
Service interval: MON. to FRI. (runs in two sections: Potters Bar–Highgate and Friern Barnet or Muswell Hill–Pimlico). Potters Bar *LT Garage* 60 mins. (morn. peak hours 12 mins.); Potters Bar *LT Garage*–Friern Barnet 10-15 mins.; Friern Barnet–Muswell Hill 3-5 mins.); Muswell Hill–Victoria 3-5 mins.; Victoria–Pimlico 10-15 mins. (peak hours 4-8 mins.). SAT., Potters Bar *Station*–Potters Bar *LT Garage* 60 mins. (morn. 30 mins.); Potters Bar *LT Garage*–Friern Barnet 10-12 mins.; Friern Barnet–Muswell Hill 10-12 mins. (peak hours Muswell Hill–Victoria 3-6 mins.; Victoria–Pimlico 10-12 mins. SUN., Potters Bar *Station*–Potters Bar *LT Garage* 60 mins.; Potters Bar *LT* Highstone, morn. 20 mins., aft. and eve. 15 mins.; Hadley Highstone–Friern Barnet 6-10 mins.; Friern Barnet–Victoria, morn. 6-10 mins., Victoria–Pimlico, morn. 20 mins., aft. and eve. 15 mins. The intervals between buses may be longer in the early morning and late e

	First	* MON. to FRI.				Last		First	* SATURDAY				Last		First	SU
POTTERS BAR STATION	...	...	7 16	8 14	4 10	...	11 49	...	...	...	7 23	8 56	4 39	...	11 49	...	...	9 2
Potters Bar *LT Garage*	...	5 43	7 23	8 21	4 17	..	11 56	..	..	5 41	7 30	9 3	4 42	10 3	11 56	..	6 41	9 3
Hadley Highstone *Two Brewers*	...	5 52	7 32	8 30	4 26	...	12 5	....	...	5 51	7 40	9 13	4 52	10 13	12 6	...	6 50	9 4
Barnet *Church*	...	5 56	7 36	8 34	4 30	..	12 9	..	...	5 56	7 45	9 18	4 57	10 18	12 11	..	6 54	9 4
Whetstone *Black Bull*	...	6 3	7 43	8 41	4 37	...	12 16	..	...	6 3	7 52	9 25	5 4	10 25	12 18	...	7 1	9 5
Friern Barnet *Orange Tree*	...	6 12	7 52	8 50	4 46	10 36	12 25	..	...	6 12	8 1	9 34	5 13	10 34	12 27	...	7 9	10
Muswell Hill *Broadway*	...	6 21	8 1	8 59	4 55	10 45	12 34	..	...	6 21	8 10	9 43	5 22	10 43	12 36	...	7 18	10 1
Archway *LT Station*	5 50	6 32	8 12	9 10	5 6	10 56	T12 44	..	5 50	6 32	8 21	9 54	5 33	10 54	T12 46	7 8	7 28	10 2
Camden Town *Britannia*	6 0	6 42	8 22	...	5 16	11 6	....	..	6 0	6 42	8 31	10 4	5 43	11 4	....	7 18	7 38	10 3
Euston Road *Hampstead Road*	6 5	6 47	8 27	...	5 21	11 11	..	..	6 5	6 47	8 36	10 9	5 48	11 9	....	7 23	7 43	10 3
Charing Cross *Trafalgar Square*	6 14	6 56	8 36	...	5 31	11 20	....	....	6 14	6 56	8 45	10 18	5 57	11 18	....	7 31	7 51	10 4
Victoria *Station, S. R.*	6 22	7 4	8 44	...	5 43	11 28	..	..	6 22	7 4	8 53	10 27	6 5	11 26	..	7 39	7 59	10 5
PIMLICO *Dolphin Square*	6 27	7 9	8 49	...	5 48	11 33	....	....	6 27	7 9	8 58	10 32	6 10	11 31	....	7 44	8 4	10 5

PIMLICO *Dolphin Square*	...	6 34	8 33	....	9 3	...	11 23	11 38	....	6 34	...	9 2	...	11 23	11 38	....	7 53	...
Victoria *Station, S. R.*	..	6 39	8 38	..	9 8	10 13	11 28	11 43	..	6 39	..	9 7	10 15	11 28	11 43	..	7 58	..
Charing Cross *Trafalgar Square*	....	6 47	8 46	....	9 16	10 21	11 36	11 51	....	6 47	....	9 15	10 23	11 36	11 51	....	8 6	....
Euston Road *Hampstead Road*	..	6 56	8 55	..	9 25	10 30	11 45	12 0	..	6 56	..	9 24	10 32	11 45	12 0	..	8 14	..
Camden Town *Britannia*	....	7 1	9 0	....	9 30	10 35	11 50	12 5	....	7 1	....	9 29	10 37	11 50	12 5	....	8 19	....
Archway *LT Station*	T6 17	7 11	9 10	..	9 40	10 45	12 0	T12 15	T6 17	7 11	....	9 39	10 47	12 0	12 15	T7 32	8 29	...
Muswell Hill *Broadway*	6 27	7 22	9 21	....	9 51	10 56	12 11	....	6 27	7 22	..	9 50	10 58	12 11	....	7 41	8 39	....
Friern Barnet *Orange Tree*	6 36	7 31	9 30	..	10 0	11 5	12 20	....	6 36	7 31	..	9 59	11 7	12 20	..	7 50	8 48	..
Whetstone *Black Bull*	6 45	...	9 39	....	10 9	11 14	12 29	....	6 45	7 40	..	10 8	11 16	12 29	....	7 58	8 56	....
Barnet *Church*	6 52	..	9 46	..	10 16	11 21	12 36	..	6 52	7 47	..	10 15	11 23	12 36	..	8 5	9 3	..
Hadley Highstone *Two Brewers*	6 56	...	9 50	....	10 10	11 25	12 40	....	6 57	7 52	....	10 20	11 28	12 41	....	8 9	9 7	....
Potters Bar *LT Garage*	7 3	..	9 59	..	10 29	11 34	12 49	..	7 7	8 2	..	10 30	11 38	12 51	..	8 18	9 16	..
POTTERS BAR STATION	7 12	...	...	...	10 36	11 41	....	....	7 14	8 9	...	10 37	11 45	...	....	...	9 23	...

†–Time at Archway Tavern. *–Early journey.

Appendix A - 1: London Bus Timetable (1958)

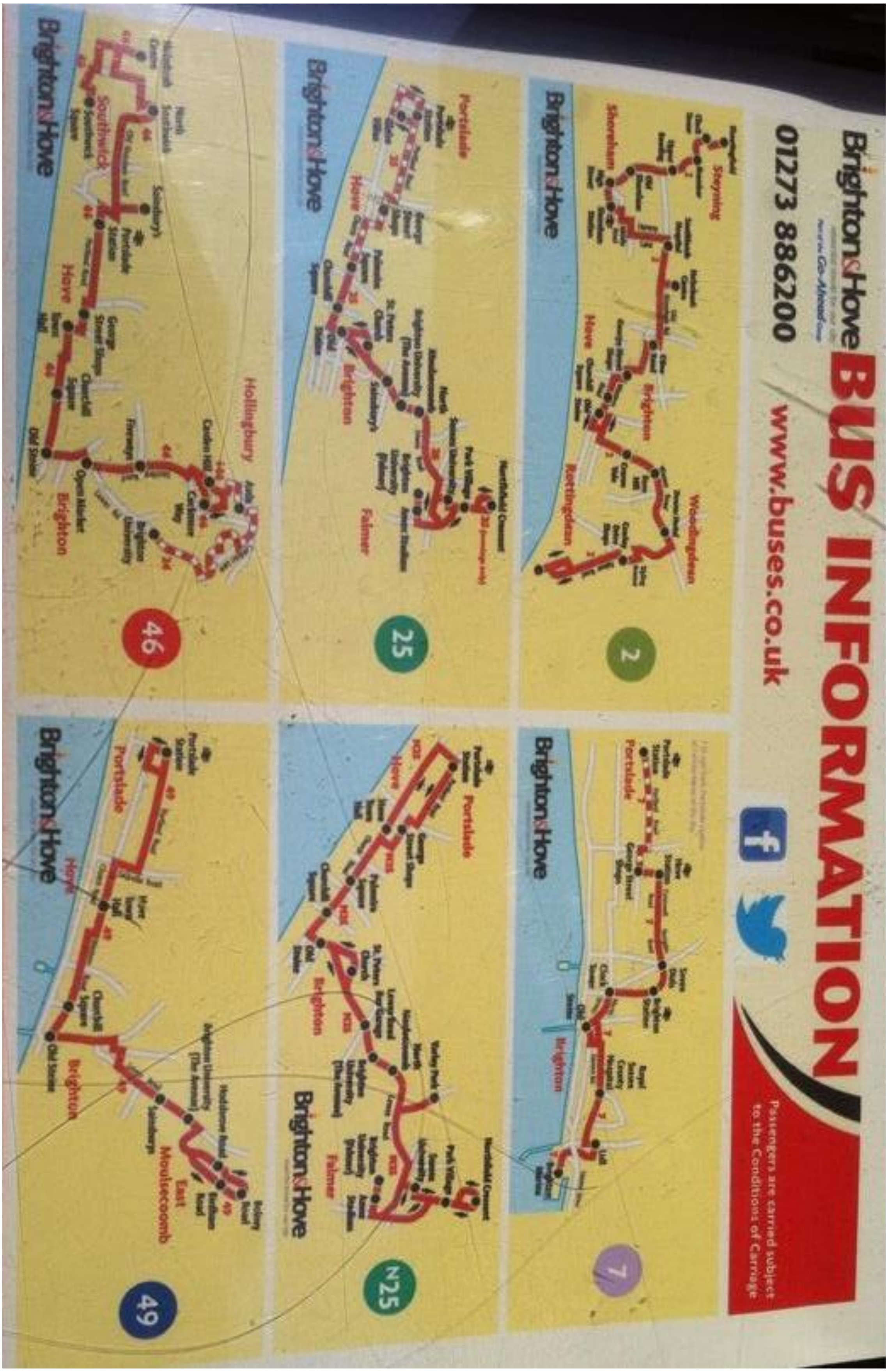


Approximate minutes past each hour from this stop

Bus Route Number:	2	7	25	46	49	95
Times Apply:	Mon-Fri	Mon-Fri	Mon-Fri	Mon-Fri	Mon-Fri	Mon-Fri
Destination:	Rottingdean	Brighton Marina	Universities	Hollingbury Cuckmere Way	East Moulsecoomb	Newman School
Hour of Day						
4 am						
5 am			12 42			
6 am	22 47	55	12 42(D)		29 41 52	
7 am	07 25 45	07 21 32 46	18 36 41 50 57*	17(C) 50(B)	04 14 24 34 44 54	
8 am	06X 07NX 26X 29NX 46		04* 10 15* 23 28* 41*	10 30 50	04 19 29 39 49 59	00X
9 am	04 24 44			10 30 50	09 19 29 39 49 59	
10 am	04 24 44			10 30 50	09 19 29 39 49 59	
11 am	04 24 44			10 30 50	09 19 29 39 49 59	
12 pm	04 24 44			10 30 50	09 19 29 39 49 59	
1 pm	04 24 44NX 44X(A)			10 30 50	09 19 29 39 49 59	
2 pm	04 24 44			10 30 50	09 19 29 39 49 59	
3 pm	04 24 44			10 30 50	09 19 29 39 49 59	
4 pm	04 24 44			10 30 50	09 19 29 39 49 59	
5 pm	09 29 49		59*	10 30 50	09 19 29 39 51	
6 pm	15 35 55		05 35* 49	10(C) 30(C) 50(C)	03 15 25 35 45 55	
7 pm	21 41			27(C)	05 15 25 35 45	
8 pm	11 41			27(C)	00 15 45	
9 pm	11 41			27(B)	00 15 45	
10 pm	11 41(F)			27(B)	00 20 40	
11 pm	08(E) 45(F)		39	17(B)	00 20 35	
12 am						
1 am						
2 am						
3 am						

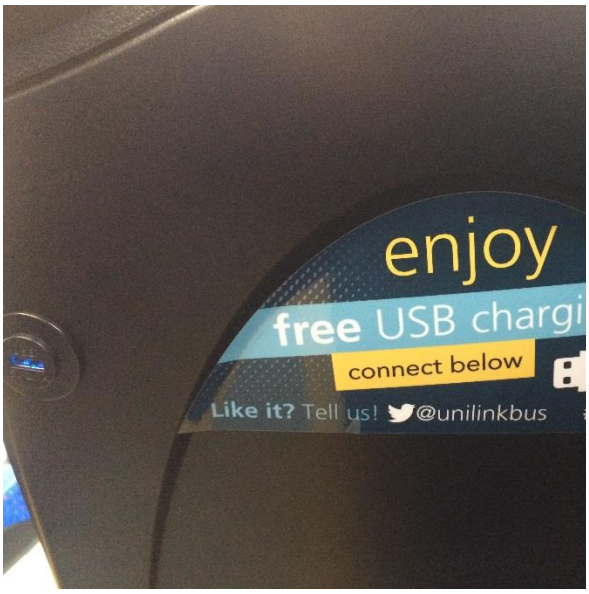
Appendix A - 2: Brighton and Hove bus stop information: timetable (2017)

Appendix A - 3: Brighton and Hove bus stop information: prices (2015)



Appendix A - 4: Brighton and Hove bus stop information: service route maps

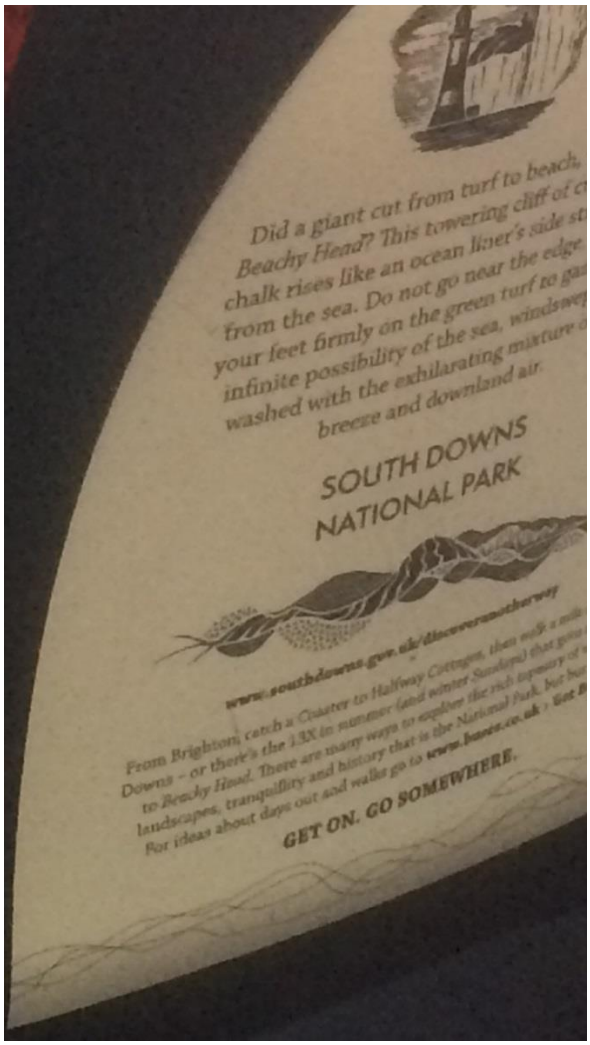
Appendix A - 5: Contextual review – Melee of rail passengers when service disruption occurs, and information provision dissolves.



Appendix A - 6: General observations – Unilink offering free USB charging (2016)

Appendix A - 7: General observation - Get on and go somewhere campaign – timetable advertisement (2016)

Appendix A - 8: General observation– Ticket printing changes, legibility problems (2016)



Appendix A - 9: General observation - Get on and go somewhere campaign – seat advertisement (2016)

The printing of the ticket information is illegible in places. E.g. what should read as Southampton Central reads as Southampton Lentral. There is plenty of space on the ticket to improve quality of information.

Appendix A - 10: General Observation: In-journey Variations (2016)

Services arriving at this stop could not alight safely as this vehicle blocked the bus stop. Services had to stop further away from the intended location causing travellers confusion as to how to board / stop an arriving service to board.

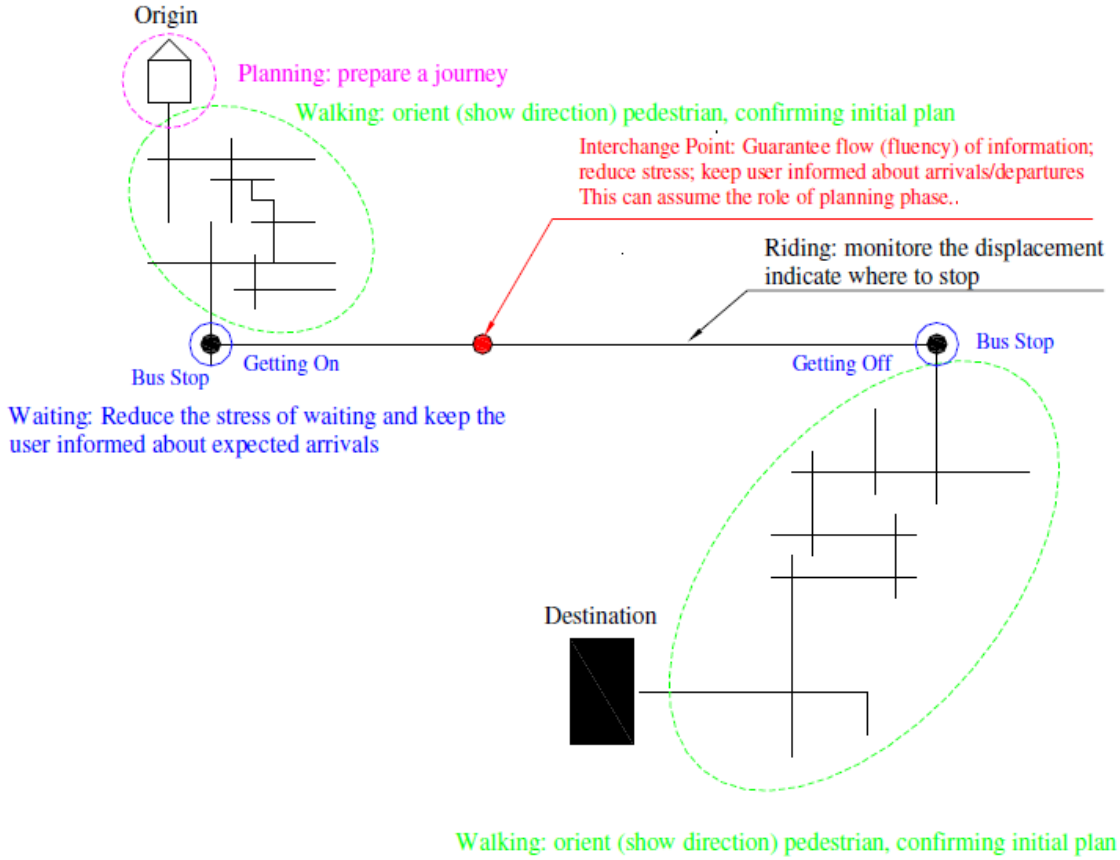
Appendix A - 11: Information Provision At-Stop Regarding Stop Closure, Observed 22/10/2014

The signage assumed that the traveller is familiar with the local area enough to find Westpark Road. What you cannot see in this image, is that inside the bus shelter a small real-time arrivals/departure board is still showing services as if they will arrive at this stopping point.

APPENDIX B: STAGES OF TRAVEL INFORMATION USE

Appendix C presents a review of the traveller's motivations relating to travel information consumption based on the stage the traveller seeks information (pre-trip/in-trip). And links to a similar analysis profile as Chapter 4.

The stages of information use



Appendix B - 1: Information chain in in-trip journey planning (Caiafa, 2010)

In Chapter 2, the stages of information use was explored and discussed in relation to the types of travel information sources that are available to the traveller as they plan a trip. This literature led to a series of specific keyword terms for the travellers' behaviour for pre-trip travel information use was produced;

- An individual who will '**seek**' out relevant travel information,
- Will be able to obtain '**static**' estimated travel information,
- Will use that information to '**evaluate/compare**' their travel options, and
- The process of seeking and evaluating travel information is defined by the individuals personal and journey '**preferences**'.

In addition to this, a set of similar keyword terms for the travellers in-trip travel information use was produced;

- An individual who is '**focused**' and '**journey driven**',
- Will be able to obtain '**dynamic**' real-time travel information,
- Will use that information to '**react to**' travel circumstances, and
- Will use that information to '**check**' journey progress and if needed will '**re-plan**' their journey in-trip.

Stage 2: Exploring the stages of information use

These keyword terms were put through the same triangulation process using the focus group transcripts and contextual review, where relevant.

Pre-trip travel information use 'descriptive terms'

The contextual review, a part of the triangulation, was not able to convey the intentions behind the observed behaviour because of the nature of that method observing behaviour as it would naturally occur without interference. Similarly, certain aspects of the other triangulation sources, the contextual review and focus group transcripts, were limited and not able to expose the extent of this stage of information use fully. To address this difficulty any findings from either of these sources would be interpreted using the knowledge obtained during the literature review aspect of the triangulation. For example, an observed behaviour during the contextual review in cases where service disruption occurred revealed that travellers would seek support from surrounding staff and travellers. The interpretative difficulty, in this case, was the basis for the traveller's enquiry, and whether it was a result of personal knowledge or learned knowledge gained through pre-trip information use. It could be assumed that the information that the traveller used to describe their travel concerns indicate that the traveller is operating using learnt knowledge rather than personal knowledge obtained through exposure and experience as the traveller is approaching an alternative information source for assistance. In essence, indicating that the traveller was unable to regenerate relevant personal knowledge to address the issue or handle that journey autonomously (Ishikawa and Montello, 2006). Alternatively, it can also reveal that the traveller's personal knowledge and/or pre-trip information gathering was insufficient and therefore, unable to help the traveller deal with the emerging disruptions. Thus, confirming that the traveller's pre-trip use of travel information was insufficient or non-existent if there was a reliance on personal experience (Transport for London, 2009). There is more reason to believe that this is the case when the traveller could not communicate their concern, demonstrated a lack of understanding or portrayed a sense of uncertainty about travel decisions as they conversed

with an available traveller or staff member (Hochmair, 2005). This observation itself confirms the findings in Chapter 4, which suggested that travellers with a lack of personal knowledge, or familiarity, have a reliance on external information sources in-trip to address the insufficiencies in pre-trip information gathering and understanding. It is reasonable to deduce that if insufficiencies exist in traveller's knowledge or information gathering, then pre-trip information use is more likely linked to confirming/testing route possibilities and assumptions rather than to fully understanding all the travel information available relevant to the journey. The focus group transcripts confirmed that travellers do indeed fixate on their beliefs and experiences towards service provision which supports this assertion, see Appendix B - 2.

Appendix B - 2: Extracts from focus group sessions linked to travellers awareness

Verbatim Commentary	Tagged NVIVO codes
"It's a busy area that I live in."	Awareness - service provision
Another issue is we've got one bus driver won't let too many people on, you know, to get too packed, but then you've got another driver that will get it so packed that you can't breathe."	Awareness - service provision
"I was in London for the day, and when I got back to Havant Station, which is my nearest station", "I live on a very good bus route. I only live about five - seven, minutes from a bus stop so it's quite easy."	Awareness - service provision
"It was about 9 o'clock, and at that time the buses are once hourly.	Awareness - service provision
"That's part of my bugbear I think, and they do turn up – I know the sequence now: a 23, another one, then the 7, then the 2, and so I know when my bus is going to come along and nine times out of ten you get two turn up at the same time. It's the same old story."	Awareness - service provision

Similarly, Appendix B - 2 reveals that the traveller's preferences directed information use and interpretation. Further confirming that pre-trip information use is exploratory and confirmatory and not necessarily an in-depth activity, see Appendix B - 3 and Appendix B - 4 which shows that habitual and non-habitual travellers focus on travel information based on factors that matter to them or their journey.

Appendix B - 3: Extracts from focus group sessions with infrequent users of public transport.

Verbatim Commentary	Tagged NVIVO codes
"I've got two children" … "with the buggy."	Space, provision
Another issue is we've got one bus driver won't let too many people on, you know, to get too packed, but then you've got another driver that will get it so packed that you can't breathe."	Crowding, seating
"My chief issues is the cost of the fares, where the fares have got so dear now, that's one issue.	Cost
"It was about 9 o'clock, and at that time the buses are once hourly. And I mean really, you know, I'm just, this one… Was I going to wait until you know sort of 45 minutes, 50 minutes, for the next bus at five past ten?"	Time

Appendix B - 4: Extracts from focus group sessions with frequent users of public transport.

Verbatim Commentary	Tagged NVIVO codes
"Judge my distances."	Distance
"Judge it on the weather as well – if it's pouring with rain then I'll use the bus."	Weather
"I live on a very good bus route. I only live about five - seven minutes from a bus stop, so it's quite easy."	Reliability
"But if I catch the one that goes the long way round it actually stops on the right side of the road for me. So depending on how much time I've got, sometimes I'll 'Oh, there's the number 1 down there; I've got enough time I'll go for it, a few minutes more what difference does I make?'"	Time, Familiarity
"I've been at a bus stop, and there's been someone in a wheelchair and someone with buggies and on a number 2 – because I use the number 2 every day - and the driver because of the style of bus, as you say, because there are steps, or they can't lower the plate, he's actually had to turn around and say 'You have to wait for the next one because we can't get you on here'. But absolutely with space as well; there isn't much space on a number 2."	Provision

As expected, the views captured in the above tables demonstrate that a traveller's travel information preferences link to personal, and journey needs such as finance, time, route details, provision and comfort. However, the traveller's views also reveal that they focus on other issues such as availability, accessibility, consistency and reliability. These views show that travellers require the ability to evaluate and compare route possibilities because of their focus on these

specific travel information needs. Therefore, it is clear that the pre-trip journey planning traveller requires the ability to process travel information logically to make decisions and commit to travelling that journey (Transport for London, 2009). The focus group transcripts uncovered examples of travellers that pre-trip journey plan in greater depth because of the enjoyment found in accepting the challenge to find the best route possible for their journey, despite the earlier assertion that pre-trip journey planning is not in-depth. For example, Focus Group: Portsmouth Travellers Session, Frequent Traveller Session, Female stated:

> 'I spend a lot of time just looking at information. I don't really use what's on my phone because I still prefer the paper timetables. I'll spend hours just looking through timetables and looking at the transport maps. I think that's just part of the fun for me, actually going somewhere; it's the planning'.

According to Transport for London's Customer Touchpoint Typology, this type of traveller is described as a system master who takes pride in their acquired knowledge and approaches pre-trip journey planning as if it were 'a challenge rather than a chore' (Transport for London, 2009). It is clear that there are many different approaches to pre-trip information use, despite the level of travel information that a traveller uses and processes remaining unclear. Therefore, pre-trip journey planning is a personal activity and one in which the traveller will do based on their ability and willingness to do so, see Chapter 4.

Overall, the subjective sources (contextual review and focus groups) were not in disagreement with the previous findings, and so, the specific keyword terms were converted into a specific description to personify the travellers that do conduct pre-trip journey planning.

Appendix B - 5: Pre-trip journey planning definition (conceptual)

Planning before a journey
Is a **seeker** of **static** travel information and will use various methods to **compare** and **evaluate** that information, typically through a journey planner. The traveller's **preferences drive** what sort of the information they need and its ability to meet the journey needs.

In-trip travel information use 'descriptive terms'

The other triangulation sources, and in particular the contextual review, was able to observe in greater detail the stability and accuracy of in-trip travel information such as real-time departure boards, announcements and available staff knowledge. An insight that is notably lacking in literature because of the focus on attitudinal survey methods (Balcombe et al., 2004). During the observation period, these methods of delivering travel information were shown to drop arriving services when they were late, announcements where inconsistent with the in-trip service provision and available staff lacked relevant knowledge, see Appendix B - 6.

Appendix B - 6: Extracts from Contextual Review

Date	Contextual Enquiry Observation	Tagged NVIVO Notes
29th November 2013 (AM)	U1a was 5mins late, real-time departure board stopped displaying its arrival. Traveller's spoke with other travellers, enquiry was whether the traveller missed that service or, if it arrived earlier than scheduled.	Real-time, departure board, Inaccuracies.
3rd December 2013 (AM)	Another bus driver boarded temporarily to speak with the driver of this bus. Query regarding Itchen bridge improvements and what this driver knew about it. The outbound route was diverted, but nothing was said of the inbound route. It is clear that the drivers were not given full information by their supervisors which is also how the drivers described it. These road works have been in action for a month prior to the recorded date of observation. The conversation ended with the drivers concluding that at the end of their next route they would call the depot.	Staff, Unclear Information.
3rd December 2013 (PM)	17:33 Southern service to Brighton – automated announcement incorrect, announcing next stop as Cosham, not Fareham. Some passengers, vocalised to train crew in carriage if this was correct, a staff member made a new announcement to correct the automated announcement.	Announcements, Unclear information.

Information offered in-trip, accurate to the in-trip situation, can enable travellers who lack the necessary skills to react autonomously to emerging travel situations, and also support travellers that did not pre-trip journey plan their trip sufficiently. However, the traveller's travel expectations, formed on their lack of understanding of what to expect in-trip, are the first to struggle with emerging in-trip alterations. The traveller's lack of understanding this case could have come from the use of estimated information pre-trip, which is not necessarily an accurate reflection of in-trip service provision. The examples described in Appendix B - 6 show that when travel information sources in-trip is inaccurate, it will require the traveller to adopt a process of 'checking' and 're-checking' available travel information to address how the changes affect the journey and potentially force an impromptu 're-plan'. One of the stated examples, the 17:33 Southern service to Brighton, demonstrated that the way operators modify services to handle in-trip service issues also reflects the reasons why estimated information that assumes normal service cannot accurately explain how operators choose to handle in-trip disruptions. Therefore, the pre-trip traveller entering into the in-trip environment is primed with a lack of knowledge about realistic service provision unless they have had prior exposure to the operators operating

procedures in service disruption. It is important to note that in-trip information is more flexible than pre-trip information. Therefore, the traveller has to accept some of the responsibility for managing minor and significant information alterations in-trip (Filippi et al., 2013). Consequently, the unfamiliar travellers are the least able to take that responsibility, and thus, presents a barrier to attracting the non-habitual traveller into public transport (Transport for London, 2009). In addition to this, the traveller's ability to make adjustments to their journey, to incorporate flexibility, is linked to the traveller's journey needs and whether that particular journey can accept in-trip variability (Tirachini and Hensher, 2011, Tirachini et al., 2014, Chorus et al., 2006c, Bottom et al., 2002, Golledge, 2002, Lappin and Bottom, 2001, Lyons, 2006, TCRP, 2003, Todd, 2007, Vipre, 2006, Bovy and Stern, 1990). One of the stated examples, the U1A Unlink service dropping from real-time departure boards after being five minutes late, shows that in this situation travellers felt the need to approach other travellers to gather more information about that particular services. The traveller's enquiry may have indicated that there were additional journey considerations, such as being time-poor or have a need for reliable information to maintain their confidence. Further evidencing that the traveller is journey driven, and needs to address the issue, a late-running service, to ensure they make their journey successfully. It is important to note that another fundamental difference between pre-trip and in-trip information use is that the in-trip traveller is in effect between their origin and desired destination, and a failure to complete the journey is more relevant to the in-trip traveller (Spitadakis and Fostieri, 2012). Thus, the prior keyword terms 'journey driven' and being 'focused' on the task of successfully navigating the in-trip environment communicate the motivations for their information use effectively. Therefore, one would also expect that when information fails to satisfy a traveller's desire to complete their journey successfully, will result in intense emotional responses in-trip and a negative example of public transport use when pre-trip journey planning that may negatively influence continued public transport use (Fisher and Geiselman, 1992). To emphases this point further, see Appendix B - 7 for a walkthrough of one example where in-trip decisions were affected by inaccurate in-trip travel information.

Appendix B - 7: Extracts from Contextual Review

Date	Contextual Enquiry Observation	Tagged NVIVO Codes
6th December (PM)	At 18:03, purchased a southern ticket, passed barriers, found out that this service was delayed by 10mins. No announcements made and the National Rail app was incorrect even though the delay existed at the time of checking departure times at arrival to the station via the app. An alternative provider South West Trains was running to schedule, however, as I was in possession of Southern only ticket I was unable to board alternative services. 30mins after my arrival, announcements with platform alterations were made regarding the 18:10 service, no reason was given for the delay. The next timetabled Southern was at 19:14. Considered getting an alternative ticket, but unable to pass barriers to get an alternative ticket, couldn't be sure that I would be allowed past. Commuters statements, in a similar position to me include "it is messed up", "to complain" or raise a complaint.	operator ticketing, in-trip information, Unclear information, lack of explanation, in-trip delay
	19:14 arrives, boarded, on-board announcement suggests it will skip stops inc. Swanwick, Cosham and Havant. Six people exit, with vocal annoyance (unrepeatable), shortly after another on-board announcement was made and suggested an alternative service and platform, despite the passengers it relates to previously exiting the train after the first announcement.	Lack of explanation
	Passenger discusses the issue with staff on-board, staff indicated Southern and South West Trains have different policies. Staff said "Southern prefer to arrange things so that trains run to timetable. I can't say for certain that missing the three stations will provide that, but Southern believe so". … "if they can't keep to timetable then they won't operate."	Operator policies

The example described in Appendix B - 7 shows that on this occasion, that information offered by a mobile app was not an accurate reflection of actual in-trip service provision. Due to the travellers focus on the journey, they make journey related travel decisions using the information that they have available to them at the time they make their decision (Loomes and Sugden, 1982). As was the case for the researcher conducting the contextual review. As a consequence of poor decisions made from incorrect travel information, travellers had to adjust to the real in-trip situation and

then react accordingly. However, the choices that they previously made can restrict the number of options, if any, that are open to the traveller when the need to react to the real in-trip situation. Similarly, the traveller's ability to react appropriately was limited in the example because of the level, time and quality of travel information available to them in-trip. For example, Appendix B - 7 shows that there was a delay of 30 minutes before an announcement about the late running service was made, in effect stating that travellers needed the latter timetabled 19:14[71] Southern service because of the cancellation of the earlier 18:10 service. Before this announcement, travellers vocalised their frustration at the lack of clear guidance from typical in-trip information methods, instead, turning to other travellers in the same situation. Some travellers revealed that they were more informed about the delay, or aware of typical in-trip provision during that time of day and choose ticket types that allowed them to board alternative operators that were running as expected. However, as was proven to be the case for many travellers in this example, they had no means of resolving the issue which meant that they were forced to accept the changes as they happen as well as the consequences of the delay to their journey. In regards to the timing of in-trip travel information, Appendix B - 7 reveals that this is not always well timed. As the travellers were reliant on announcements to communicate travel information[72] one would assume that each announcement would be well thought out, appropriately targeted and offer relevant information to travellers. However, as observed, announcements communicated piecemeal travel information making it hard to communicate relevant information effectively. The first on-board announcement stated a change to the service structure and was not well received by travellers because of their 'journey driven' focus, facing a second in-trip variance. The second on-board announcement offered more comprehensive information about a train that could serve the missing stops, which was for the benefit of travellers who missed the first announcement. However, the travellers that also needed that information had already vacated the train and were awaiting the same information on the platform.

Overall, the subjective sources were not in disagreement with the previous findings, and so, the specific keyword terms were converted into a specific description to personify the travellers that do conduct in-trip journey planning.

[71] In reality, the delayed 18:10 service became the expected 19:14 service.

[72] Due to the breakdown of tech-based travel information which is unable to, in real-time, reflect rapid changes to the in-trip service provision

Appendix B - 8: In-trip journey planning definition (conceptual)

Planning during a journey
A traveller who is in transit will be **focused** on their specific destination whether that be for work / leisure or other activity (**journey driven**). They **react** to incoming real-time and **dynamic** information using that to **check** and **re-plan** their journey ensuring that they get where they want to be.

Stage 3: Delphi Feedback

These keyword terms and definitions were put through the same Delphi Study as described in Chapter 4.

Review of: Pre-trip travel information stage

To confirm the validity of the keyword terms and overall description for the pre-trip journey planning traveller a Delphi study was conducted with experts to evaluate their relevance. The reader is referred to Chapter 3, Section 3.2.2 for a more detailed explanation of the format of this particular Delphi study. In summary, a panel of public transport providers and policy makers was asked to complete a questionnaire surrounding the keyword terms and descriptions for the traveller's familiarity and stages of information use. Over the course of three rounds, they would rate the accuracy of these terms using a Likert scale. During the first round, 13 panellists gave their opinions regarding the pre-trip journey planning traveller as described in this chapter. The results indicated that the panellists had difficulty in interpreting the set keyword terms for the pre-trip journey planning traveller because of specific terminology, e.g. 'static' because of not fully understanding what this means. Similarly, panellists felt that some keywords referred to the same action, e.g. evaluate and compare. See Appendix B - 9 for the ratings and keyword suggestions made by the panellists.

Appendix B - 9: Pre-trip (key terms)

	Static	Seeker	Evaluator	Comparer	Preference driven
Strongly agree	0	1	0	0	1
Agree	5	10	11	11	12
Neutral	1	2	2	2	0
Disagree	7	0	0	0	0
Strongly disagree	0	0	0	0	0

Recommended alternatives

Scheduled **Timetabled**	**Active seeker**	**Refers to the same context**	No new recommendations

One contribution that panellists made was the impact of time in pre-trip journey planning and when exactly a person 'pre-trip' plans their journey. Some panellists revealed that they were

thinking of travellers planning with a significant amount of lead time before actual travel. Whereas, other panellists revealed that they were thinking of travellers who sought information for an imminent journey, e.g. on the same day of travel or before departure. There is a difference between these two types of pre-trip journey planning as the 'imminent' planner has access to live travel information which the 'advanced' planner does not, see Chapter 2. In some ways, the 'imminent' planner is likely to respond in a similar way to the 'in-trip' wayside planning traveller because of their interest in confirming the route and departure or journey times (Grotenhuis et al., 2007). Furthermore, this can indicate that some pre-trip planning travellers seek 'imminent' information about a journey to reduce their waiting time further emphasising the influence of time in journey planning. One of the panellists provides journey planning support for travellers revealing an alternative approach to pre-trip journey planning which may explain why some travellers were unable to address in-trip issues autonomously. In this panellist's case, they support travellers that come to their travel information shop and in effect, plans that traveller's journey for them. This method of 'conduit' planning, where an alternative person to the travelling traveller plans the journey, is often found in cases where unfamiliarity exists and the traveller lacks the ability or confidence to do so effectively (Salehian, 2014, Transport for London, 2009). This panellist revealed that 'conduit' planning could happen during all stages of information use including 'advanced', 'imminent' and even in-trip, see extract from panellist 13.

> 'We often find that there are a lot of people that are not prepared for their journey especially those that are actually seeking jobs. You would be surprised how many people come in and say 'I've got a job interview at so and so, how do I get there?' and you tell them and then ask them when their interview is and majority of the time they say something silly like in half an hour, and there is no way they have left enough time to make their journey'.
>
> Expert panellist 13, Representatives of Public Transport Service Providers

The panellists representing local public transport providers find that 'conduit' planning is, but not exclusively, amongst the older generation and not always linked to unfamiliarity. These travellers will approach travel information shops or other contact methods such as a telephone line to discuss their travel options with the operator. These panellists believed that as you travel down the generational line, technology-based 'conduit' planning begins to replace the need for information support from a person. However, no literature could be found to support this particular view directly, despite the valuable insight this view offers. The panellists were also conflicted over the level of information use in pre-trip journey planning, which was also unclear in the triangulation findings. However, the representatives of public transport services held a

stronger belief that travellers are not as likely to plan their journeys as one would think. Transport for London (2009) also concurs with this opinion, as this was found to be the case when establishing the Customer Touchpoints Typology. Recently, they have found that the visitors that use their travel information website will rely on the journey planner more than live information or maps, see Appendix B - 10. Thus, emphasising both the 'advanced' and 'conduit' pre-trip journey planning styles, especially among female travellers.

Appendix B - 10: Travellers use of the TfL website (Transport for London, 2014)

	Using journey planner to plan a route	Accessing live travel information	Maps
Woman	71%	27%	14%
Men	62%	34%	16%
Older travellers (65+)	63%	32%	16%
Younger travellers (16-24)	77%	35%	16%
Disabled People	63%	32%	18%

Alternatively, the local transport authority representatives disagree with the view that travellers are less likely to pre-trip journey plan. Instead, holding the view that travellers frequently use external travel information sources to plan their upcoming travel journeys, indicating that travel information use is not in-depth, but piecemeal. Again, no literature could be found to support this particular view directly, despite the valuable insight this view offers, so the extent that travellers do or do not pre-trip plan is still open for debate. As shown in Appendix B - 9, 7 out of the 13 panellists disagreed with the use of the keyword static, and preferred the use of scheduled or timetabled to convey the format of pre-trip information. The panellist's views about the methods traveller use to access scheduled/timetabled travel information were divided by the type of pre-trip journey planning, see Appendix B - 11. However, these views are consistent with existing literature as shown in Chapter 2.

Appendix B - 11: NVIVO Analysis: Common themes for pre-trip information source

Advanced Significant lead time	Imminent Imminent travel	Conduit Through someone else
Use of scheduled information, maps, their existing wayfinding ability and service provider websites	Departure boards, live feeds, some real-time enabled native apps.	Discussions, reviewing travel plans

Review of: In-trip travel information stage

To confirm the validity of the keyword terms and overall description for the in-trip journey planning traveller the Delphi study included them in the expert panellist review. During the first round, 13 panellists gave their opinions regarding the in-trip journey planning traveller as described in this chapter. The results indicated that the panellists found it much easier to relate to the in-trip traveller's approach and use of travel information, in some cases producing a high degree of initial consensus towards specific key terms. See Appendix B - 12 for the ratings and keyword suggestions made by the panellists.

Appendix B - 12: In-trip (key terms)

	Dynamic	Reactive	Focused	Check	Re-plan	Journey driven
Strongly agree	1	1	1	2	2	1
Agree	7	12	11	1	7	11
Neutral	0	0	1	1	1	1
Disagree	5	0	0	3	3	0
Strongly disagree	0	0	0	6	0	0

Recommended alternatives

Live info **Real-time info**	-	-	**Responsive** **Pull the information they need** **Adapt to travel situation**	-

It is clear from Appendix B - 12 that the in-trip traveller is reactive and responsive to in-trip travel information and will have complete focus on their destination. The results also indicated that the panellists had difficulty in interpreting the set keyword term 'dynamic' to describe the format of live-travel information because of not fully understanding what this means, instead preferring the use of 'live' information. In regards to the type of travel information sources that an in-trip traveller would use, the panellists suggested that the pre-cursor to this was the traveller's technical ability and whether they were 'tech-savvy'. A tech-savvy traveller, according to the panellists, is classified as a traveller with the means of personalising their travel information through the use of smartphone apps and social media. Therefore, suggesting that there are two types of travel information sources, described in Appendix B - 13.

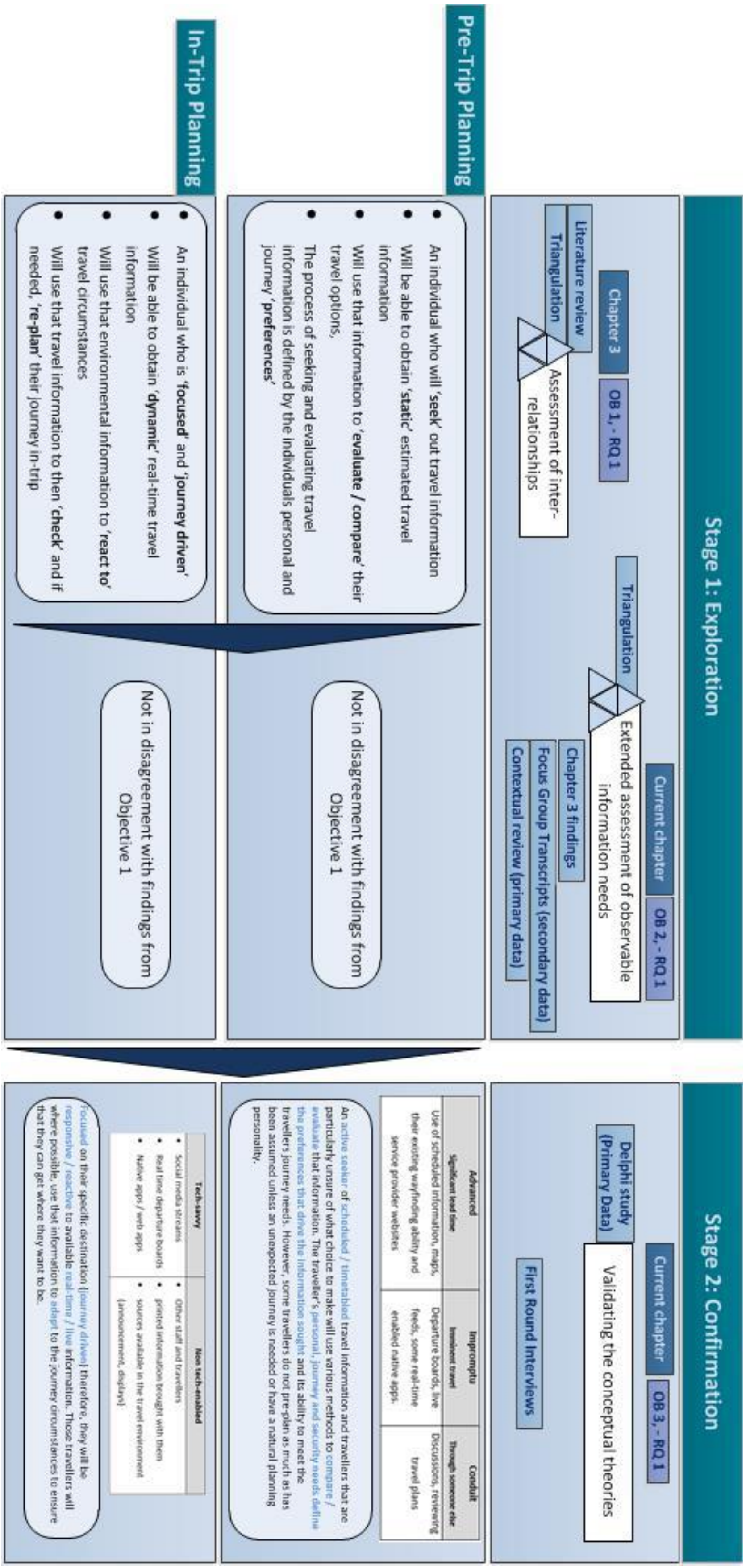
Appendix B - 13: NVIVO Analysis: Common themes for In-trip information source

Tech-savvy	Non tech-enabled
• Social media streams • Real time departure boards • Native apps / web apps	• Other staff and travellers • Printed information brought with them • Sources available in the travel environment (announcement, displays)

The panellists representing local public transport providers felt that the tech-savvy travellers would have a reduced reliance or need for information, but if needed, would predominately prefer social media streams, e.g. Twitter, Facebook. Whereas, the local transport authority representatives felt that travellers would place more reliance on real-time departure boards and mobile apps enabled with live travel information. However, both groups were in agreement that the non-tech enabled travellers would rely more on vocalised information or, ask available staff and travellers for in-trip guidance. One thing is clear, and that is, if it is the traveller's natural tendency to plan, even while in-trip, they will do so by any means available to them (Transport for London, 2009). Panellists, particularly the operators, felt that there was a link between the travellers need for in-trip travel information and the frequency of services operating that particular route. TAS Partnership (2002) found that headways did influence the traveller's willingness to uptake a service, suggesting that this may be because a frequent service reduces the need to be overly concerned with travel details, confirming the operator's views. Therefore, longer waiting times increase the value of in-trip travel information, perhaps because the impact disruptions have on infrequent services. The panellists representing local public transport providers were also quite frank about the level of enquiries they get about display boards and in-trip inaccuracies, finding that travellers appreciate their presence but often view them with scepticism. Similarly, the local transport authority representatives suggested that despite in-trip travel information weaknesses, travellers believe that these issues would be remedied in the future because of how much travel information has changed over the years.

The role of journey stage on journey planning

The findings so far considered the concepts that progressed from the exploration studies and the first round Delphi study discussions, which brought out and confirmed the stages of travel information use, see Appendix B - 14. Appendix B - 15 presents the altered stage of information use descriptions, based on the first round interviews.



Appendix B - 14: Stages of information use - progression

Appendix B - 15: Stages of information use - confirmed definitions

Planning before a journey	Planning during a journey
An **active seeker** of **scheduled / timetabled** travel information and travellers that are particularly unsure of what choice to make will use various methods to **compare / evaluate** that information. The traveller's **personal, journey and security needs define the preferences that drive the information sought** and its ability to meet the traveller's journey needs. However, some travellers do not pre-plan as much as has been assumed unless an unexpected journey is needed or have a natural planning personality.	**Focused** on their specific destination (**journey driven**) therefore, they will be **responsive / reactive** to available **real-time / live** information. Those travellers will where possible, use that information to **adapt** to the journey circumstances to ensure that they can get where they want to be.

The improved descriptions shown in Appendix B - 15 are the evolved outcome of the prior descriptions (see Appendix B - 5 and Appendix B - 8). Rounds two and three of the Delphi study used these descriptions along with the collective 'anonymised' results from prior rounds to build consensus. During rounds two and three, 12 panellists gave their opinions regarding both the pre-trip and in-trip stages of information use as described in Appendix B - 15. The results, see Appendix B - 16, show that consensus for both the pre-trip and in-trip description improved from round one to round three. The results, particularly round two, show that local transport council expert's views were more varied for the pre-trip stage of information use and public service providers were similarly more varied for the in-trip stage of information use. See the earlier discussion for evidence of their differing views towards the different stages of information use. As a collective whole in round three, they were able to work together to reach consensus. Therefore, the newer definitions are considered closer to the appropriate descriptions for information use during pre and in-trip journey planning.

Appendix B - 16: Delphi results - Average score for stages of information use

Pre-trip planning	In-trip planning
Round by round results: All panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 7.38 13 1.121 Round 2 (new) 7.50 12 1.567 Round 3 (re-evaluate) 8.00 12 .000 Total 7.62 37 1.114 Operators panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 7.33 6 1.633 Round 2 (new) 7.60 5 .894 Round 3 (re-evaluate) 8.00 5 .000 Total 7.63 16 1.088 Council panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 7.43 7 .535 Round 2 (new) 7.43 7 1.988 Round 3 (re-evaluate) 8.00 7 .000 Total 7.62 21 1.161	**Round by round results:** All panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 8.46 13 .776 Round 2 (new) 7.92 12 1.240 Round 3 (re-evaluate) 8.00 12 .000 Total 8.14 37 .855 Operators panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 8.67 6 .816 Round 2 (new) 7.40 5 1.817 Round 3 (re-evaluate) 8.00 5 .000 Total 8.06 16 1.181 Council panellists Rating Round / Mean / N / Std. Deviation Round 1 (conceptual) 8.29 7 .756 Round 2 (new) 8.29 7 .488 Round 3 (re-evaluate) 8.00 7 .000 Total 8.19 21 .512

In regards to the keyword terms that formed these descriptions, specific terms were rejected or replaced because of describing the same things or the language itself was unclear. The process for how these keyword terms evolved is expressed in Appendix B - 17 which shows the ratings and the progression for both stages of information use. Note that the keywords that are styled in bold represent the original terms used.

Appendix B - 17: Round by round analysis of the key terms

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree		Strongly agree	Agree	Neutral	Disagree	Strongly disagree		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	
Pre-Trip	**Static**	0	5	1	7	0	D												
	(CHANGED) - Scheduled / Timetabled							4	7	1	0	0	A	12	0	0	0	0	SA
	Seeker	1	10	2	0	0	A												
	(CHANGED) - 'Active' seeker							0	11	1	0	0	A	0	12	0	0	0	A
	Evaluator	0	11	2	0	0	A												
	Comparer	0	11	2	0	0	A												
	(Merged) - Naturally unsure planners will evaluate / compare							2	6	4	0	0	A	0	12	0	0	0	A
	Preference driven	1	12	0	0	0	A												
	(Altered) - Personal, journey and security needs define preferences							3	7	1	1	0	A	0	12	0	0	0	A
	(Altered) - Preferences drive information sought							2	10	0	0	0	A	0	12	0	0	0	A
	(New) - Travellers do not plan unless a new journey arises are pre-planners by nature							3	6	2	1	0	A	0	12	0	0	0	A
In-Trip	**Dynamic**	1	7	0	5	0	A												
	(Changed) - Live / Real Time Info							5	7	0	0	0	A	12	0	0	0	0	SA
	Reactive	1	12	0	0	0	A												
	(Altered) - Reactive / responsive to journey experience and available info							3	8	1	0	0	A	0	12	0	0	0	A
	(New) - Reactive to service frequencies							3	9	0	0	0	A	0	12	0	0	0	A
	Focused	1	11	1	0	0	A	3	8	1	0	0	A	0	12	0	0	0	A
	Check	2	1	1	3	6	SD												
	Re-plan	2	7	1	3	0	A												
	(Changed / Merged) - Will adapt to journey circumstance							2	8	2	0	0	A	0	12	0	0	0	A
	(New) - Experienced travellers will pull information they need							6	5	1	0	0	SA	12	0	0	0	0	SA
	Journey driven	1	11	1	0	0	A	0	11	1	0	0	A	0	12	0	0	0	A
	(New) - Describes typical commuters							2	6	3	1	0	A	0	12	0	0	0	A

Regarding pre-trip information use, the majority of the keyword terms were altered in some way or another to represent the subjects clearly, such as the source of information rather than the format of the information. Some terms were changed to summarise one or more of the prior keyword terms into more meaningful descriptions, such as a 'seeker' evolving into an 'active seeker' of travel information. Similarly, new elements based on views raised by the panellists were included such as the perceived lack of pre-trip journey planning unless it is the traveller's natural tendency. For in-trip information use, alterations were made to some of the keyword terms for similar reasons to the pre-trip stage such as the source of information rather than its format and more informative descriptions such as traveller's using travel information to 'adapt' rather than 're-plan'. In addition to this, new views were considered such as experienced travellers 'pulling' relevant travel information and that overall, the in-trip description itself describes the typical commuter familiar with public transport services. However, these were not incorporated into the final description for in-trip information use as they corresponded to a particular traveller's familiarity and ability with public transport services. Instead, these views were carried forward in the Delphi to gain the panellist's opinions and whether they would agree that in-trip information is modified in such a way by a 'familiar' or 'regular' traveller. As all panellists agreed that these views were accurate, they were added to the Traveller Planning Type five segmentation that represents a familiar traveller's use of travel information in-trip. The reader is referred to Chapter 5, for a summary of the traveller planning types as defined by the Traveller Planning Types Framework.

Chapter Summary

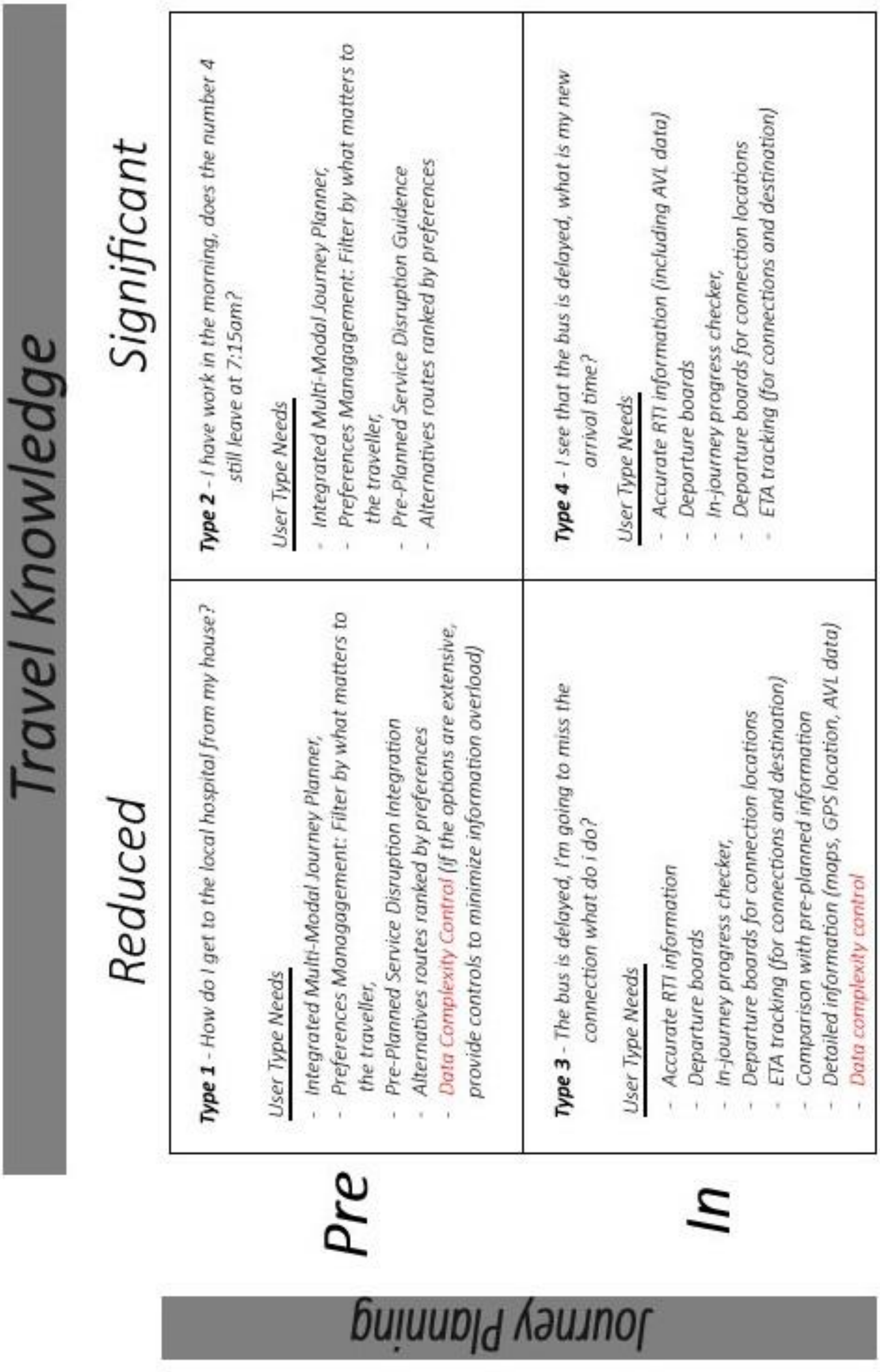
This chapter has discussed the way that travellers respond to and use travel information during each stage of information use, by deliberately taking a high-level view of those stages. The decision to take a high-level view was for two reasons. Firstly, literature was inconsistent about the different steps involved in in-trip travel either breaking this into wayside and on-board or breaking it into seven steps. Secondly, the keyword terms for each of those steps would, in effect, replicate the same motivations towards information use captured in the final descriptions, see Appendix B - 15. This chapter has clearly defined the critical differences between the stages of information use based on the reasons why motivations towards information use in that stage would be different. As well as, establish that pre-trip journey planning does not adequately prepare travellers for the experiences of in-trip travel as services will not always replicate estimated travel information. Similarly, in-trip information will not always accurately reflect in-trip situations that deviate from the estimated pre-trip information, often degrading to the point where human information sources are required with the accurate

knowledge to provide appropriate advice/guidance. To conclude, the crux of the issue is that accurate, timely and relevant travel information during both stages will not give the traveller control over the public transport system. However, it can give travellers the awareness they need to make reasoned travel decisions that will enable them to conduct their journey successfully.

APPENDIX C: CONCEPTUAL VERSION OF THE TPT FRAMEWORK

	Reduced wayfinding ability	Significant wayfinding ability
Pre-planning	Is a **seeker** of **static** travel information and will use various methods to **compare** and **evaluate** that information, typically through a journey planner. The traveller's **preferences drive** what sort of information they need and its ability to meet the journey needs.	A traveller who has little experience or trust in public transport services will be naturally **unsure** of what services will satisfy their journey needs. Therefore, seeking travel information tends to leave the traveller **concerned** as to if they can trust the information they find.	Due to their detailed working **knowledge** of specific routes and local transport service providers they are naturally **capable** of finding the travel information. They are able to work **independently** of ridged journey plans and in some cases do not need use plans at all.
In-journey planning	A traveller who is in transit will be **focused** on their specific destination whether that be for work / leisure or other activity (**journey driven**). They **react** to incoming real-time and **dynamic** information using that to **check** and **re-plan** their journey ensuring that they get where they want to be.	When they travel these concerns grow into **anxieties** and are **cautious** of things deviating from a plan that they are following. This ultimately makes them **reliant** on reliable services (not subject to service disruption) as their limited knowledge leaves them **stranded** and in need of external information sources such as staff and other travellers for assistance.	When travelling these travellers are **dynamic**, using past experience and their knowledge to manoeuvre through the network. In the eventuality of service disruption they can **flexibly** recalibrate their journey or understand incoming information in order to effectively re-plan.

Appendix C - 1: Crossover mapping (Conceptual findings)



Appendix C - 2: Traveller Planning Types Framework (Conceptual Version)

APPENDIX D: SURVEY SCRIPTS

Delphi Study (Expert Review) – Rounds 1-3

Part 1: Underpinning theories (Keyword terms and descriptions).

Q1	To what extent do you agree with the following descriptions for journey planning and traveller mentalities **(keywords are highlighted in blue)**

A pre-journey planner	**An in-journey planner**
Is a **seeker** of **static** travel information and will use various methods to **compare** and **evaluate** that information, typically through a journey planner. The traveller's **preferences drive** what sort of the information they need and its ability to meet the journey needs.	A traveller who is in transit will be **focused** on their specific destination whether that be for work / leisure or other activity (**journey driven**). They **react** to incoming real-time and **dynamic** information using that to **check** and **re-plan** their journey ensuring that they get where they want to be.
Strongly disagree … **Strongly Agree** 1 2 3 4 5 6 7 8 9 10 Accurate	**Strongly disagree** … **Strongly Agree** 1 2 3 4 5 6 7 8 9 10 Accurate

A traveller with limited familiarity with public transport	**A traveller with extensive familiarity with public transport**
A traveller who has little experience or trust in public transport services will be naturally **unsure** of what services will satisfy their journey needs. Therefore, seeking travel information tends to leave the traveller **concerned** as to if they can trust the information they find. Moreover, when they travel these concerns grow into **anxieties** and are **cautious** of things deviating from a plan that they are following. Which ultimately makes them **reliant** on reliable services (not subject to service disruption) as their limited knowledge leaves them **stranded** and in need of external information sources such as staff and other travellers for assistance.	Due to their detailed working **knowledge** of specific routes and local transport service providers they are naturally **capable** of finding the travel information. They are able to work **independently** of ridged journey plans and in some cases do not need use plans at all. When travelling these travellers are **dynamic**, using past experience and their knowledge to manoeuvre through the network. In the eventuality of service disruption they can **flexibly** recalibrate their journey or understand incoming information in order to effectively re-plan.
Strongly disagree … **Strongly Agree** 1 2 3 4 5 6 7 8 9 10 Accurate	**Strongly disagree** … **Strongly Agree** 1 2 3 4 5 6 7 8 9 10 Accurate

Q2	Which keywords do you agree with? What keywords would you recommend and why?

Pre-Planner		**In-Journey Planner**	
Static		Dynamic	
Seeker		Reactive	
Evaluator		Focused	
Comparer		Check	
Preference driven		Re-planner	
		Journey driven	

Limited familiarity with public transport		**Extensive familiarity with public transport**	
Cautious		Flexible	
Concerned		Dynamic	
Anxious		Capable	
Unsure		Independent	
Reliant		Knowledgeable	
Stranded			

Q3	To what extent do you agree that the travellers (as descriptions above) need these data points?

	Do not agree to its necessity 1	2	3	4	5	6	7	8	9	Agree to its necessity 10
Up-to-date and accurate travel information										
Realistic travel (journey) times										
Accessibility to local services										
Mobility friendly services										
Clear understandable costs relating to the journey										
Ability to avoid busy or crowded services										
A reliable public transport service with reliable information (e.g. consistency)										

Q4	Was there anything you were expecting to see on this list that, if so what was it?

Part 2: Framework evaluation (based on presented framework).

These questions were accompanies with the Traveller planning type framework.

SHOW FRAMEWORK HANDOUT

Q5	To what extent do you agree that this framework is …?

	Strongly Disagree 1	2	3	4	5	6	7	8	9	Strongly Agree 10
Is clear										
Is learnable										
Is creditable										
Is relevant										
Is significant										

Q6	To what extent do you agree that this framework satisfies the traveller types described above?

Strongly Disagree 1	2	3	4	5	6	7	8	9	Strongly Agree 10

Q7	To what extent do you agree with the 'traveller type' profile descriptions for?

	Strongly Disagree 1	2	3	4	5	6	7	8	9	Strongly Agree 10
Pre planning and limited familiarity										
Pre planning and extensive familiarity										
In journey and limited familiarity										
In journey and extensive familiarity										

Q8	Was there anything missing from the framework that you expected to see?

Category 2 – Frameworks Representation

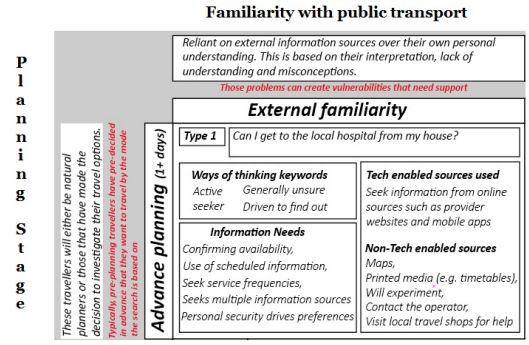
Q9	To what extent do you agree that this framework represents the travellers you support?

Strongly Disagree 1	2	3	4	5	6	7	8	9	Strongly Agree 10

Q10	Who do you think is the intended audience is for this framework?

Delphi Study (Expert Review) – Rounds 2 and 3

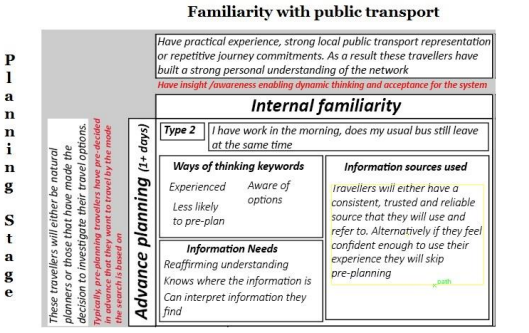
After round 1, the modified traveller planning types these were included in the second part of the questionnaire, based on this format of questioning. In other words, rounds 2 and three included the original questions and these new questions.



This is the altered framework segment for a pre-planning traveller who has limited personal experience (relies on external information sources).

To what extent do you agree that this segment describes this kind of traveller?

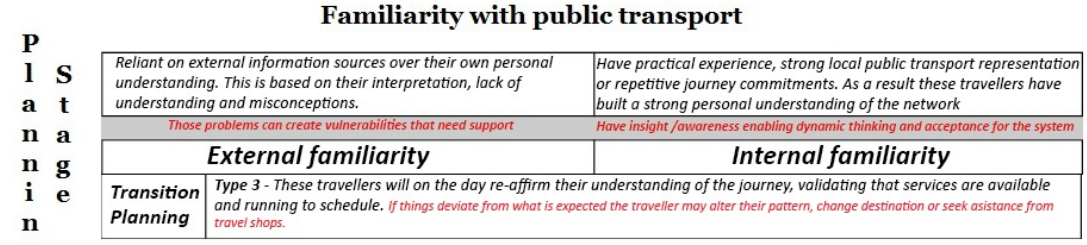
Strongly agree 1 2 3 4 5 6 7



This is the altered framework segment for a pre-planning traveller who has extensive personal experience (relies on their personal experience and understanding).

To what extent do you agree that this segment describes this kind of traveller?

Strongly agree 1 2 3 4 5 6 7



This is a new segment that crosses both types of knowledge dependent travellers (on external sources / on personal experience) and deals with travellers who seek travel information that is reasonably close to leaving for that trip but will be interested in current travel information.

To what extent do you agree that this segment describes this kind of traveller?

Strongly agree 1 2 3 4 5 6 7 8 9 10 Strongly disagree

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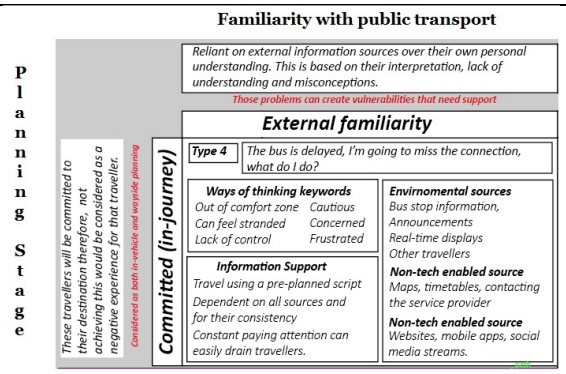
<td> 
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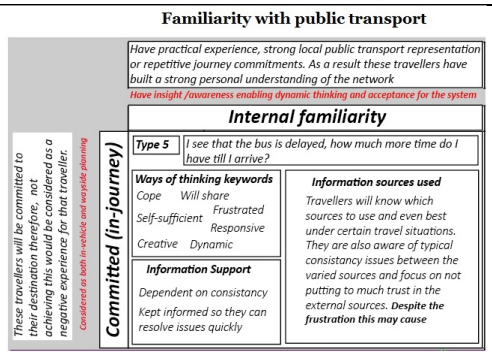
<td> 
</td>
</tr>
<tr>
<td>This is the altered framework segment for a committed in-journey traveller who has limited personal experience (relies on external information sources).

To what extent do you agree that this segment describes this kind of traveller?

Strongly agree 1 2 3 4 5 6 7</td>
<td>This is the altered framework segment for a committed in-journey traveller who has extensive personal experience (relies on their experience and understanding).

To what extent do you agree that this segment describes this kind of traveller?

Strongly agree 1 2 3 4 5 6 7</td>
</tr>
</table>

Experiment: Before evaluation

Participant travel information use

Participants in the final experiment initially completed a participant that captured their use of travel information, their familiarity of the trialled journey planners and their travel patterns

A. About you Please tick ✔

Q1 - Age			
Under 18		45-54	
18 -24		55-64	
25-34		65+	
35-44			

Q2 - Gender	
Male	
Female	
Unspecified	

Q3 - Employment	
Full-time	
Part time	
At-home parent	
Student	
Retired	
Unspecified	

Q4 – What travel options do you have (tick all that apply)	
Hold a driver's license	
Own a car	
Travel in a car as a passenger	
Have a free bus pass	
Pay cash for bus and or trains	
Own a season ticket for buses and or trains	
Own a smartphone	
Travel with children	
Need services to be disabled friendly	

B. Typical travel pattern (Please tick the most appropriate option)

Q5a – In a typical week, how often do you use certain travel methods?

	none	1-2 days	2-4 days	5+ days
Bus				
Cycle				
Car (as driver)				
Car (as passenger)				
Ferry				
Motorcycle				
Taxi				
Train				
Underground				
Walk (more than 10mins)				

Q5b – In a typical week, how often do you travel for these reasons?

	none	1-2 days	2-4 days	5+ days
Medical services				
Shopping				
Leisure				
Visiting friends / family				
Education				
Work (or business trip)				
School-Run				

Q6– What type of transport/s did you catch today?

C. General travel information use (Please tick the most appropriate option, unless stated)

7a - Do you seek travel information before travelling?	
Yes	
Sometimes	
No	

7b - Do you pre-plan for journeys that are … ?	
Familiar	
Unfamiliar	
I do not plan	

8a - Do you seek travel information during travel?	
Yes	
Sometimes	
No	

8b - Do you check for disruptions for journeys that are … ?	
Familiar	
Unfamiliar	
I do not plan	

7c – When preplanning which sources would you use (tick all that apply)	
Printed timetable	
Service provider website	
Social media	
Journey planner	
Travel app on smartphone	
Travel forums	
Google maps	
Other online sources	
Call service provider	
Use my knowledge	
Ask friends / family	

8c – When in-journey which sources would you use (tick all that apply)	
At-stop – printed information	
At-stop – real time information	
Announcements	
Check Social media	
Post on social media	
Travel app on smartphone	
Check a map	
Use past experience	
Ask for help (staff/travellers)	
Observe others	
Call the service provider	

D. Relationship with tools you will be evaluating

(Please tick the most appropriate option, unless stated)	**Southampton MyJourney Planner**	**Traveline Southwest Journey Planner**	**Google Maps Journey Planning**
9a – Have you used this journey planning tool before?	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐
	If <u>yes,</u> please answer the following questions related to that tool. **If <u>no,</u> please ignore the remaining questions** related to that tool.		
9b – Do you use this tool regularly in a typical week	Yes ☐ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

If yes… please answer question 10 and 12
If no… please answer question 11 and 12

10 – In a typical week, how often will you use this tool	1-2 days ☐ 2-4 days ☐ 5+ days ☐	1-2 days ☐ 2-4 days ☐ 5+ days ☐	1-2 days ☐ 2-4 days ☐ 5+ days ☐
11 – would you describe your use of this tool as	Weekly ☐ Monthly ☐ Yearly ☐ As required ☐	Weekly ☐ Monthly ☐ Yearly ☐ As required ☐	Weekly ☐ Monthly ☐ Yearly ☐ As required ☐
12 – on a scale of 1-5, how satisfied were you that this tool meet your travel information needs	**Very unsatisfied** **Very satisfied** **1 2 3 4 5** ☐ ☐ ☐ ☐ ☐	**Very unsatisfied** **Very satisfied** **1 2 3 4 5** ☐ ☐ ☐ ☐ ☐	**Very unsatisfied** **Very satisfied** **1 2 3 4 5** ☐ ☐ ☐ ☐ ☐

Experiment: During evaluation

Unfamiliar journey evaluation questions (per journey planner)

Please plan the journey provided to you using ***[Journey planner name]***, after planning your journey, please answer these questions by rating if this information is offered by the journey planner, if you need to refer back to the travel planning tool, please do so. These questions do not specifically relate to the journey you have planned.

A. Basic Travel Information, How easy did you:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Find the quickest way to a destination				
2) Find all available routes				
3) Find the best time to travel				
4) Find how easy it is to get to certain destination types				
5) Find the next bus to a specific destination				
6) Find a journey without interchanges.				
7) Find the areas of emerging in-journey difficulty **(Disruptions)**				
8) Find out about areas of planned difficulty **(disruptions)**				
9) Find how operators handle and present information in service disruption				

A. Basic Travel Information, How easy did you:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
10) Find out operators policies for dealing with service disruptions				
11) Find the area coverage for specific operators **(e.g. a route map)**				
12) Find the area coverage for all operators **(e.g. an area map)**				
13) Find the area coverage by ticket type **(e.g. ticket zoning)**				
14) Identify if route timetables are summarized **(not listing all calling points)**				
15) Access the information to satisfy the questions asked in this survey				
16) The information is actionable **(e.g. usable, useful and clear)**				
17) Interpret available information				
18) Know the information is complete **(e.g. unrestricted and available)**				

Unfamiliar journey evaluation questions (per journey planner)

Please plan the journey provided to you using ***[Journey planner name]***, after planning your journey, please answer these questions by rating if this information is offered by the journey planner, if you need to refer back to the travel planning tool, please do so. Complete sections A-F if time is available to do so

A. Basic Travel Information, How easy did you:

	How easy did you ….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	Please tick ✔ If you …. believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Find arrival / departure times for a specific stop?				
2) Find arrival / departure times for all stops on a route?				
3) Find first and last service times for a specific route?				
4) Find how frequent services are?				
5) Find estimated journey duration for a specific service?				
6) Find fare price for a single or one way journey?				
7) Find fare price for a return journey?				
8) Find fare price for travelling all day?				
9) Find fare price for travelling on multiple days (season ticket)?				
10) Find operator restrictions for ticket types?				

A. Basic Travel Information, How easy did you:

	How easy did you ….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	Please tick ✔ If you …. believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
11) Find ways you can pay (e.g. cash, card, smartcard, online, other)?				
12) Obtain this information (e.g. Number of clicks)?				
13) Interpret this information (is it clear enough for you)?				
14) Check the number of remaining days on a season ticket?				
15) Compare costs with other operators?				
16) Check what operator accepts your ticket?				

B. Advanced Travel Information, How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Confirm if your journey is expected to be busy?				
2) Confirm if your journey is expected to be busy for prams?				
3) Confirm if planning support is provided **(e.g. displays, maps)**				
4) Confirm if extra facilities are available **(e.g. Wi-Fi, charging points)**				
5) Confirm where essential needs are met **(e.g. toilets, cash machines)**				
6) Confirm where and when trained staff are available				
7) Confirm arrival location layout **(e.g. safe crossing places, pathways)**				
8) Confirm security provision **(e.g. lighting, staffing levels, CCTV)**				
9) Confirm ticketing machines are available and working				
10) Find out what is nearby your destination **(e.g. local shops)**				
11) Find out when the services at your destination close				
12) Identify services that have low floor entry **(e.g. step free access)**				

B. Advanced Travel Information, How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	Please tick ✔ If you …. believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
13) Identify services that call at places that have a low curb				
14) Identify services that offer vocalized announcements				
15) Identify service that support the hard of hearing **(e.g. inductive loop)**				
16) Identify services that guarantee / monitor designated seating areas				
17) Identify services where staff have received training for specific difficulties **(e.g. anxiety, autism, mobility constraint etc.)**				
18) Identify services that are typically affected by congestion				
19) Identify service reliability on different days of the week				
20) Identify service reliability during the course of a day				
21) Identify service reliability during peak times				
22) Identify service reliability during off-peak times				

C. Information Presentation. How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Find a detailed journey breakdown (e.g. interchanges, etc.)				
2) Find and switch between journey breakdown and list of other journeys				
3) Explore and compare your travel options				
4) Find obscure or less known routes to build your knowledge				
5) Freely find information the way you want to				
6) Feel confident that you can rely on this knowledge as you travel.				

D. Information Reliability (Trusting in its accuracy). How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Confirm the future reliability of obtained information				
2) Confirm whether planned disruption is expected to disrupt services				
3) Find alternative travel times to avoid the disruption				
4) Determine how disruption will affect route timetable, frequency etc.				
5) Compare planned information with actual journey circumstances				
6) Identify whether the disruption information is estimated or confirmed				
7) Find alternative travel times to avoid the disruption				
8) Find other locations that could satisfy journey requirements				
9) Identify alternative modes available for your ticket type				
10) Identify how travellers felt the interchange experience went **(ratings)**				
11) Use the information you have collected in journey (tracking)				
12) Track journey travel times as you travel				
13) Find out about the reliability of an interchange as you travel				

D. Information Reliability (Trusting in its accuracy). How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
14) Access this tool in-journey to re-plan your journey, in-journey				
15) Use the information provided by this tool in-journey				

E. Supporting Decisions. How easy was it to:

	How easy is it to….? Please tick ✔ Difficult 1 2 3 4 5 Easy	Please tick ✔ If you …. are unable to find this item	believe it is taking too long to find	This information is important to me Please tick ✔ Not at all 1 2 3 4 5 Very important
1) Apply a journey time limit when searching for travel options				
2) Apply an interchange limit when searching for travel options				
3) Find routes that are under 30mins for a specific journey				

E. Supporting Decisions. How easy was it to:

	How easy is it to….? Please tick ✔ Difficult … Easy 1 2 3 4 5	Please tick ✔ If you …. are unable to find this item	Please tick ✔ If you …. believe it is taking too long to find	This information is important to me Please tick ✔ Not at all … Very important 1 2 3 4 5
4) Find routes that are under 30mins from your specific locations				
5) Store and use personal preferences **(e.g. home stop, specific provider etc.)**				
6) Find route recommendations from other travellers **(ratings)**				
7) Compare travel options				
8) Find every travel option				
9) Limit the number of options presented at one time				

F. Incentivised to select certain options. To what extent do you feel as if:

	To what extent do you feel as if ? Please tick ✔ Not at all — Strongly 1 2 3 4 5	Please tick ✔ If .... You are unable to determine if this is present	How happy are you to receive this kind of incentive Please tick ✔ Very unhappy — Very happy 1 2 3 4 5
1) You are being incentivised to select an option because of cost savings			
2) You are being incentivised to select an option because of time savings			
3) You are being incentivised to select an option because of the environmental impacts			
4) You are being incentivised to select an option because of how other travellers respond			
5) You are being incentivised to select an option because of other reasons			
6) You are being incentivised to select an option because of social expectation			
7) This source of information understands how you want travel information presented			
8) This source of information is presenting that information with you in mind			
9) This source of information presents default travel options that get straight to your needs			
10) This source of information presents a large set of options clearly			
11) This source learns about your needs to simplify the process of obtaining information			

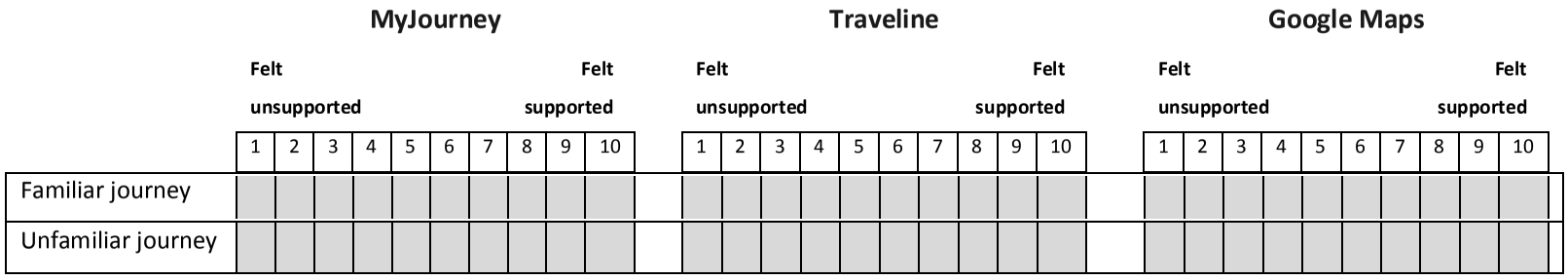
12) This source took into account how quickly you needed to obtain information			
13) This sources helps you anticipate problems you could encounter as you travel			
14) The information you were seeking was presented to you at the right time			
15) The feedback that is offered is relevant when it is offered			
16) The feedback that is offered by this source is clear and understandable			
17) This source lets you give feedback to rate your journey experiences (e.g. at interchanges)			
18) This sources lets you see other travellers feedback about the journey experiences			

Experiment: After evaluation

Reflections

A. **On a scale of 1 – 10, where 10 means you felt particularly supported**, did you feel that these tools supported you plan a familiar / unfamiliar journey? (Please tick ✔)

B. **On a scale of 1 – 10, where 10 means you felt particularly supported**, did you feel that these tools met your information needs for a familiar / unfamiliar journey? (Please tick ✔)



C. Which would you use again if you had to plan a familiar / unfamiliar journey?

(Please tick ✔ all that apply)

	MyJourney			Traveline			Google Maps		
Familiar journey									
Unfamiliar journey									