“This is where public transport falls down”: Place based perspectives of multimodal travel

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Abstract

No single transport mode can replace the private car in terms of its support for flexible mobility. Combinations of multiple transport modes are required. If we are to contribute to reduced car dependency it is crucial that we understand what makes such multi-modal journeys difficult. Despite large bodies of literature on mode choice and on perceptions and experiences of various travel modes, few scholars have looked specifically at journeys that combine more than one transport mode. This research fills that gap, taking a qualitative approach to explore end-user perspectives of the challenges therein. Specifically, it focusses on the barriers people in urban, peri-urban, and rural areas perceive when thinking about combining two or more transport modes in a single journey. Thematic analysis of the responses of 146 participants of a series of asynchronous online focus groups revealed an overall picture of challenges shared, with some differences in the relative importance of different barriers for those in different locations. The time incurred, the difficulties in synchronising timetables, and the criticality of each leg's reliability are core barriers for all, while those in rural areas are more affected by basic service provision and the physical linking of different modes. Of greater significance for urban and peri-urban residents were the complexities around planning a multi-modal journey where there are multiple options available, as well as the facilities available at stations and stops. Results are discussed in terms of interventions that could help people in different residential settings use their car less.

Keywords: Asynchronous Online Focus Groups (AOFG), multimodal travel, urban, peri-urban, rural, car dependency.

Highlights

- Asynchronous online focus groups held with 146 participants giving their views on multi-modal travel.
- Similarities and differences between those in urban, peri-urban, and rural areas are explored.
- An overall picture of challenges shared, with time incurred, reliability, and timetable coordination representing inter-related challenges.
- Rural residents more affected by physical coordination and the lack of safe active travel infrastructure to and from stations.
- Urban residents give more importance to the complexities of journey planning and ticketing where multiple options are available.

“This is where public transport falls down”: Place based perspectives of multimodal travel

1. Introduction

There is no single transport mode that can offer the same level of flexibility and freedom as the private motor vehicle. Electrification of that mode is being promoted by governments around the world; however, this will not solve our transport system’s problems (it may even exacerbate them; Eyre & Killip, 2019). Hence the growing interest in multimodal travel, i.e., those journeys that combine two or more modes of transport.

The research presented in this article explores the challenges people face when making such journeys, i.e., those that combine multiple transport modes. Given the importance of residential location on working and travelling patterns (in part due to differing access to public transport and active travel networks, discussed below), this research explores the extent to which the challenges to multi-modal journeys differ for those living in urban, rural, and peri-urban areas. As discussed below, there is currently a dearth of literature on people’s lived experiences of multi-modal journeys. This research therefore employs a qualitative approach, with the aim being to shed light on the primary challenges involved in (and therefore barriers to greater uptake of) multi-modal journeys made by people living in the three location types.

2. Literature review

The attention paid to multimodal trips has grown with the proliferation of smart journey planning and ticketing apps (such as Mobility as a Service; Narayanan & Antoniou, 2023). These typically support combinations of public transport, active travel, car- and ridesharing, micromobility, and dynamic demand responsive transport to support door-to-door travel. Uptake, use of, and experience with each of these modes has been studied and reported on extensively in the literature, and a whole raft of constraints and barriers to the individual use of these modes have been explored (Biernat et al., 2018; Fishman et al., 2012; Pearson et al., 2023; Pigeon et al., 2021; Semenescu & Coca, 2022; van Soest et al., 2019).

Far more studies have been published on these topics than can be referenced here; however, the unique or additional challenges involved in taking journeys that require the use of two or more modes of transport have not received nearly the same level of attention. To

understand an overcome these challenges is becoming ever more critical with the growing climate crisis (IPCC, 2023). We need to reduce reliance on the private vehicle, yet for many journeys, especially for those outside of urban areas, it is the only single transport mode available (Matyas, 2020). Combing multiple modes of transport will be the only way to undertake many journeys, hence we need to first understand, and then remove (or reduce) the real and perceived barriers to those trips.

It is worth noting at this point that given the initial need to access public or shared transport networks (typically by walking) almost any journey not taken by a private vehicle (or only walking) can be consider as multi-modal. Indeed, a person's use of public transport is one of the strongest predictors of the extent to which they walk (Bozovic et al., 2021). It is not always feasible, however, to access public transport networks by only walking (Daniels & Mulley, 2013), hence the need for first- and last-mile passenger services that (in theory) complement public transport (Meng et al., 2020).

These complementary modes maybe shared or private, with e-scooters an emerging example of the former (e.g., Bao & Lim, 2022), and use of the private bicycle an established example of the latter (e.g., Martens, 2004). For those able to access them, buses have also long been considered in terms of their capacity to feed rail networks (e.g., Chien & Schonfeld, 1998). Access is, however, highly dependent on an individual's home location, with significant differences in service provision in urban and rural areas, and in the sub-urban and semi-rural peripheries where rural and urban regions interface (herein referred to as peri-urban areas; European Commission, 2015).

Explorations of mode choice can be considered in terms of satisfaction and attitudes, with bi-directional (and/or cyclical) relationships existing therein (De Vos, 2019; De Vos et al., 2022). Travel satisfaction has been the focus of a large body work, with many making comparisons between users of different travel modes (Chaloux et al., 2019; St-Louis et al., 2014; Thomas & Walker, 2015) and a dedicated scale having been developed to measure it (De Vos et al., 2015). Yet there is only one example (to this author's knowledge) of research specifically looking at multimodal journeys.

Susilo and Cats (2014) considered overall satisfaction with multi-modal journeys in their work, highlighting a prevailing focus on main or primary trip stages in the extant literature hence. Their use of a questionnaire allowed for statistical modelling of the factors influencing satisfaction, with results pointing to the importance of station environment, ease of transfer, overall journey time, and trip complexity. Perhaps most interestingly (in the context of the current work), they found satisfaction with a public transport stage (of a multimodal journey)

and satisfaction with preceding stage(s) to be interdependent, emphasising the importance of the "door-to-door perspective" (Susilo & Cats, 2014)

Although Susilo and Cats' model included a wide variety of factors, the quantitative approach taken did not allow for exploration of factors beyond the items included, a limitation highlighted by the authors themselves. This is where a qualitative approach could provide further insight into traveller experience.

Before going on to describe the current research, it is worth drawing attention to three related areas of research. The first is the passenger transfer domain. Not all transfers are made during multi-modal trips (i.e., many involve connecting two services of the same mode); however, relevance to the current study must be acknowledged. Quantitative approaches to understanding the impact on transfer on satisfaction with, or willingness to pay for services is a common focus (e.g., dell'Olio et al., 2011; Espino & Román, 2020); however, the same criticism can and has been applied to that work as was described in relation to Susilo and Cats' (2014) work. Cascajo et al. (2019) make this point when justifying their use of focus groups to explore the factors influencing the 'transfer penalty' (i.e., the additional burden introduced by the need to change services). This has relevance for any multi-modal journey that requires the traveller to wait between services, with Cascajo et al. (2019) highlighting the importance of waiting times on that transfer penalty.

A second related research topic that deserves mention here is multimodality, defined as "the phenomenon of an individual using more than one mode of transport in a given period" (An et al., 2022). Studies in this field do not typically focus on single, multimodal journeys, rather consider multimodality as an individual's tendency to utilise different modes of transport for different journeys, contrasting the multimodal individual with the car-dependent individual who uses the car for most (or all) of their journeys. It is a term applied to an individual, not a trip. The interested reader is referred to Groth et al. (2021), Liu et al. (2022), and Molin et al. (2016) for three perspectives of multimodality.

The third relevant topic in which recent interest has arisen is Mobility as a Service (MaaS), a system that "aims to integrate multimodal transportation options into a single on-demand mobility service accessible via a single digital interface" (Alyavina et al., 2020). Essentially a journey planning and ticketing app, with some systems also offering bundles or packages of transport options paid on a subscription basis (Hensher et al., 2021), it is predicated on multi-modal travel as an alternative to private car ownership and use. There have been qualitative studies exploring MaaS use and uptake; however, most have focussed

on use (or planned or intended use) of the app or uptake of subscription models (e.g., Alyavina et al., 2020; Pawełoszek, 2022).

One study did go further, using semi-structured interviews to explore the challenges faced by mothers of children under 12 in Brussels when taking multimodal journeys (Cooper & Vanoutrive, 2022). That research highlighted the importance of station access for those travelling with push chairs or strollers, the need for safe bike parking at stations, and the value for money of the overall trip. The study highlighted some important challenges involved in journeys requiring the combination of modes; however, much of the focus was on walking and public transport, with some attention paid to improving shared vehicle services for families. This is not surprising given the urban focus of the research. Moreover, the research was limited in scope, exploring only a single use case (i.e., mothers of young children in Brussels). The extent to which these challenges are common across user types, and across locations, remains to be seen.

3. Methodology

This research uses Asynchronous Online Focus Groups (AOFG; Sweet, 2001), a technology-mediated focus group method that involves the use of internet forums or discussion boards to gather input from a target population. More commonly used in health research (given the level of anonymity and the benefits this has in terms of perceptions of safety and willingness to discuss potentially sensitive topics; (Reisner et al., 2018)), the method has previously been used in a transport context (Dichabeng et al., 2021).

As with any method, it has its limitations (primarily in terms of limits participant-participant interaction compared to face-to-face focus groups); however, it overcomes many of the disadvantages of traditional, in-person focus groups (Gordon et al., 2021). In allowing participants to respond in their own time, AOFGs facilitate participation from those that have irregular work schedules or family responsibilities. By removing the time pressure, a participant is able to focus more on the content of the message rather than on the management of the conversation (Joinson, 2003). Furthermore, in taking place fully online, AOFGs also facilitate participation from those who would find it difficult to travel to a specific location. Given the aim of the current research to explore perspectives of multi-modal travel across user types and locations, especially considering those in peri-urban and rural areas and those with potentially complex journey requirements (i.e., not just able-bodied

urbanites with free time to attend focus group sessions), the method was considered especially suitable.

3.1. Study context

This research was undertaken in the context of the Solent Future Transport Zone (FTZ) project, a UK government funded initiative aiming to improve transport accessibility and sustainability. The Solent FTZ (Figure 1), which is situated within the wider Solent region in the southern part of the UK, comprises the three cities of Portsmouth, Southampton, and Winchester, the Isle of Wight, and a large number of small towns, suburban areas, and semi-rural zones, with an estimated population of 1.6 million (Solent Transport, 2019).

Figure 1. The Solent Future Transport Zone (from explore.osmaps.com)

It is a dispersed and highly car-dependent region characterised by poor transport links to and from city centres, large employers outside of urban centres, and de-agglomerated commuting patterns (Pritchard, 2022). The zone includes parts of two national parks, the UK's most densely populated city, and a largely rural island reached by one of the most expensive ferry crossings in Europe (per kilometre; Isle of Wight Guru, 2022). Car ownership rates in the central areas of the three cities are in line with other urban areas in the UK, with at least one car or van present in around 70% of households (with variation across neighbourhoods therein). Across the Isle of Wight, 79% of households own at least one car or van. The wider peri-urban and rural areas included are characterised by even higher car or van ownership rates, at 90 to 95%, figures typical for these types of settings (ONS, 2023).

3.2. Focus group membership

As described above, the aim of this research was to explore the challenges people face when undertaking multi-modal journeys and how these might differ based on a person's place of residence. To separate the participants by the type of setting in which they lived, participants self-identified as living in an urban, peri-urban, or rural area during the sign-up process. Participants were asked "Of the following three options, how would you describe the place you live? We are interested here in your own perception of the place you live, not in an 'official' definition". They were provided with the following definitions:

- Urban - considered here as living within the limits of a city or town.
- Peri-urban - considered as living in suburban areas on the edge of a city or town or between cities or towns.
- Rural - considered as living in a small village or in the countryside.

This approach to group separation was considered suitable given the impact on travel of one's own perception of the place one lives (rather than official definitions) (Pot et al., 2020), a perception that is strongly influenced by the quality of the transport infrastructure and services in that setting (Pikora et al., 2006). Indeed, Mounce et al. (2020) suggest that the definition of rurality partly depends on an area's level of transport accessibility. More important, therefore, than normative definitions of location and accessibility is a person's own evaluation of their capacity to be mobile (Kaufmann et al., 2004). This is highlighted by the consistent mismatch between self-reported perceptions of accessibility and quantitative measures of distance and travel time (Lättman et al., 2018). This self-identification approach also avoids the challenges to and inconsistencies in official urban, rural, sub-urban, or peri-urban definitions (Bennett et al., 2019), the blurring of these concepts (Dymitrow & Stenseke, 2016), and the lack of consistency between official definitions and residents' own perceptions of where they live (Jacob & Luloff, 1995).

Participants were also separated by gender via self-selection. At sign-up, they were asked "Please indicate your preference for participation in a single or mixed gender online focus group, or if you have no strong preference" (having previously indicated their gender). All of those that selected either single or mixed were assigned to the group of their choice, with those stating no preference assigned to a group based on the availability of a sufficient number of participants to complete each group (with a goal of broadly even group sizes).

This separation served to address a methodological question concerning the impact of focus group gender make-up on online focus group responses (i.e., do participants discuss issues to a greater or lesser extent, or differently, if all other members of the group are of the same gender, compared to when groups are mixed?). This question is not addressed in this article (it is the focus of future work); however, it merits mention here as it influenced the design of the focus groups, with nine focus groups resulting from the three (urban, peri-urban, rural) by three (male, female, mixed) design.

3.3. Online platform and study design

The free to use ProBoards® website was used to host the nine AOFGs. Participants were required to be registered to access the relevant group forum, with access password restricted such that group members could only access the forum to which they were assigned. Use of the forums was wholly anonymous, with usernames bearing no relationship to real names or email addresses. The platform supports the creation of 'threads' such that each topic is included in a separate webpage. Separate threads were created to host participant information (including ethical information and website specific instructions) and each of the study questions, of which there were five (with one of interest here).

Study length of AOFGs varies and is dependent on the needs of the research, with study periods of one day (LaForge et al., 2022) to six months (Im, 2006) having been reported in the literature. The research described in this article took place over the course of 17 days, a period considered sufficient to allow participants to engage with the questions posed. In total, five topics were posed, one of which is of interest here: "What are the biggest challenges involved in multi-modal journeys, i.e., those that involve more than one transport type (e.g., e-scooter and bus, cycling and train, walking and bus, car and train, etc.), with one or more changes of service within the same journey?". They were not guided in any other way, i.e., they were not asked to focus on leisure or commuting travel, or short- or long-distance travel. The question was asked on day five of the 17-day study. The other questions (one posted before and four after) related to current mobility habits, to a specific mobility app being released in the study area, and to gender differences in people's travel experiences.

The study design and questions were piloted with six participants prior to wider participant recruitment. All participants were academic or research members of the Solent FTZ project team, none of whom was involved in designing the study. The pilot ran for 12

days, and the results and feedback gathered informed the final study design and procedure, and question wording.

3.4. Recruitment

Asynchronous Online Focus Groups (AOFG) allow for larger group sizes than face-to-face studies, thereby supporting the collection of a greater variety of views and experiences. Group sizes of 10 to 20 are typical (LaForge et al., 2022; Williams et al., 2012), but group size is not limited in the way in-person focus groups are, with benefits having been reported for even larger groups (Stewart & Williams, 2005). In the current study, 10-15 participants per focus group (i.e., 90 to 135 participants total) was considered a suitable recruitment goal.

Ethical approval for the study was obtained from the University of Southampton's Faculty of Engineering and Physical Sciences Ethics Committee (ID 73638.A1). Participant recruitment occurred wholly online. Emails were sent to colleagues and an advert placed in the University of Southampton's internal, online news portal requesting participation. Posts were also made to multiple Facebook groups, primarily to community pages for villages, towns, and suburbs or zones of the three main cities within the study area (i.e., Portsmouth, Southampton, and Winchester), as well as to groups for residents of the Isle of Wight. It was also posted to groups for communities immediately outside of the Solent FTZ boundaries. Participants were reimbursed £10 for their time.

A total of 223 individuals emailed in response to the study adverts, 26 of whom were university employees. Each of those 223 were emailed study information and a link to a demographic questionnaire (hosted on Qualtrics). This was completed by 173 individuals. Each of those was assigned a unique username and signed up to the relevant focus group. Ultimately, 146 individuals participated in the study, providing at least one response to the questions posted in the online focus group forums. The demographic characteristics of these 146 individuals is presented in Table 2, separated by focus group membership. Figure 3 presents the mode of transport that participants indicated using most, again separated by focus group.

Group size varied according to the number of people that responded to the study adverts, with the smallest group comprising male residents of rural areas and the largest comprising female residents of peri-urban areas. Those in rural areas were typically older than those in peri-urban or urban areas. This is largely line with UK rural and urban population statistics (DEFRA, 2021). More females than males participated (at a ratio of around 3:2) and only one

person identifying as non-binary participated (accurate population rates for which do not yet exist in the UK, though have been estimated at 1% when including those identifying as trans (Stonewall, 2022)).

Table 2. Age and gender characteristics of the sample

		Number of members	Mean age	Age SD	Age range
Urban	**Male**	15	43.7	12.4	31-71
	Female	18	41.2	10.9	29-65
	Mixed	16 (10 female, 5 male, 1 non-binary)	44.6	13.8	21-76
Peri-urban	**Male**	19	49.9	14.7	20-73
	Female	26	41.5	12.4	21-69
	Mixed	25 (15 female, 10 male)	46.4	14.9	18-70
Rural	**Male**	6	58.3	3.4	55-64
	Female	11	51.7	10.9	37-70
	Mixed	10 (6 female, 4 male)	56.6	16.3	32-77
	Totals	146	46.3	13.7	18-77

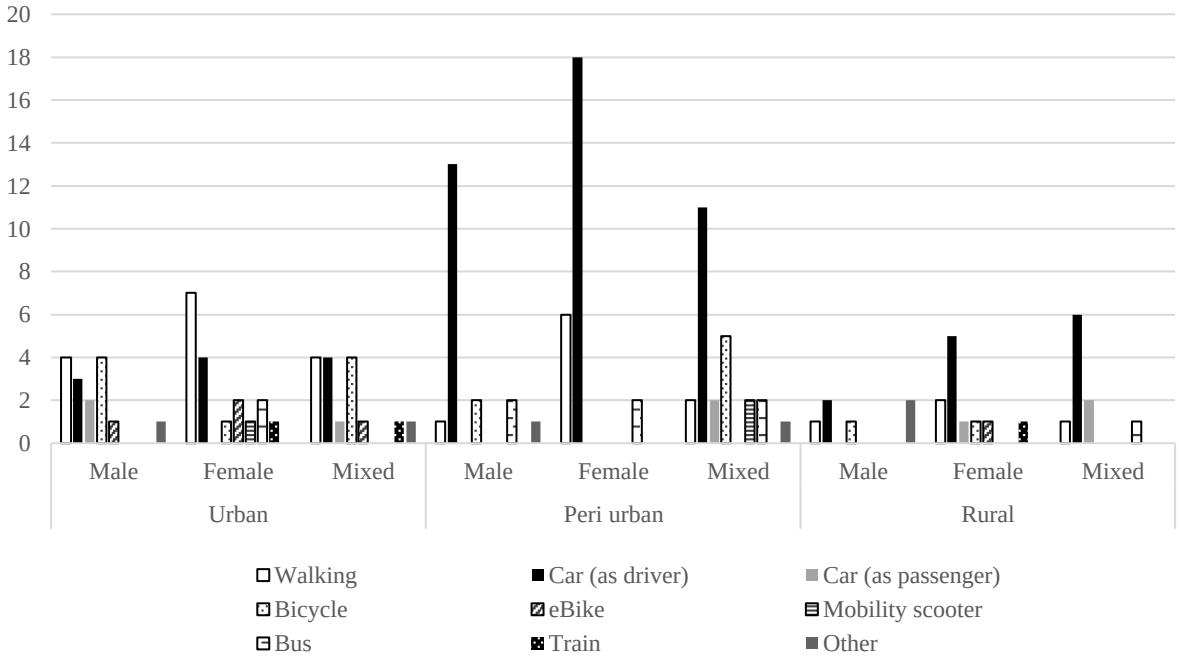

Figure 3. Mode of transport most often used by participants.

3.5. Analysis

Participants' responses to the question posed in the online focus group were subjected to inductive thematic analysis whereby a categorisation scheme was developed that identified patterns (or themes) in the responses provided by participants (in line with Braun & Clarke, 2006). The categorisation scheme was developed iteratively, with approximately four passes of the response set required to attain and apply the final thematic coding scheme. The first pass allowed the analyst to familiarise themselves with the data and to begin identifying themes; in the second pass, an early categorisation scheme was distilled from the initial themes; in the third pass, the scheme was applied and refined; the fourth pass re-applied the refined scheme to arrive at code counts (some further refinements were made without another full pass of the response sets). One analyst performed all analyses. To validate the thematic coding scheme, an inter-rater agreement exercise was undertaken. All participant comments were first broken down into individual segments to which a single thematic code was applied. Approximately 10% of those segments were then randomly selected from each focus group's data set. A second individual, unconnected to the current study, was introduced to the thematic coding scheme and then presented with the selection of excerpts from the forums, each of which was to be assigned one code. Percentage agreement and Cohen's kappa statistic were then calculated to provide an indication of the reliability of the thematic coding scheme.

4. Results and discussion

4.1. In numbers

Across all nine focus groups, the respondents' provided 19,559 words of text in response to the question posed, across a total of 182 individual forum posts. Data on the number of individual forum posts made by participants, the number of words written, and the average number of words per post for each focus group, for each question, are summarised in Figures 1 to 3. The level of activity was comparable across all forums, once sample size is accounted for. The mixed, peri-urban focus group stood out as attracting the wordiest posts, with the least amount of input provided by rural residents (a reflection of sample size).

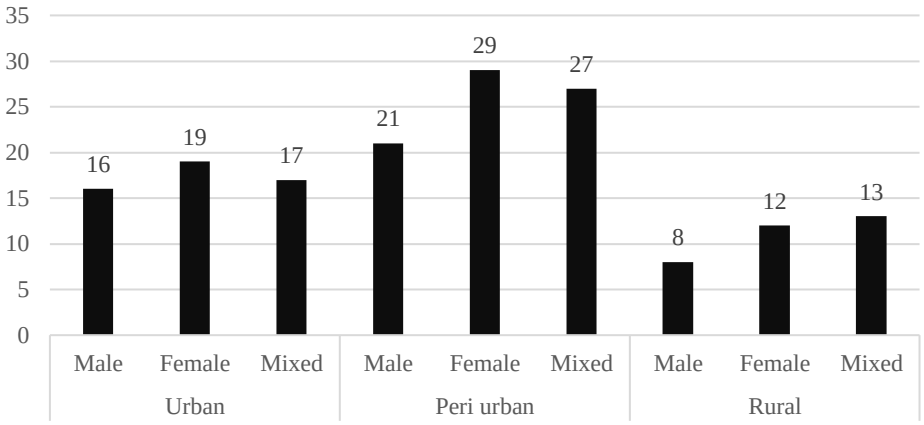

Figure 1. Raw number of posts made in each online focus group forum.

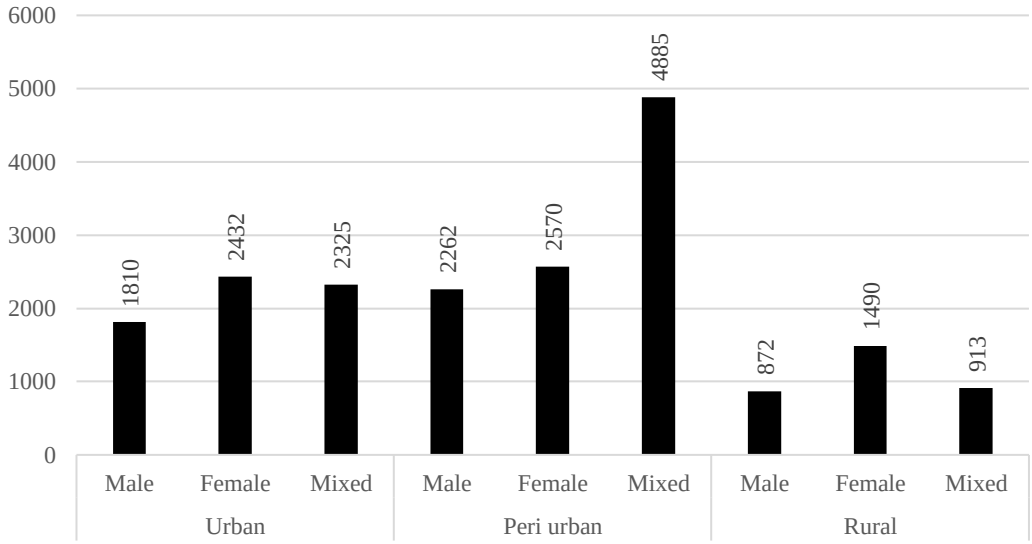

Figure 2. Raw number of words written in each online focus group forum.

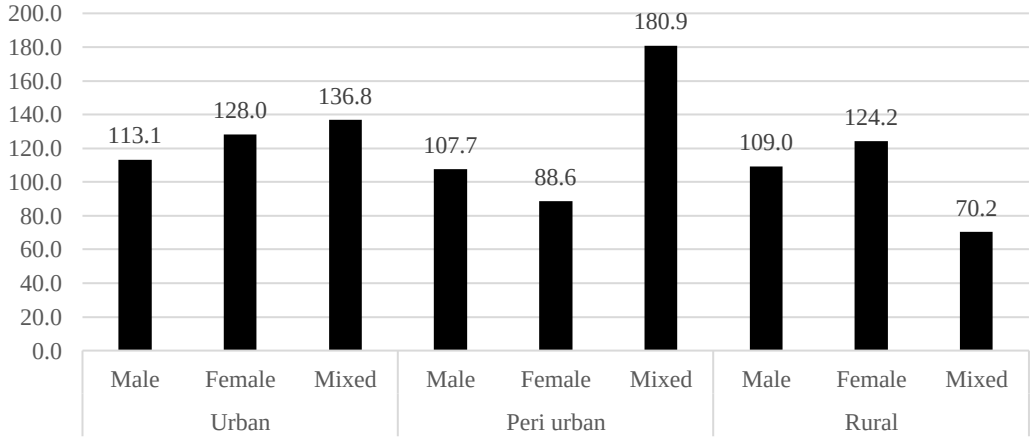

Figure 3. Average number of words written per post in each online focus group forum.

4.2. Thematic analysis

In total, 19 themes were identified. As described above, approximately 10% of the data (from each group) were re-analysed by a second individual and both analysts' results compared. Percentage agreement, at 81%, and Cohen's kappa, at κ=.79, indicated moderate to strong agreement (McHugh, 2012). The themes are summarised in Table 3 alongside representative quotes from participants. Table 3 also displays the number of times each theme was identified in the responses of those living in urban, peri-urban, and rural areas. These counts are presented graphically in Figure 4 as proportions of the total number of themes identified in each response set. A summary and discussion of the most common themes is then provided, with a focus on the similarities and differences between responses of those reporting their residential location as urban, peri-urban, or rural (male, female, and mixed group responses have been combined as gender differences are not the focus of the following analysis, only location). Quotes are attributed to an individual by the username they were assigned. Usernames were created based on the group of which they were a member and the order in which they were signed up (and have no other significance).

Table 3. Categorisation scheme for responses to the question *"What are the biggest challenges involved in multi-modal journeys, i.e., those that involve more than one transport type (e.g., eScooter and bus, cycling and train, walking and bus, car and train, etc.), with one or more changes of service within the same journey?"* The number of times each category is present broken down by participants' home location.

Category	Description	Example quote	Number of times mentioned			
			Participant home location			Total
			Urban	Peri-urban	Rural	
Bikes on public transport	Difficulties taking bikes on vehicles and through stops and through stations (excluding theft – see bike parking)	"One of the hardest things about cycling and then getting the train is that it's so difficult to take your bike on the train!" fp4	9	15	5	29
Time	Time incurred over and above single mode journeys, including waiting and having to build in 'wiggle room'	"There's a great bus service between Winchester, our village and Southampton, but if you need to change when you get to Southampton, which many do, it can be a time consuming (and possibly wet) wait" mixr9	21	40	10	71
Timetable coordination and coverage	Issues with multimodal timetable coordination, service frequency, and the lack of coverage at required hours	"The main difficulty with using a mix of transport is trying to get both to match up time wise for me not to be waiting ages somewhere waiting for the next link" fp15	21	42	15	78
Critical reliability	The risk of missing connections, or being stranded, of being late for engagements, and the associated stress	"the risk that one trip is delayed and then you miss the next part of your journey or is even cancelled and you are left in the middle of nowhere with no chance to catch another train" fu20	15	30	9	54
Geographical network coordination and coverage	Physical coordination of services, including bus-stops being too far, no buses to rail stations, no onward options, no micromobility	"depending on where you live on the Island even travelling to the red jet or fast cat services are a serious pain, often needing two buses. For the fastcat at the end of Ryde Pier, the train is no longer running so you are faced with a challenging walk along a very long pier" mp3	8	12	7	27
Safety and security at connections	Safety and security concerns specific to interchanges and waiting between services, including lighting, staffing, etc.	"Working till late in the evening and changing trains at St Denys I often felt unsafe" fp24	6	3	0	9
Safety and comfort to reach public transport	Active travel journeys to stations and stops described as unsafe or difficult to undertake	"the biggest challenge is the lack of safe road or cycle path to get to the train station unless I use the narrow pedestrian pavement" fr15	4	10	5	19
Comfort at connections	Including shelter from weather, seats, and the services available (not including toilets – see *Toilets*)	"Literally everywhere needs better waiting spaces, too. Somewhere fairly enclosed, with seating and loos should be a standard for all transport nodes. And all bus stops should have a shelter!" mixu9	7	8	3	18
Bike parking and theft	At stations and destinations, including theft concerns	"I cycle, then catch the ferry with my bike. I could leave my bike locked up on the hard but I'm not sure it would be there on return as we have a lot of bike thefts in the area" mu5	10	8	6	24
Toilets	And the lack thereof on services or at stops and stations	"the toilets at the station have been out of order and as a disabled person, or for any person, this is not acceptable" mixu17	4	0	4	8
Ticketing	Related to both the complexities of ticketing and the extra cost of requiring multiple tickets	"The lack of integrated ticketing is an issue. Buying different tickets for different bus services and train services gets complicated and makes it harder to work within a budget" mixu10	17	26	9	52

Parking and car access	Parking and access to public transport stations and stops, and the difficulties therein	“We drive to our local station and use blue badge to park in streets nearby as we only commute one or two days a week and the station parking is crazily expensive. My husband has to drop me first then park and double back to make train in time as its too far for me to walk by walker” mixu16	3	8	4	15
Children	Comments specifically mentioning children, including safety at interchanges, the tiring nature of changing services, and the need carry additional baggage	“Ah I remember those days from when my children were small. It’s exhausting to travel in a multi-modal way” mixu10	5	2	3	10
Baggage	Difficulties involved in carrying items up and down stairs at stations or stops (and on services, but this is not a specifically multi-modal issue)	“Hythe ferry doesn’t tie up time wise either and is too difficult to get on and off of with a case” fr10	5	4	1	10
Accessibility	Problems for those with mobility or visual impairments, on services and at stations and stops. Weak-link concept, where a journey needs only one inaccessible aspect	“Accessible locations in which to do the transition. Ability to transition between modes of transport which are able to take my mobility scooter or have disabled specific seating” fu4	8	7	7	22
Route and time planning	Concerning difficulties with planning, including having, too many options or variables and unreliable info related to timings, locations, and mode choice	“Hard to work out what connections you need if changing transport types, websites don’t seem to link together too well (transport for London seems OK at this, can combine a bus/underground route to give you a journey), but outside of London I find it rather complicated navigating multiple websites for each type of transport to find my journey” mp4	10	11	0	21
PT and AT problems	Any comments concerning challenges with public transport and active travel not specifically related to multi modal journeys	“There was only one bus from my workplace to home, and it’s very slow. It took five times longer than driving a car. I had a very bad headache when got off the bus. I promised myself this’s unfortunately not my option any more, even when the train is cancelled” mixp27	9	15	6	30
Positive	Positive comments about public transport and active travel, typically about travel in other countries, with UK comparing badly	“When I travel abroad I don’t even look up train or bus times as I mostly know they will be frequent, in fact I recently stayed on the outskirts of Amsterdam and even then the bus came every 10 minutes!” fp11	3	18	3	24
Wait time dilemma	Explicit mention of the dilemma between balancing the desire for service changes with short stopover times with the risk of missing connections if any service is delayed	“Having enough time for transition between modes but not so much that it adds a huge amount of journey time or you are left standing in the cold/rain/dark for ages” fu14	2	4	0	6

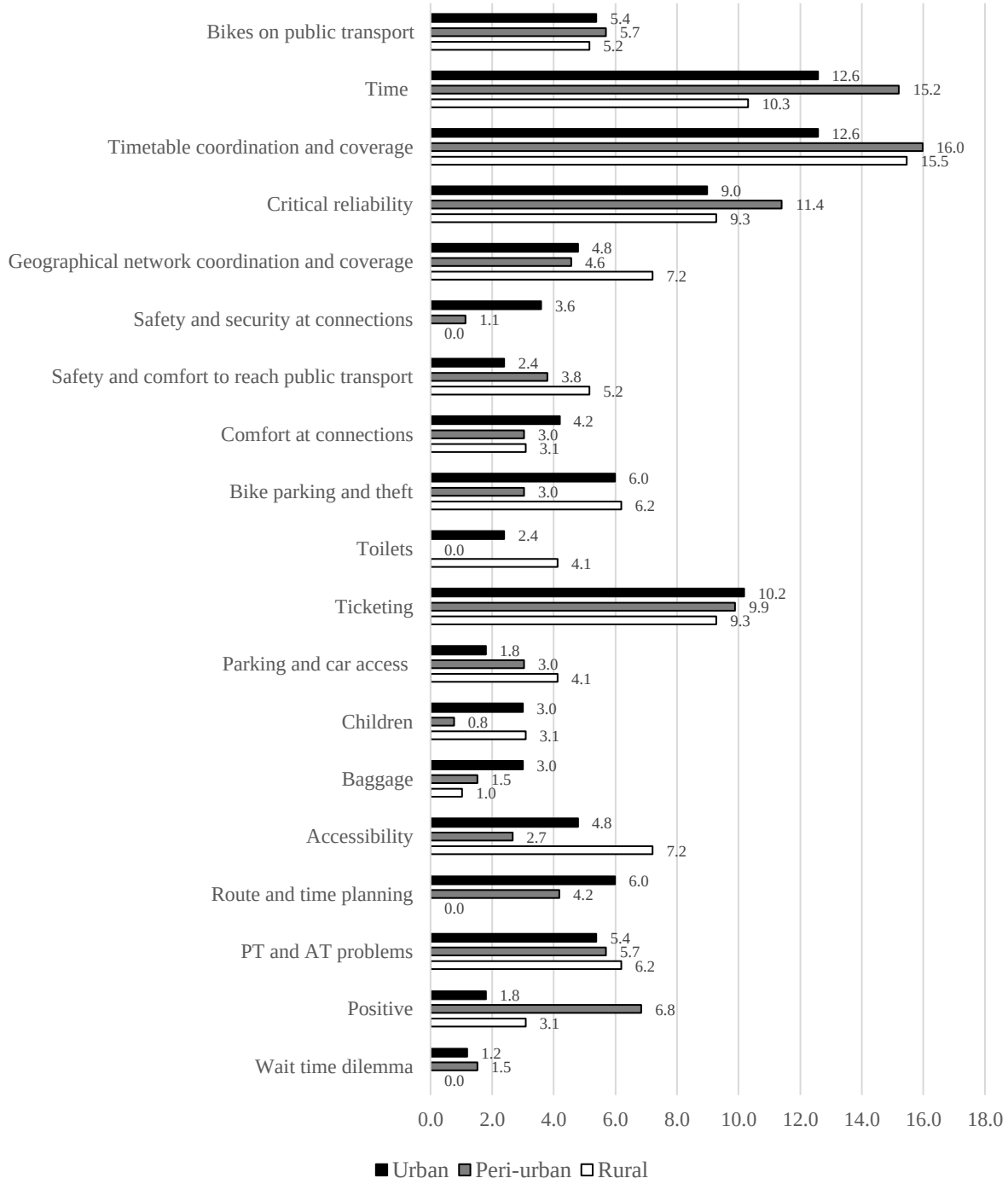

Figure 4. Presence of each theme in the responses of those living in different areas, presented as percentage of the total number of individual themes applied to each response set (i.e., the relative prominence of each theme in each response set)

The extent to which the themes were present were broadly similar, with the four most prominent themes being the same for participants regardless of home location. *Timetable coordination and coverage* and *Time* were the first and second most prominent themes in the responses from all three groups. *Critical reliability* and *Ticketing* were the third and fourth

most common in the rural and peri-urban groups, with *Ticketing* coming third and *Critical reliability* fourth in the urban group.

Timetable coordination and coverage

Comments categorised under this theme drew attention to problems with coordination between the timetables of different services. The theme also included comments regarding coordination problems arising from the infrequency of services and the lack of one or more connecting services at the required hours.

> *"I think frequency is key if it's a bus and train combination, otherwise it could be a complete nightmare of waiting round" fp20*
> *"My multi mode journeys involve a ferry across the Solent then a train. The timings simply do not work meaning the train often leaves before I arrive on the ferry" mr4*
> *"the last train runs far too early to be used if you want to go out for the evening into Southampton or Portsmouth. Even getting back from Southampton is now tricky as the last buses on the No 3 route have never been reinstated since lockdown" fu6*

Timetable coordination is a major issue for public transport, one that has attracted significant attention from the transport engineering, optimisation, and operations research communities (e.g., Kuo et al., 2023; Liu et al., 2021). This is a challenge for any bus service that 'feeds' a rail network, although there may be potential to address this by using smaller, more flexible road vehicles (e.g., Zhang et al., 2020). Alternatively, there has been work suggesting a car-share service would link well with public transport (Huwer, 2004). The determinants of car-share adoption are, however, complex, with instrumental qualities (i.e., practical benefits) combining with affective (i.e., related to experience with the mode) and symbolic (e.g., normative beliefs) qualities to impact upon a person's tendency to use such a service (Jain et al., 2021).

Time

Time is clearly linked with *Timetable coordination and coverage*, and the two themes commonly appeared together in participants' comments; however, where *Timetable coordination and coverage* specifically addressed timetabling issues, the *Time* theme

included comments more generally discussing the time cost incurred by multi modal travel over and above single mode journeys. This included references to waiting between services, having to build in additional time to allow for changeovers and potential delays or disruptions, and the cumulative time cost of journeys involving multiple legs.

> *"you end up spending half the day getting to your destination" fu7.*
> *"I would say the biggest challenges are…Finding the time - for example, walking to the bus stop and getting the bus somewhere adds a considerable amount of time to both the outward and return journey, especially given the unreliability of buses being early or late" mixp23*
> *"I think the main issues are the additional time needed for multi-modal journeys as so often there is a wait in between" mixu10*

Although not necessarily a uniquely multi-modal issue, insofar as public transport journeys generally require additional time over and above private vehicle journeys in the UK (Department for Transport, 2021), the multiplicative time cost of combining different modes, the time required to access to public transport services, and the time spent waiting between services, are clearly strong barriers to such journeys.

Critical reliability

Comments categorised under this theme referred to the risk of missing connections, of being stranded, or of being late for engagements, and the stress associated with that risk.

> *"the risk that one trip is delayed and then you miss the next part of your journey or is even cancelled and you are left in the middle of nowhere with no chance to catch another train" fu20*
> *"Anyone who has been caught out by scarce, unreliable, and irregular bus and train connections will conclude that the stress and expense of trying to do "the right thing" is just not worthwhile" fr14*

This was often, but not always, co-present with the *Timetable coordination and coverage* theme, with comments typically discussing the stress generated by the risks associated with poor timetable coordination and coverage. In a similar manner, the *Time* theme was also

often co-present, with participants discussing the impact on wait times (and ultimately journey times) of missing connections.

Beyond the practical importance to one's daily routine of arriving to places on time, the affective component is critical. Uncertainty and stress have significant influence over satisfaction with and acceptance of a mode (e.g., Kang et al., 2019; Stradling et al., 2007), and service reliability impacts upon these factors in complex ways (Soza-Parra et al., 2019). It has long been recognised that a single bad experience can have significant and lasting effect on customer satisfaction (Hocutt & Stone, 1998). This therefore represents a significant barrier to undertaking journeys requiring a service change and (more broadly) to transport paradigms that aim to supplant the private vehicle ownership model (like Mobility as a Service).

Ticketing

This theme was unrelated to the previous three, covering comments related to the both the complexities of ticketing and the extra cost of requiring multiple tickets. This was often framed in terms of the need to buy tickets from multiple service providers, the lack of cross-service validity of certain passes or season tickets, and the excessive cost of multi-modal journeys.

> *"the biggest issues with multi-modal travel is the stacking of costs" usermu10*
> *"For me it's an issue of ticketing. I want to go out into town by train as it's quicker but come home on the bus as it runs later and is closer to my location. This means buying two tickets at two different cost (both almost the same as a return fare) even though the bus and rail company are owned by the same people" fp18*
> *"The lack of joined up pricing between the Stubbington/Gosport peninsula and Portsmouth and Southampton means that changing transport services is seriously expensive" mixp16*

Where the previous three themes might also arise in explorations of public transport experience and uptake (as can be seen in Ramos et al., 2019), the *Ticketing* factor is more specific to multi-modal journeys. The unification (and therefore simplification) of multi-modal ticketing is (or at least was, prior to global events in the past three years) a priority in the EU policy agenda (European Commission, 2018) and is the basic premise of Mobility as

a Service (MaaS), the most recent label applied to the ongoing pursuit for integrated transport (Lyons et al., 2019). That it was one of the most prominent themes in the focus group responses is (in part) promising, as it implies that the push for such systems is justified. Cost was one of the five core determinants of mode choice identified by Gardner and Abraham (2007), and not only is the overall cost important to travellers taking multi-modal journeys, but the predictability and transparency of those costs (Clauss & Döppe, 2016).

Other themes and observations

The overall picture of multi-modal travel painted by the responses of participants across locations is almost exclusively negative. General challenges experienced when using public transport (including cost, convenience, and comfort compared to the car) were commonly expressed, with a sense that these issues are amplified when combining multiple public transport segments:

> *"Basically any reasons not to use public transport are squared, not doubled, when using multiple" mixp8*
>
> *"Oh dear, yes, this is where public transport falls down" mixp12*

Some respondents did highlight that almost any journey not taken door-to-door by a private vehicle is multi-modal in the sense that one must first access a public transport or private vehicle hire network (*"It's a necessity unless your* [sic] *using your own car or taxi which is a door to door service"* mixr3). One participant noted that the combination of one leg of active or private travel with one public transport leg is preferrable to combining multiple public transport services, framing their point in terms of controllability:

> *"I think the best way to combine different modes of transport is to have one mode within your control and the other outside of your control. So walking and the train, e-scooter and the train, walking and the bus etc etc. That way you are in control of adjusting one mode if the train/bus/ferry is late or delayed. Combining the train and a bus or ferry and the bus are things I would like to avoid" fu15*

This resonates with Mann and Abraham's (2006) assertion that travellers typically seek control and avoid dependency on external factors, as this leads to stress and feelings of inconvenience (Clauss & Döppe, 2016). This is likely connected to feelings of autonomy, and

the lack thereof when one has little control over the way a journey will progress (Hiscock et al., 2002), a point reflected in the prominence of the *Timetable coordination and coverage* and *Critical reliability* themes common across all response sets.

Relatedly, and building on the themes related to timetabling and the risk of missing connections, six individuals (two urban, four peri-urban) specifically described the 'waiting time dilemma' of multi-modal travel, whereby there is a need to balance the desire for service changes with short stopover times with the risk of missing connections if any service is delayed, and the stress that this dilemma generates ("*Having enough time for transition between modes but not so much that it adds a huge amount of journey time or you are left standing in the cold/rain/dark for ages"* fu14). Again, the uncertainty involved is clearly a barrier; however, there are also barriers to combing a 'controllable' mode with public transport.

Combining active travel with public transport may be preferable to combinations of two forms of public transport in this regard, but it is still not without difficulties, some of which were highlighted in the responses. Discussed barriers included those related to accessing stations and stops, to getting bikes on public transport (mainly concerning trains, with some reference to the almost complete inability to do so on UK buses), and to the security of bike parking at stations:

> *"it's so difficult to take your bike on the train!" fp4*
> *"the biggest challenge is the lack of safe road or cycle path to get to the train station" fr15*
> *"I could leave my bike locked up on the hard but I'm not sure it would be there on return" mu5*

In terms of taking bikes on public transport, discussions did not differ noticeably between the groups from different areas; however, mentions of bike parking and theft were less prominent in peri-urban residents' responses. This result does not invite easy explanation. One might expect the combination of cycling and public transport to be of greater concern to peri-urban residents, where stations are more likely to be too far to walk when compared to urban settings, but where cycling infrastructure is more likely to be present when compared to rural settings. In other words, in settings where bike-train combinations are likely to be a stronger non-car contender (Martens, 2004) and where security at train stations is likely to be important (Heinen & Buehler, 2019; Martens, 2007; Weliwitiya et al., 2019).

Somewhat related, though not always bike specific, was the *Safety and comfort to reach public transport* theme. This theme included comments concerning the perception of active travel routes that need be used to access stations, typically by walking or cycling.

> *"it might be safe and well lit where you start, say in a city but then at the other end you might have to do a dark walk, even a 5-10 minute walk would make me uncomfortable (especially leaving some stations are unlit and involve alleys)" fp2*
> *"safety to cycle to the train station as my location is rural with fast country roads" mixr10*

This was more prominent in the responses of rural residents, the reasons for which are highlighted in the second of the two quotes presented above. The lack of supportive infrastructure in rural areas is a major barrier to the uptake of cycling generally (Geffen, 2021), and clearly also to multi-modal travel. This issue is not only pertinent for the traditional bicycle, but for e-bikes and e-scooters. To that end, there is good evidence to suggest that wider availability of e-bikes, in combination with improvements to infrastructure, could significantly increase the proportion of trips taken by bike and public transport in rural areas (Lovelace et al., 2017).

Although unlikely to address the safety aspect alone, micromobility provided under share or hire schemes has the potential to overcome some of the challenges involved in combining active travel with public transport, with strong benefits having been demonstrated in this regard (Fearnley et al., 2020), especially in areas underserved by public transport (Vinagre Díaz et al., 2023). That said, those services must also be available close enough to a person's home to represent a viable alternative to the private car. The lack of such services was included under the *Geographical network coordination and coverage* theme, covering comments related to problems with the physical coordination of services. Perhaps unsurprisingly, the locations of bus stops, stations, and micromobility options, and the lack of coordination therein, was notably more prominent in the responses of rural residents. This was most often phrased in terms of the travel distances required to access the public transport network, but also in terms of connecting services together.

> *"It's a twenty minute walk to our nearest station" mixr9*
> *"sometimes there is no transport option other than a taxi at the other end" fp23*

Although this study did not focus specifically on those with mobility issues and/or other disabilities, comments concerning problems experienced by those with mobility or visual impairments, on services and at stations and stops, were the 6th, 11th, and 14th most common themes identified in the rural, urban, and peri-urban groups' responses, respectively (*"the hassle of using public transport with a wheelchair user is just not worth the effort"* fr14).

The reason for this to be of greater importance to those in the rural group may be related to the age of the sample (reflective of broader differences in ages of urban vs. rural populations). This may also be related to the geographical characteristics of the study region, with some referring to the difficulty in the use of boats to travel across parts of the Isle of Wight or to the mainland (*"the jenny boat is impossible with any luggage and a disability"* fr10; *"Due to the nature of my disability … I need to book a connecting ferry and cabin with toilet facilities. This often means there is difficulty getting a connecting ferry"* mr1). These two factors are likely combinatorial, with the population of the Isle of Wight significantly older than the UK average (Office for National Statistics, 2023).

Where the rural residents made no comments were in the *Route and time planning* and *Safety and security at stations* themes. These were only identified in urban and peri-urban residents' responses. The absence of the former, concerning the complexities of planning journeys where multiple transport services are available, is likely related to the lack of options in rural areas. When there is only one bus or one train, and no public or shared options available, complexity is greatly reduced, hence support in this aspect of multi-modal travelling is not required. Basic availability (including *Geographical network coordination and coverage*) is a far more significant issue.

For those in urban and peri-urban areas that did mention *Route and time planning* as a challenge, a modern journey planning system (such as Mobility as a Service) may facilitate multi-modal trips; however, instrumental factors (i.e., the availability of services, the time incurred) combine with affective attributes (e.g., comfort, perceived safety) to influence mode choice (Grison et al., 2017). Those designing such journey planners should take this into account. If we are to help those in rural areas travel more sustainably, however, service provision (rather than information provision) is far more important (Mulley et al., 2023)

Regarding *Safety and security at stations*, one might expect this to be more of a concern for those living near quieter stations and stops where there are fewer other people around (Hidayati et al., 2020), i.e., in more rural areas; however, this was not borne out in the focus group responses. The perception of safety at train stations is paramount, affecting different

groups of people differently (Sundling & Ceccato, 2022), hence more work in this area is recommended.

Perceived problems with existing public transport systems and active travel infrastructure came through strongly in all focus groups, and many of the issues of greatest prominence in participants' responses were interlinked, with timetabling incompatibilities contributing to long waiting (and overall journey) times, frequency issues relating to a wait time dilemma (risky connection or long wait?), and the criticality of reliability when changing infrequent services in order to reach engagements in time (in systems perceived as unreliable in the UK and more globally; Alkubati et al., 2023; Morton et al., 2016), all contributing to a stressful and unpleasant experience. The inter-modal synchronization problem has previously been noted as an important target for improvements to public transport (Ramos et al., 2019). This appears to be of comparable importance to those in urban, peri-urban, and rural areas.

Comfort at connections was present across the groups' responses, but to a fairly low extent. Although this goes against some of the transfer literature (where station environment has been highlighted as a factor of importance; Chauhan et al., 2021), it is in line with Susilo and Cats' (2014) findings. Although the transfer environment quality did influence overall satisfaction with multi-modal journeys when considered alone, influence became insignificant after including trip complexity and travel time (Susilo & Cats, 2014).

Summary of key findings and recommendations

The following table summarises the key findings of the analysis presented above and presents example recommendations (linked to supporting literature) to address the challenges identified. These recommendations are made in the context of the goal of moving beyond the current car-focussed mobility paradigm to one that combines sustainable, non-car services to fulfil transport needs. Each recommendation is linked with the related theme(s) that emerged from the focus groups and with the residential location(s) (i.e., the people within those locations) to which the recommendation is most applicable.

Table 4. Key findings and recommendations.

Key finding	**Recommendation**	**Relevant theme(s)**	**Most relevant group(s)**
Interacting issues of journey time, timetable coordination, and reliability represent major barriers to multi-modal travel.	At the strategic level, mandate timetable coordination between different transport service providers (Liu et al., 2021)	Timetable coordination and coverage; Critical reliability; Wait time dilemma	Peri-urban (Also urban and rural)
	Implement work policies to accept travel time on public transport as productive (Lyons et al., 2007)	Time	Peri-urban, (Also urban and rural)
The stacking of costs (of multiple services) is perceived as a major barrier when comparing to the perceived cost of car use.	Implement cross-service ticketing (i.e., unification) with price caps (including subsidy) (Hörcher & Tirachini, 2021)	Ticketing	All
	Educational / information interventions focussing on revealing the true cost of car ownership (Gössling et al., 2022)	Ticketing	All
People are put off by the complexities of multi-modal journeys and the ticket combinations required.	Implement joint journey planning and ticketing systems (such as MaaS) to support planning and undertaking complex journeys (Hensher et al., 2021)	Route and time planning Ticketing	Urban, Peri-urban
Difficulties accessing public transport networks hinder non-car travel.	Improve active travel infrastructure connecting rural areas with public transport nodes (Han et al., 2022)	Safety and comfort to reach public transport	Rural
	Expand shared micromobility schemes (including e-bikes and e-scooters) beyond the urban realm (Askarzadeh & Bridgelall, 2021)	Geographical network coordination and coverage	Rural
The combination of one controllable leg (i.e., private, on-demand, or share/hire systems) with one uncontrollable leg (e.g., traditional public transport) is highly preferred over combination of multiple uncontrollable legs*.	Ensure secure bike parking is implemented at all public transport network nodes (Heinen & Buehler, 2019)	Bike parking and theft	All[+]
	Provide better on-service facilities for transporting bikes, including by bus (Pucher & Buehler, 2009)	Bikes on public transport	All
	Improve active travel infrastructure connections to public transport nodes (Aldred, 2019)	Safety and comfort to reach public transport	All
	Implement car share and dynamic demand responsive transport schemes to support flexible access to public transport networks in rural areas (Coutinho et al., 2020)	Geographical network coordination and coverage	Rural

Notes: * Although not included in the 'Relevant theme' column (for brevity), supporting the combination of controllable (e.g., private bikes) and uncontrollable (e.g., trains) journey legs also contributes to addressing issues relating to *Time*, *Timetable coordination and coverage*, *Critical reliability*, and *Wait time dilemma*, with those issues most applicable to combinations of different traditional public transport services (e.g., bus and train).

[+] *Bike parking and theft* was less prominent in the responses of peri-urban residents; however, such groups may also be reasonably expected to benefit from interventions aimed at improving combinations of active travel and public transport (McIlroy, 2023).

5. Limitations and future work

Qualitative research is not usually overly concerned with the representativeness of samples; however, the research presented here has attempted to offer comparisons between groups. Representativeness therefore becomes of greater importance. The demographic make-up of the participant groups did largely reflect broader population statistics (gov.uk, 2023); however, recruitment occurred almost entirely online, via Facebook. The platform has a low representation of 18-25 year-olds and an over representation of females in the UK (NapoleonCat.com, 2023), both of which were reflected in this study's sample. This recruitment method also risks excluding less digitally literate individuals. The focus group method itself, being entirely online, also carries this risk (Tran et al., 2021). Importantly for the current study, digital literacy and accessibility are not equal across groups, with older individuals based in rural areas less digitally active than younger, urban-based individuals (ONS, 2019). This may have influenced representation across areas. Nevertheless, the benefits of using community Facebook groups to get regional representation at very low cost, and the benefits of the online focus group method in facilitating engagement from people unlikely to travel to in-person focus groups, outweigh these limitations.

This study has not considered demographics beyond a person's place of residence. A person's family situation, their disability status, their socioeconomic status, and their employment characteristics all affect transport behaviour, and age arises several times in the analyses and discussions presented above. To constrain focus, these have not been considered in this article. Transport is a highly gendered domain (Parnell et al., 2022), hence this is also a factor of significant interest, a point highlighted by Susilo and Cats (2014). Although not addressed above, it is highly likely that comments made by participants, particularly with regards to safety and security, will have differed between people of different genders. Moreover, gender was a characteristic on which focus group membership was based. To devote sufficient attention to the impact of residential location, this factor was not explored in this article. It is the focus of separate, on-going work.

Returning to disability and socioeconomic status, this information was not purposively gathered from participants in the demographic questionnaire but did come through in their comments (particularly comments concerning disability and accessibility). Group representation therefore becomes a factor, with the possibility that the self-selection bias is not equal between different groups. Access to transport itself may also represent an influential factor in a person's choice to participate in the study, with those more affected by

transport issues more likely to participate in such a study. This would have affected results. That said, self-selection bias is common across methods of this type (and others), with no data existing that suggest AOFGs are less or more prone to this bias.

Although a detailed treatment is beyond the scope of this article, it is worth briefly discussing some of the limitations (or characteristics) of the AOFG method itself and its use here. The choice to aim for 10-15 participants per group was discussed above (in line with other AOFG research; LaForge et al., 2022; Williams et al., 2012); however, this did lead to large conversations comprising many forum posts within each group. It was also the case that most participants provided only one response. Although there were instances of participants directly responding to others' comments (by using a website feature to 'quote' another's post), only a small number of individuals typically did this (perhaps those already more comfortable with the use of internet forums). In this sense, it is possible that a questionnaire survey comprising open-ended questions may have generated comparable data. That said, earlier posts did influence the content of latter ones, even if participants did not use the 'quote' function (e.g., *"I agree with the post about hard to get a bike on a train"* fp13).

In the traditional, in-person focus group, discussion is stimulated not only by participant-participant interaction, but by input from the research team (via prompts and probes, seeking clarification or further discussion of issues of interest). This *can* be done in the AOFG context but was not in the present study. This was to allow the discussion to be driven only by participants. The AOFG approach as used here avoids the potential for the periods of (at best unproductive, at worst awkward) silence that can occur during an in-person focus group, hence researcher input is not *required* in the same way as it is in a traditional focus group. Nevertheless, the potential for researcher input to have generated further results of interest is acknowledged.

One aspect that was not explored in depth in the analyses presented above was the extent to which themes interacted with each other. As mentioned above, some themes were often co-present, for example the *Time*, *Timetable coordination*, and *Critical reliability* themes. A focussed exploration of these interactions, perhaps via the use of network analysis methods, would likely yield interesting results. Indeed, such analysis techniques have previously been used in the analysis of textual data taken from asynchronous online discussions (Rolim et al., 2019). This was, however, beyond the scope of the current study, hence represents an avenue for future work.

When situating a study in a specific context, there will always be questions of transferability. Although no two places are wholly alike, the demographic characteristics of

the sample were largely representative of the wider UK population, as was the geographical nature of the study region, comprising dense urban areas that expand into peri-urban fringes populated by commuting populations, beyond which are dispersed, semi-rural villages poorly connected by public transport. Moreover, the themes raised by participants of this research resonated strongly with discussions found elsewhere in the literature (as discussed above). Although every place has its own unique features which deserve consideration (notably the inclusion of the Isle of Wight in this study's region of interest), results presented above are therefore expected to be largely transferable.

Finally, a brief mention of the reliability and validity of this type of qualitative, thematic analysis is warranted. Inter-rater reliability was calculated, with results suggesting the thematic coding scheme to be a suitable representation of the concepts emerging from the discussions (McHugh, 2012). That said, it should be acknowledged that had another individual performed the analyses, results would likely have been different. This is not a criticism of qualitative research, rather a characteristic, with two distinct views of the same data able to be different whilst also both being valid and insightful.

6. Summary and conclusions

A sizable body of literature exists that explores the determinants of mode choice and the decision-making processes therein. Much of this, however, compares individual transport modes without considering multi-modal travel (Clauss & Döppe, 2016). Work on multi-modal journeys has more often taken a quantitative approach (Susilo & Cats, 2014), hence may miss influential factors, and none (to this author's knowledge) explores the issue with regards to a person's place of residence.

To address these gaps in the literature, a series of asynchronous online focus groups were held with 146 residents of a region comprising three cities, parts of two national parks, and an island reached by a famously expensive ferry crossing. Considering responses in terms of urban, peri-urban, and rural distinctions gave an overall picture of challenges shared, with the time incurred, the difficulties in synchronising timetables, and the criticality of each leg's reliability being major challenges for multi-modal journeys. As one respondent put it, *"any reasons not to use public transport are squared, not doubled, when using multiple"* (mixp8).

Some differences were noted, with those in rural areas more affected by basic service provision and the physical linking of different modes. Expanding the availability of shared micromobility (for example e-scooters), a mode that is currently unavailable in the rural areas

included in this research's study region, may combat this issue. It would also overcome the control issue highlighted whereby users were more likely to consider combining a controllable mode (e.g., a private or shared/hired vehicle) with an uncontrollable one (e.g., bus or train) over the combination of two uncontrollable modes. This would not, however, overcome challenges around the safety with which one can reach the public transport network, also of greater importance to rural residents. This points to the need to improve active travel infrastructure in rural areas, where the potential to combine bicycle and train journeys is hampered by a perception that it is currently unsafe to travel by bike.

Of greater significance for urban and peri-urban residents were the complexities around planning a multi-modal journey where there are multiple options available. This highlights the potential for combined journey planning and ticketing apps to facilitate such travel and therefore contribute to a more sustainable transport system. Participants from those areas also cited safety at stations and stops as a greater concern. Information on safety (including, e.g., staffing, lighting, CCTV) could be incorporated into such an app; however, reaching less digitally literature populations remains a challenge.

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8. References

Aldred, R. (2019). Built environment interventions to increase active travel: A critical review and discussion. *Current environmental health reports*, *6*, 309-315.

Alkubati, M. A., Khalifa, N. A., & Al-barakani, H. A. (2023). An overview of public transport reliability studies using a bibliometric analysis. *Ain Shams Engineering Journal*, *14*(3), 101908. https://doi.org/https://doi.org/10.1016/j.asej.2022.101908

Alyavina, E., Nikitas, A., & Tchouamou Njoya, E. (2020). Mobility as a service and sustainable travel behaviour: A thematic analysis study. *Transportation Research Part F: Traffic Psychology and Behaviour*, *73*, 362-381. https://doi.org/https://doi.org/10.1016/j.trf.2020.07.004

An, Z., Heinen, E., & Watling, D. (2022). Multimodal travel behaviour, attitudes, and cognitive dissonance. *Transportation Research Part F: Traffic Psychology and Behaviour*, *91*, 260-273. https://doi.org/https://doi.org/10.1016/j.trf.2022.10.007

Askarzadeh, T., & Bridgelall, R. (2021). Micromobility station placement optimization for a rural setting. *Journal of Advanced Transportation*, *2021*, 1-10.

Bao, H. X. H., & Lim, Y. (2022). Behavioural interventions for micro-mobility adoption: Low-hanging fruits or hard nuts to crack? *Transportation Research Part F: Traffic Psychology and Behaviour*, *84*, 423-441. https://doi.org/https://doi.org/10.1016/j.trf.2021.12.011

Bennett, K. J., Borders, T. F., Holmes, G. M., Kozhimannil, K. B., & Ziller, E. (2019). What is rural? Challenges and implications of definitions that inadequately encompass rural people and places. *Health Affairs*, *38*(12), 1985-1992.

Biernat, E., Buchholtz, S., & Bartkiewicz, P. (2018). Motivations and barriers to bicycle commuting: Lessons from Poland. *Transportation Research Part F: Traffic Psychology and Behaviour*, *55*, 492-502. https://doi.org/https://doi.org/10.1016/j.trf.2018.03.024

Bozovic, T., Stewart, T., Hinckson, E., & Smith, M. (2021). Clearing the path to transcend barriers to walking: Analysis of associations between perceptions and walking behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour*, *77*, 197-208. https://doi.org/https://doi.org/10.1016/j.trf.2021.01.003

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Cascajo, R., Lopez, E., Herrero, F., & Monzon, A. (2019). User perception of transfers in multimodal urban trips: A qualitative study. *International Journal of Sustainable Transportation*, *13*(6), 393-406. https://doi.org/10.1080/15568318.2018.1476632

Chaloux, N., Boisjoly, G., Grisé, E., El-Geneidy, A., & Levinson, D. (2019). I only get some satisfaction: Introducing satisfaction into measures of accessibility. *Transportation Research Part F: Traffic Psychology and Behaviour*, *62*, 833-843. https://doi.org/https://doi.org/10.1016/j.trf.2019.03.008

Chauhan, V., Gupta, A., & Parida, M. (2021). Demystifying service quality of Multimodal Transportation Hub (MMTH) through measuring users' satisfaction of public transport. *Transport Policy*, *102*, 47-60. https://doi.org/https://doi.org/10.1016/j.tranpol.2021.01.004

Chien, S., & Schonfeld, P. (1998). Joint optimization of a rail transit line and its feeder bus system [https://doi.org/10.1002/atr.5670320302]. *Journal of Advanced Transportation*, *32*(3), 253-284. https://doi.org/https://doi.org/10.1002/atr.5670320302

Clauss, T., & Döppe, S. (2016). Why do urban travelers select multimodal travel options: A repertory grid analysis. *Transportation Research Part A: Policy and Practice*, *93*, 93-116. https://doi.org/https://doi.org/10.1016/j.tra.2016.08.021

Cooper, E., & Vanoutrive, T. (2022). Does MaaS address the challenges of multi-modal mothers? User perspectives from Brussels, Belgium. *Transport Policy*, *127*, 130-138. https://doi.org/https://doi.org/10.1016/j.tranpol.2022.08.021

Coutinho, F. M., van Oort, N., Christoforou, Z., Alonso-González, M. J., Cats, O., & Hoogendoorn, S. (2020). Impacts of replacing a fixed public transport line by a demand responsive transport system: Case study of a rural area in Amsterdam. *Research in Transportation Economics*, *83*, 100910.

Daniels, R., & Mulley, C. (2013). Explaining walking distance to public transport

The dominance of public transport supply. *Journal of Transport and Land Use*, *6*(2), 5-20. http://www.jstor.org/stable/26202654

De Vos, J. (2019). Satisfaction-induced travel behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour*, *63*, 12-21. https://doi.org/https://doi.org/10.1016/j.trf.2019.03.001

De Vos, J., Schwanen, T., Van Acker, V., & Witlox, F. (2015). How satisfying is the Scale for Travel Satisfaction? *Transportation Research Part F: Traffic Psychology and Behaviour*, *29*, 121-130. https://doi.org/https://doi.org/10.1016/j.trf.2015.01.007

De Vos, J., Singleton, P. A., & Gärling, T. (2022). From attitude to satisfaction: introducing the travel mode choice cycle. *Transport Reviews*, *42*(2), 204-221. https://doi.org/10.1080/01441647.2021.1958952

DEFRA. (2021). *Rural population and migration*. Department for Environment and Rural Affairs. Retrieved 09/12/2022 from https://www.gov.uk/government/statistics/rural-population-and-migration/rural-population-and-migration

dell'Olio, L., Ibeas, A., Cecín, P., & dell'Olio, F. (2011). Willingness to pay for improving service quality in a multimodal area. *Transportation Research Part C: Emerging Technologies*, *19*(6), 1060-1070. https://doi.org/https://doi.org/10.1016/j.trc.2011.06.004

Department for Transport. (2021). *Journey time statistics, England: 2019*. Retrieved 06/03/2023 from https://www.gov.uk/government/statistics/journey-time-statistics-england-2019#:~:text=In%202019%2C%20the%20average%20minimum,by%20public%20transport%20or%20walking

Dichabeng, P., Merat, N., & Markkula, G. (2021). Factors that influence the acceptance of future shared automated vehicles – A focus group study with United Kingdom drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, *82*, 121-140. https://doi.org/https://doi.org/10.1016/j.trf.2021.08.009

Dymitrow, M., & Stenseke, M. (2016). Rural-urban blurring and the subjectivity within. *Rural landscapes: Society, environment, history*, *3*(1).

Espino, R., & Román, C. (2020). Valuation of transfer for bus users: The case of Gran Canaria. *Transportation Research Part A: Policy and Practice*, *137*, 131-144. https://doi.org/https://doi.org/10.1016/j.tra.2020.05.003

European Commission. (2015). *INSPIRE registry: peri urban areas*. Retrieved 22/03/2023 from https://inspire.ec.europa.eu/codelist/SupplementaryRegulationValue/7_1_4_7_PeriUrbanAreas

European Commission. (2018). *2018 - Year of Multimodality*. Retrieved 24/03/2023 from https://transport.ec.europa.eu/transport-themes/logistics-and-multimodal-transport/2018-year-multimodality_en#:~:text=To%20support%20these%20aims%20EU,for%20the%20EU%20transport%20system.

Eyre, N., & Killip, G. (2019). *Shifting the focus: energy demand in a net-zero carbon UK*. Centre for Research into Energy Demand Solutions.

Fearnley, N., Johnsson, E., & Berge, S. H. (2020). Patterns of e-scooter use in combination with public transport. *Findings*.

Fishman, E., Washington, S., & Haworth, N. (2012). Barriers and facilitators to public bicycle scheme use: A qualitative approach. *Transportation Research Part F: Traffic Psychology and Behaviour*, *15*(6), 686-698. https://doi.org/https://doi.org/10.1016/j.trf.2012.08.002

Gardner, B., & Abraham, C. (2007). What drives car use? A grounded theory analysis of commuters' reasons for driving. *Transportation Research Part F: Traffic Psychology and Behaviour*, *10*(3), 187-200.

Geffen, R. (2021). *Government's "innovative" rural transport plans overlook the basics*. CyclingUK. Retrieved 24/03/2023 from https://www.cyclinguk.org/blog/governments-innovative-rural-transport-plans-overlook-basics

Gordon, A. R., Calzo, J. P., Eiduson, R., Sharp, K., Silverstein, S., Lopez, E., Thomson, K., & Reisner, S. L. (2021). Asynchronous Online Focus Groups for Health Research: Case Study and Lessons Learned. *International Journal of Qualitative Methods*, *20*, 1609406921990489. https://doi.org/10.1177/1609406921990489

Gössling, S., Kees, J., & Litman, T. (2022). The lifetime cost of driving a car. *Ecological Economics*, *194*, 107335.

gov.uk. (2023). *Official Statistics: Population Age Profile*. Retrieved 05/072023 from https://www.gov.uk/government/statistics/population-statistics-for-rural-england/b-population-age-profile#:~:text=The%20average%20age%20in%20Rural,for%20England%20of%2040.3%20years.

Grison, E., Burkhardt, J.-M., & Gyselinck, V. (2017). How do users choose their routes in public transport? The effect of individual profile and contextual factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, *51*, 24-37. https://doi.org/https://doi.org/10.1016/j.trf.2017.08.011

Groth, S., Hunecke, M., & Wittowsky, D. (2021). Middle-Class, Cosmopolitans and Precariat among Millennials between Automobility and Multimodality. *Transportation Research Interdisciplinary Perspectives*, *12*, 100467. https://doi.org/https://doi.org/10.1016/j.trip.2021.100467

Han, L., Wang, Y., Ao, Y., Ding, X., Li, M., & Wang, T. (2022). The built environment impacts on route choice from home to school for rural students: A stated preference experiment. *Frontiers in public health*, *10*, 1087467.

Heinen, E., & Buehler, R. (2019). Bicycle parking: a systematic review of scientific literature on parking behaviour, parking preferences, and their influence on cycling and travel behaviour. *Transport Reviews*, *39*(5), 630-656.

Hensher, D. A., Ho, C. Q., & Reck, D. J. (2021). Mobility as a service and private car use: Evidence from the Sydney MaaS trial. *Transportation Research Part A: Policy and Practice*, *145*, 17-33.

Hidayati, I., Tan, W., & Yamu, C. (2020). How gender differences and perceptions of safety shape urban mobility in Southeast Asia. *Transportation Research Part F: Traffic Psychology and Behaviour*, *73*, 155-173. https://doi.org/https://doi.org/10.1016/j.trf.2020.06.014

Hiscock, R., Macintyre, S., Kearns, A., & Ellaway, A. (2002). Means of transport and ontological security: Do cars provide psycho-social benefits to their users? *Transportation Research Part D: Transport and Environment*, *7*(2), 119-135. https://doi.org/https://doi.org/10.1016/S1361-9209(01)00015-3

Hocutt, M. A., & Stone, T. H. (1998). The impact of employee empowerment on the quality of a service recovery effort. *Journal of quality management*, *3*(1), 117-132.

Hörcher, D., & Tirachini, A. (2021). A review of public transport economics. *Economics of Transportation*, *25*, 100196. https://doi.org/https://doi.org/10.1016/j.ecotra.2021.100196

Huwer, U. (2004). Public transport and car-sharing—benefits and effects of combined services. *Transport Policy*, *11*(1), 77-87. https://doi.org/https://doi.org/10.1016/j.tranpol.2003.08.002

Im, E.-O. (2006). White cancer patients' perception of gender and ethnic differences in pain experience. *Cancer Nursing*, *29*(6), 441.

IPCC. (2023). *Synthesis report of the sixth IPCC assessment report (IP6)*. https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_LongerReport.pdf

Isle of Wight Guru. (2022). *Is the Solent the most expensive ferry crossing in the world?* Retrieved 10/03/2023 from https://www.isleofwightguru.co.uk/blog/is-the-solent-the-most-expensive-ferry-crossing-in-the-world

Jacob, S., & Luloff, A. E. (1995). Exploring the Meaning of Rural Through Cognitive Maps 1. *Rural Sociology*, *60*(2), 260-273.

Jain, T., Rose, G., & Johnson, M. (2021). “Don’t you want the dream?”: Psycho-social determinants of car share adoption. *Transportation Research Part F: Traffic Psychology and Behaviour*, *78*, 226-245. https://doi.org/https://doi.org/10.1016/j.trf.2021.02.008

Joinson, A. N. (2003). Understanding the psychology of Internet behaviour: Virtual worlds, real lives. *Revista iberoamericana de educación a distancia*, *6*(2), 190.

Kang, A. S., Jayaraman, K., Soh, K.-L., & Wong, W. P. (2019). Convenience, flexible service, and commute impedance as the predictors of drivers’ intention to switch and behavioral readiness to use public transport. *Transportation Research Part F: Traffic Psychology and Behaviour*, *62*, 505-519. https://doi.org/https://doi.org/10.1016/j.trf.2019.02.005

Kaufmann, V., Bergman, M. M., & Joye, D. (2004). Motility: mobility as capital. *International Journal of Urban and Regional Research*, *28*(4), 745-756. https://doi.org/https://doi.org/10.1111/j.0309-1317.2004.00549.x

Kuo, Y.-H., Leung, J. M. Y., & Yan, Y. (2023). Public transport for smart cities: Recent innovations and future challenges. *European Journal of Operational Research*, *306*(3), 1001-1026. https://doi.org/https://doi.org/10.1016/j.ejor.2022.06.057

LaForge, K., Gray, M., Stack, E., Livingston, C. J., & Hildebran, C. (2022). Using Asynchronous Online Focus Groups to Capture Healthcare Professional Opinions. *International Journal of Qualitative Methods*, *21*, 16094069221095658. https://doi.org/10.1177/16094069221095658

Lättman, K., Olsson, L. E., & Friman, M. (2018). A new approach to accessibility – Examining perceived accessibility in contrast to objectively measured accessibility in daily travel. *Research in Transportation Economics*, *69*, 501-511. https://doi.org/https://doi.org/10.1016/j.retrec.2018.06.002

Liu, Q., Liu, Z., An, Z., Zhao, P., & Zhao, D. (2022). A modal shift due to a free within-destination tourist bus scheme: Multimodality and transport equity implications. *Research in Transportation Business & Management*, 100863. https://doi.org/https://doi.org/10.1016/j.rtbm.2022.100863

Liu, T., Cats, O., & Gkiotsalitis, K. (2021). A review of public transport transfer coordination at the tactical planning phase. *Transportation Research Part C: Emerging Technologies*, *133*, 103450.

Lovelace, R., Goodman, A., Aldred, R., Berkoff, N., Abbas, A., & Woodcock, J. (2017). The Propensity to Cycle Tool: An open source online system for sustainable transport planning. *Journal of Transport and Land Use*, *10*(1), 505-528.

Lyons, G., Hammond, P., & Mackay, K. (2019). The importance of user perspective in the evolution of MaaS. *Transportation Research Part A: Policy and Practice*, *121*, 22-36. https://doi.org/https://doi.org/10.1016/j.tra.2018.12.010

Lyons, G., Jain, J., & Holley, D. (2007). The use of travel time by rail passengers in Great Britain. *Transportation Research Part A: Policy and Practice*, *41*(1), 107-120. https://doi.org/https://doi.org/10.1016/j.tra.2006.05.012

Mann, E., & Abraham, C. (2006). The role of affect in UK commuters' travel mode choices: An interpretative phenomenological analysis. *British journal of psychology*, *97*(2), 155-176.

Martens, K. (2004). The bicycle as a feedering mode: experiences from three European countries. *Transportation Research Part D: Transport and Environment*, *9*(4), 281-294. https://doi.org/https://doi.org/10.1016/j.trd.2004.02.005

Martens, K. (2007). Promoting bike-and-ride: The Dutch experience. *Transportation Research Part A: Policy and Practice*, *41*(4), 326-338. https://doi.org/https://doi.org/10.1016/j.tra.2006.09.010

Matyas, M. (2020). Opportunities and barriers to multimodal cities: lessons learned from in-depth interviews about attitudes towards mobility as a service. *European Transport Research Review*, *12*(1), 7. https://doi.org/10.1186/s12544-020-0395-z

McHugh, M. L. (2012). Interrater reliability: the kappa statistic. *Biochemia medica*, *22*(3), 276-282.

McIlroy, R. C. (2023). *Why Is Car Access Important to Commuters and What Could Help Them Use Other Modes of Transport?: An Analysis of Responses to a University Staff Travel Survey (No. TRBAM-23-00229)* Transportation Research Board, 8th to 12th of January 2023, Washington, DC.

Meng, L., Somenahalli, S., & Berry, S. (2020). Policy implementation of multi-modal (shared) mobility: review of a supply-demand value proposition canvas. *Transport Reviews*, *40*(5), 670-684. https://doi.org/10.1080/01441647.2020.1758237

Molin, E., Mokhtarian, P., & Kroesen, M. (2016). Multimodal travel groups and attitudes: A latent class cluster analysis of Dutch travelers. *Transportation Research Part A: Policy and Practice*, *83*, 14-29. https://doi.org/https://doi.org/10.1016/j.tra.2015.11.001

Morton, C., Caulfield, B., & Anable, J. (2016). Customer perceptions of quality of service in public transport: Evidence for bus transit in Scotland. *Case Studies on Transport Policy*, *4*(3), 199-207.

Mounce, R., Beecroft, M., & Nelson, J. D. (2020). On the role of frameworks and smart mobility in addressing the rural mobility problem. *Research in Transportation Economics*, *83*, 100956.

Mulley, C., Nelson, J. D., Ho, C., & Hensher, D. A. (2023). MaaS in a regional and rural setting: Recent experience. *Transport Policy*, *133*, 75-85. https://doi.org/https://doi.org/10.1016/j.tranpol.2023.01.014

NapoleonCat.com. (2023). *Facebook users in United Kingdom February 2023*. Retrieved 09/03/2023 from https://napoleoncat.com/stats/facebook-users-in-united_kingdom/2023/02/

Narayanan, S., & Antoniou, C. (2023). Shared mobility services towards Mobility as a Service (MaaS): What, who and when? *Transportation Research Part A: Policy and Practice*, *168*, 103581. https://doi.org/https://doi.org/10.1016/j.tra.2023.103581

Office for National Statistics. (2023). *How life has changed on the Isle of Wight: Census 2021*. Retrieved 07/03/2023 from https://www.ons.gov.uk/visualisations/censusareachanges/E06000046/

ONS. (2019). *Exploring the UK's digital divide*. Retrieved 05/07/2023 from file:///Users/richmcilroy/Downloads/Exploring%20the%20UK%20s%20digital%20divide.pdf

ONS. (2023). *Census maps*. Retrieved 05/07/2023 from https://www.ons.gov.uk/census/maps/choropleth/housing/number-of-cars-or-vans/number-of-cars-5a/no-cars-or-vans-in-household?msoa=E02004795

Parnell, K. J., Pope, K. A., Hart, S., Sturgess, E., Hayward, R., Leonard, P., & Madeira-Revell, K. (2022). 'It's a man's world': a gender-equitable scoping review of gender, transportation, and work. *Ergonomics*, *65*(11), 1537-1553. https://doi.org/10.1080/00140139.2022.2070662

Pawełoszek, I. (2022). Towards a Smart City—The Study of Car-Sharing Services in Poland. *Energies*, *15*(22).

Pearson, L., Reeder, S., Gabbe, B., & Beck, B. (2023). What a girl wants: A mixed-methods study of gender differences in the barriers to and enablers of riding a bike in Australia. *Transportation Research Part F: Traffic Psychology and Behaviour*, *94*, 453-465. https://doi.org/https://doi.org/10.1016/j.trf.2023.03.010

Pigeon, C., Alauzet, A., & Paire-Ficout, L. (2021). Factors of acceptability, acceptance and usage for non-rail autonomous public transport vehicles: A systematic literature review. *Transportation Research Part F: Traffic Psychology and Behaviour*, *81*, 251-270. https://doi.org/https://doi.org/10.1016/j.trf.2021.06.008

Pikora, T. J., Giles-Corti, B., Knuiman, M. W., Bull, F. C., Jamrozik, K., & Donovan, R. J. (2006). Neighborhood environmental factors correlated with walking near home: Using SPACES. *Medicine and science in sports and exercise*, *38*(4), 708-714.

Pot, F. J., Koster, S., Tillema, T., & Jorritsma, P. (2020). Linking experienced barriers during daily travel and transport poverty in peripheral rural areas: the case of Zeeland, the Netherlands. *European journal of transport and infrastructure research*, *20*(3), 29-46.

Pritchard, J. (2022). MaaS to pull us out of a car-centric orbit: Principles for sustainable Mobility-as-a-Service in the context of unsustainable car dependency. *Case Studies on Transport Policy*, *10*(3), 1483-1493. https://doi.org/https://doi.org/10.1016/j.cstp.2022.08.004

Pucher, J., & Buehler, R. (2009). Integrating Bicycling and Public Transport in North America. *Journal of Public Transportation*, *12*(3), 79-104. https://doi.org/https://doi.org/10.5038/2375-0901.12.3.5

Ramos, S., Vicente, P., Passos, A. M., Costa, P., & Reis, E. (2019). Perceptions of the Public Transport Service as a Barrier to the Adoption of Public Transport: A Qualitative Study. *Social Sciences*, *8*(5), 150. https://www.mdpi.com/2076-0760/8/5/150

Reisner, S. L., Randazzo, R. K., White Hughto, J. M., Peitzmeier, S., DuBois, L. Z., Pardee, D. J., Marrow, E., McLean, S., & Potter, J. (2018). Sensitive health topics with underserved patient populations: Methodological considerations for online focus group discussions. *Qualitative health research*, *28*(10), 1658-1673.

Rolim, V., Mello, R. F. L. d., Kovanovic, V., & Gaševic, D. (2019, 15-18 July 2019). Analysing Social Presence in Online Discussions Through Network and Text Analytics. 2019 IEEE 19th International Conference on Advanced Learning Technologies (ICALT),

Semenescu, A., & Coca, D. (2022). Why people fail to bike the talk: Car dependence as a barrier to cycling. *Transportation Research Part F: Traffic Psychology and Behaviour*, *88*, 208-222. https://doi.org/https://doi.org/10.1016/j.trf.2022.05.025

Solent Transport. (2019). Solent Mobility Zone: Future Mobility Zone Fund Expression of Interest. In.

Soza-Parra, J., Raveau, S., Muñoz, J. C., & Cats, O. (2019). The underlying effect of public transport reliability on users' satisfaction. *Transportation Research Part A: Policy and Practice*, *126*, 83-93. https://doi.org/https://doi.org/10.1016/j.tra.2019.06.004

St-Louis, E., Manaugh, K., van Lierop, D., & El-Geneidy, A. (2014). The happy commuter: A comparison of commuter satisfaction across modes. *Transportation Research Part F: Traffic Psychology and Behaviour*, *26*, 160-170. https://doi.org/https://doi.org/10.1016/j.trf.2014.07.004

Stewart, K., & Williams, M. (2005). Researching online populations: the use of online focus groups for social research. *Qualitative Research*, *5*(4), 395-416.

Stonewall. (2022). *The truth about trans*. Retrieved 09/12/2022 from https://www.stonewall.org.uk/the-truth-about-trans#:~:text=The%20best%20estimate%20at%20the,population%20of%20over%2060%20million.

Stradling, S. G., Anable, J., & Carreno, M. (2007). Performance, importance and user disgruntlement: A six-step method for measuring satisfaction with travel modes. *Transportation Research Part A: Policy and Practice*, *41*(1), 98-106.

Sundling, C., & Ceccato, V. (2022). The impact of rail-based stations on passengers' safety perceptions. A systematic review of international evidence. *Transportation Research Part F: Traffic Psychology and Behaviour*, *86*, 99-120. https://doi.org/https://doi.org/10.1016/j.trf.2022.02.011

Susilo, Y. O., & Cats, O. (2014). Exploring key determinants of travel satisfaction for multi-modal trips by different traveler groups. *Transportation Research Part A: Policy and Practice*, *67*, 366-380. https://doi.org/https://doi.org/10.1016/j.tra.2014.08.002

Sweet, C. (2001). Designing and conducting virtual focus groups. *Qualitative Market Research: An International Journal*.

Thomas, G. O., & Walker, I. (2015). Users of different travel modes differ in journey satisfaction and habit strength but not environmental worldviews: A large-scale survey of drivers, walkers, bicyclists and bus users commuting to a UK university. *Transportation Research Part F: Traffic Psychology and Behaviour*, *34*, 86-93. https://doi.org/https://doi.org/10.1016/j.trf.2015.07.016

Tran, B., Rafinejad-Farahani, B., Moodie, S., O'Hagan, R., & Glista, D. (2021). A scoping review of virtual focus group methods used in rehabilitation sciences. *International Journal of Qualitative Methods*, *20*, 16094069211042227.

van Soest, D., Tight, M. R., & Rogers, C. D. F. (2019). Exploring transport perceptions across urban areas using free associations. *Transportation Research Part F: Traffic Psychology and Behaviour*, *65*, 316-333. https://doi.org/https://doi.org/10.1016/j.trf.2019.08.005

Vinagre Díaz, J. J., Fernández Pozo, R., Rodríguez González, A. B., Wilby, M. R., & Anvari, B. (2023). Blind classification of e-scooter trips according to their relationship with public transport. *Transportation*, 1-22.

Weliwitiya, H., Rose, G., & Johnson, M. (2019). Bicycle train intermodality: Effects of demography, station characteristics and the built environment. *Journal of Transport Geography*, *74*, 395-404. https://doi.org/https://doi.org/10.1016/j.jtrangeo.2018.12.016

Williams, S., Clausen, M. G., Robertson, A., Peacock, S., & McPherson, K. (2012). Methodological Reflections on the Use of Asynchronous Online Focus Groups in Health Research. *International Journal of Qualitative Methods*, *11*(4), 368-383. https://doi.org/10.1177/160940691201100405

Zhang, S., Ceder, A. A., & Cao, Z. (2020). Integrated optimization for feeder bus timetabling and procurement scheme with consideration of environmental impact. *Computers & Industrial Engineering*, *145*, 106501. https://doi.org/https://doi.org/10.1016/j.cie.2020.106501