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Understanding the exclusion issues of Mobility-as-a-Service (MaaS): the potential problems of older travellers' involvement

Yuanjun Li, Sharon Cook and Andrew May

Loughborough Design School, Leicestershire, UK
y.li5@lboro.ac.uk

Abstract. A series of pilots and service fragments of Mobility-as-a-Service have launched out in recent years, but it is generally recognized as is still on the early stage of its development, whether in terms of the service concept and framework, the level of urban construction and the acceptance of travellers. According to the earlier study of MaaS in a workshop in middle England, the result referred to the lack of consensus and mismatch of value propositions among stakeholders, which leads to the early market has not fully considered the requirements of the older travellers. Therefore, this study reviews previous literatures and summarized the logic relation of the relevant key influencing factors, in order to provide the evidence for future sustainable development of MaaS on the aspect of increasing older travellers' social participation.

Keywords: Mobility-as-a-Service, Service development, Design for the Elderly.

1 Introduction

Mobility-as-a-Service (MaaS) is an emerging concept in the field of transportation in recent years. It was firstly proposed by Hietanen (2014) and has developed fast since then. Various pilots around the world are paving the way for exploring the transformation of future transport eco-system, while the definition of MaaS concept itself has also experiencing continuously upgrades. According to the early proposal of MaaS, it refers to the integration of different transports and information from both private and public sectors (Hietanene, 2014; Datson, 2016; Hilgert et al., 2016), which is expected to become an alternative choice for people to travel rather than owning a car (Melis et al., 2016&2018). It can be expected to relieve the traffic congestion on urban road and increase the efficiency of transport system (EI Anrwi et al., 2017; Wong et al., 2018). By using MaaS, users can obtain the seamless travel experience with higher added value and lower price (Melis et al., 2016), and have more flexibility to meet their individual lifestyle (Atkins, 2015; Hilgert et al., 2016).

Basing on the digital platform (Jittrapirom et al, 2017; Li and Voegel, 2017), MaaS is proved to have the younger generations (Jittrapirom et al, 2018) and the people who used to take multi-modal transports (Jittrapirom et al, 2018; Ho et al., 2018; Alonso-González et al., 2017) as the early adopters, whose trip purposes are mainly for commuting and business (Jittrapirom et al, 2018). However, since there is no truly complete MaaS service has been launched yet, the evidence is limited about the acceptance level of different user groups (Ho et al., 2018), and it's unable to detail users' requirements on various experience context (Giesecke et al., 2016). For the older travellers - who are predicted to be less likely using MaaS (Jittrapirom et al., 2018), they will not only have difficulties with interface interaction due to certain physical condition decrease, but will also have challenges to change their original life style.

Since it will require cognitive and affective efforts of them in preparing for and undertaking a journey (Stradling, 2006; Lyons et al., 2019), commenters suggest that MaaS will intentionally nudging people's behaviour (Smith et al., 2018), it's worthy to consider whether this innovation is responsible (Stilgoe et al., 2013; Lyons et al., 2019; Pangbourne et al., 2018) that will not hurt the trust of customers or cause unnecessary exclusion. Therefore, this paper aims to provide the relevant evidence and sort out the logic relation that described but not have been summarized from the previous studies for subsequent sustainable design in the early stage of MaaS service development, and then bring forward the key factors for further consideration.

Through the literature review, this paper firstly observed the contradiction of current older people's travel pattern and the expected vision proposed by MaaS, and found a series of uncertainties caused by the lack of evidence and knowledges which could make the older people getting excluded from the new service. On this basis, an exploring study focused on the stakeholders in MaaS eco-system was launched to understand whether this situation is actually happen, will happen in the future, and what is the reason for it. At last, combined with the literature and the data obtained, insights are proposed for later service iteration of MaaS, in order to increase older travellers' involvement.

2 The Dimensions of MaaS's Impacts on Mobility

2.1 Individual Mobility and Urban Mobility

According to Suen and Mitchell (2000), "mobility" means having transport services going where and when one wants to travel; being informed about the services; knowing how to use them; being able to use them; and having the means to pay for them. But as mobility itself is ambiguous to define, a popular way to assess it, is by trip rate (Alsnih et al. 2003), while the trips basically refer to the original end-to-end journey undertaking with activities or specific purpose.

In literatures, mobility is often understood as Individual Mobility and Urban Mobility. Individual Mobility relates to one's specific ability, such as walking, grasping, climbing stairs and etc. To a broader concept, it could also reflect in the movement outdoors and the use of transportation, for example accessing shops, services and facilities in the community and participating in social and cultural activities (WHO, 2015; Rantanen, 2013); Urban Mobility, refers to the number of personal kilometres travelled per annum, is predicted to be tripled in 2010-2050, and accounts for the proportion of 64% of total mobility. It indicates that if current trends continue, the transport system will breakdown (Lerner et al., 2012). Given this, MaaS was proposed as not only a new service, but the adjustment and reconstruction of supply chain (Kamargianni and Matyas., 2017) to reshape urban transport eco-system with disruptive innovation (Matyas and Kamargianni., 2017) and encourage travellers to change their original travel pattern to achieve the urban sustainable purpose.

However, Individual and Urban Mobility may not share the same goal, especially during the dynamic transition phase. Travellers are required to adapt to the new service to match personal demand, while the service also need to learn from travellers' changing preference to iterate service. But from current situation, the process of mutual learning has not been taken seriously due to the lack of experience, knowledge and research framework.

2.2 Older Travellers' Requirements of Mobility

Maslow (1954)'s Hierarchy of Needs (Figure 1) explains that each need must be satisfied at a lower level before they progress to higher (McLeod, 2007). On this basis, CATAPULT (2015) refined this model specifically to travellers' needs (Figure 2).

Fig. 1. Maslow's Hierarchy of Needs
(McLeod, 2007)

Fig. 2. Hierarchy of Traveller Needs
(CATAPULT, 2015)

It can be seen from the two figures above that the meaning of “good mobility service” should remove the original travel pain-points without adding new pain-points. Travellers should get a pleasant experience during the journey and then could be provided with the possibility to achieve the ideal lifestyle. ICF (Broome et al., 2009) believes that activities and participation are the basis of healthy life, while the UK and WHO also highlight the significance of independent and free travel in aging-friendly society in the policies (Shrestha et al., 2017), as it is the way to realize self-worth. However, limited by the use of private car and public transports, some older travellers would be gradually isolated from society (Engels and Liu, 2011) that directly affect their quality of life (QoL) (Marin-Lamellet and Haustein., 2015).

When growing older, people might have less transport options available, for example, the car use decrease after the aged of 55 (Mollenkopf et al., 2005), and the travel distance that relates to the retirement age (Bakaba and Ortlepp, 2010) would also decrease. There are a large number of literatures has proved that the majority elderly users are relying on personal transport (Buehler et al., 2010; Newbold et al., 2005; Alsnih et al., 2003), many researches therefore focused on the topics as safer driving of senior drivers (Li et al., 2003; Lyman at al., 2002; Whelan et al., 2006) and travel mode conversion from driving to taking public transport (Kockelman, 1997), but haven't go further to explore the relationship of lifestyle and travel motivation (Lu et al., 2016; Stradling et al., 2006; Lyons et al., 2019), and its reflection on overall travel pattern (Goulias, 2000; Doherty, 2000). As shown in Figure 3, studying older travellers' regiments of mobility requires an understanding of their environment and the value proposition. These factors constitute the context in which older travellers are placed and determine how they act and plan their daily lives.

Fig. 3. Context Diagram of Travel Pattern

In the trend of integrated transportation represented by MaaS, even an increasing number of pilots launched, relevant studies have not yet subdivided the research objects according to individual factors (Giesecke et al., 2016), nor have quantitative research much data collected (Caiati et al., 2017). Due to the constraints of early market, the existing study results are mainly based on a small population of mostly young people within the limited experimental time and geographical area, the result might be not generalizable of the larger public. Start-ups like to develop service for younger generation because the lower entry of acceptance (Li et al., 2019), while the difficulties of investigating older travellers are, firstly, older people today are more flexible and active than before (Shrestha et al., 2017), and their behaviour characteristics are diverse (Marin-Lamellet and Haustein, 2015; Caiati et al., 2017; Buehler and Nobis, 2010) with a certain degree of unpredictability (Lu et al., 2010). In addition, the existing studies usually misunderstand that the older and the disabled are homogenous group (Marin-Lamellet and Haustein, 2015). There are services specifically designed for the disabled in the market, but few are designer for the older people (Proestly and Rabiee, 2002).

2.3 Influencing Factors

In previous literatures, older travellers are divided into segmentations by different criteria, see Table 1.

Criteria	Literatures
Age	Eberhard, 1996; Giuliano et al, 2006; Haustein and Siren, 2015
Gender	Best et al., 2005; European Parliament, 2012; Leveille et al., 2000; Mattson, 2012
Life Stage	Ryley, 2006
Household Structure	Huby et al., 2000
Income	Anderson et al., 2004; Mattson, 2012; Mifsud and Lucas, 2015; Haustein, 2012; Hildebrand, 2003
Social Network	Haustein, 2012; Mollenkopf et al., 1997
Psycho-social Factors	Hiscock et al., 2002; Cullinane, 2002
Access to a car	Aigner-Breuss et al., 2010
Use of different transport modes	Aigner-Breuss et al., 2010; Mollenkopf et al., 2004; Siren and Haustein., 2013
Activity Level	Shrestha et al., 2017
Trip Complexity	Su, 2009
Urban Form	Boarnet et al., 2001; Giuliano et al., 2003

Table 1 Criteria of Older Travellers' Segmentation

The influencing factors of older people's mobility could be summarized from two aspects: objective and subjective. The former refers to the factors that individual could not control or are unchangeable in short-term, for example the congenital factors and living environment. The latter is built on objective conditions, where people can have a flexible choice space.

Objective Factors. Webber et al. (2010) concluded 5 fundamental categories of key determinants (cognitive, psychosocial, physical, environmental, and financial) of elderly mobility (Figure 4), with influences of gender, culture, and biography surrounding the entire cone.

Figure 4 Conical model of the theoretical framework for mobility in older adults
(Webber et al., 2010)

This study highlighted the interrelationships among different determinants because of the linked dimensions. These factors (Table 1) would bring a combined influence on people's mobility and reflect in their travel behaviour. For example, family members would have similar life-space (annotated on left of conical model), but due to differences in gender or biography, the overall influence would occur on 5 fundamental determinants, so that we can witness the totally different travel behaviour of family members. But this model missing the important dimension of interpersonal relationship. In this example, the travel behaviour will also be influenced by familial responsibility and household labour division. Just as if the one who has the responsibility to take the kids out to school, he/she will drive more frequently; if the elderly has other drivers in family, he/she would take public transports less.

Subjective Factors. Travel behaviour" refers to both time-use pattern and spatial features of travel and activities, while travel demands are subjectively determined by personal pursuit (or human desire) and their households (Goulias, 2000; Timmermans and Zhang, 2009). For this reason, activity-based travel demand modelling has become widely used in practice (Hildebrand, 2003; Jovicic, 2001; Rasouli and Timmermans, 2014), and further implies to a decision framework, in which travel decisions are components of a broader activity scheduling decision (Ben-Akiva et al., 1998).

In other words, travel demand and related decision making process also embody people's motivation

of travel. Factors such as survival, social contact and ego gratification (Ben-Akiva et al., 1998) would positively promote people traveling to activities. On the contrary, the aged may negatively impact on their motivation by the concerning the low perceived safety (Haustein et al., 2015), fear of falling (Mänty et al., 2009), unfamiliar applied technology (Holzinger et al., 2007), navigational problems (Alsnih et al., 2003) and other reasons, would lead to isolation and loneliness of older people.

Moreover, referring to Research Model UTAUT2, which integrates multiple models of user acceptance theory, it illustrates that, except for main determents, Behaviour Intention (BI) is also effected by contingencies from moderators that would amplify or constrain the effects of core determinants, for example age, gender and experience (Arenas-Gáitan et al., 2015).

2.4 Trip-chain

Trips are driven by the purpose of activities which reflect traveller's value and attitude towards personal and social goals. The logistical efficiency of travel is an increasingly important factor for people to consider their trip plan (Su et al., 2009), and thus the trip chain has become more common in everyone's daily travel (McGuckin et al., 2005).

The most used word to define "trip chain" is "stop" (Kitamura, 1985). Then the "trip" refers to: "The movement which carries an individual between his home and a stop or between temporally consecutive stop" (Lee and McNally, 2002). On this basis, "a set of consecutive trips which begin and end at an individual's home or work place" is known as a "tour" (McGuckin et al., 2004). If a tour is composed of more than two stops, it also defined as an "trip chain" (Su et al., 2009). According to US Federal Highway Administration (FHWA)'s definition of "tour", is the dwell time of a stop lasts longer than 30 minutes, this stop will be understood as the end of the tour (McGuckin et al., 2005).

Figure 5 Percentage distribution of home-based trip-chains by age and complexity
(Hensher, 2007)

Figure 6 Average home-based trip-chains per day by age and mode
(Hensher, 2007)

About the home-based trip chain per day (the start and end points are home), the complexity of travel doesn't decrease too much from the younger to the older travellers, and even has an increase with age 50-54 (Figure 5). The reason might because the work trips are not included, and home-based trips are more depend on trip chain to achieve. Figure 6 shows the modes used in trip chain by age, which illustrates self-driving is the most significant factor for trip chain's flexibility, while people have stable

demands on public transport chains and car passenger chains, and this demands are not effected by age. It further explains the accessibility on public transport modes and network for older people would matter most for their quality of life.

Research founded older travellers would not get benefits from the trips chain offers with higher logistical efficiency (Su, 2007), and tend to have easier tour types. Their preferences on tours like the trip sequences, destination choices and time arrangement are normally limited by reduced mobility. Other factors like gender and life cycle (McGuckin et al., 2005), income and household composition (Noland and Thomas, 2007) would also influence travellers' trip chain behaviour. In comparison, older travellers are proved to have shorter trips in a tour, but prefer more than one tours a day (Schmöcker et al., 2010). The complex trip-chain planning can be difficult for older people (Schmöcker et al., 2010).

2.5 Contradiction Points

Intelligent transports has created better conditions for urban sustainability, advocating to reduce automobile travel and increasing collaborative operation. According to the result of UbiGo 6-month trail, the new business model has shown initial success in reducing private car ownership (Sochor et al., 2014) by transforming the concept of "transport" to "accessibility". With the support of ICT, the physical accessibility can be replace by other options so that the travel plan is more flexible (Van et al., 2013).

But these advantages may bring about barriers for older travellers, such as the interaction mode with digital platform and the impacts on their original travel behaviour. Research proved the low utilization of smart phone among older people (IET, 2015) and their reluctance to accept it because of the poor understanding of the benefits (Holzinger et al., 2007). On another aspects, ICT could result in the reorganization of activities (Van et al., 2013). It is recognized as the capability to support more complex trips and trip-chains, as well as multi-tasking during the journey (Van et al., 2013). Parallel activities can reduce the disutility of trips and further affects user experience (Van et al., 2013). However, as the current older people prefer the simple travel pattern and are relatively less require the value on time efficiency (Su et al., 2009), this advantage are not so attractive as to persuade them to overcome the existing difficulties to adopt the new services.

In this development trend, the boundary of "travel" became blurred, and the identity of travellers will also change, for example, from "driver" to "passenger". By then, the use of public transport shall increase, with the advent of new forms of transport tools and infrastructures. This trend, in the contrast to the current behaviour of older travellers, can be anticipated the challenges and potential exclusion of older travellers from new transport services.

3 The Value Proposition of MaaS Stakeholders

Having an overview on the literature, the resources relate to MaaS seemed to be limited. Both stakeholders and academia are exploring the opportunities of the emerging concept, while the boundary is fuzzy. There is limited evidence of users' requirements based ethnographic differences, and most studies tended to be pilot tests and evaluations involving comparison of data between younger and older generations, but do not show a practical recommendation of approaches to increase the involvement of various user groups.

For the perspective of stakeholders, their different extent of understanding leads to different market

penetration. Service operators have their own interpretation, consideration and strategies of MaaS market, which leads to diverse types of service offerings and system. Because of the uncertainties, it's difficult to define and verify the potential exclusion issues mentioned above. Without knowing what the specific problem are, the risk of service exclusion will not be effectively minimized through afterwards service iteration. Therefore, this exploratory study involved and collected the data of a workshop in 2016, hold by IMPART (The Intelligent Mobility Partnership – Midlands Competence Centre of Excellence), brought together industry, the public sectors, academia and NGOs for 54 participants to discuss the topic about how to better understand MaaS by taking users at the centre of proposition.

The study was divided in to 4 steps (Figure 7), and the data is aimed to answer the following questions.

- What do stakeholders attention focus on?
- What do they think about older people using MaaS?
- What is the proposition of stakeholders? How to understand older travellers are ignored?

Figure 7 Methodology of Study

3.1 Identity of Participants

Referring to literature review and combining to key actors defined in MaaS system (CATAPULT, 2015), participants' composition of the workshop can be roughly decided into the following categories (Figure 8).

Figure 8 Workshop participants' composition

8 of ten gave a detailed presentation (Figure 9).

Figure 9 Presentators' composition

Need to point out that, participant's characteristic is verified by the company or organization she/he belongs to, which might not represent individual's intention. In addition, a single participant may take more than one characteristics, so this statistic can only be referred to as an evidence to analysis the reason of some results coming out.

3.2 What do stakeholders attention focus on? - Workshop Presentations

The viewpoints raised by presentation are refined into key words and phrases, and the number counted here is the times one viewpoint being raised rather than the times single words being mentioned.

Key points are generally classified into 5 groups by its content. Times of being raised could represent its amount of attention under the topic of MaaS for a certain extent, so in this stage the number could also be regarded as the weight to profile the priorities of each item. In order to obtain a more solid understanding about "what are people saying", the data collected is concluded by two criteria (Table 2).

Design for MaaS (21)	Consider for users (9)
Take users' requirements at centre (4)	Empathy needs (4)
To think wider (4)	Travel modal shift (2)
Understand human(customer) behaviour (4)	Hidden disabilities (1)
Identify pain-points (2)	Safety and security (1)
Co-design (2)	Save time and money (1)
Application of design thinking (2)	
Understand users' motivation (1)	
Service form (18)	Service content (20)
Integration and collaboration (8)	Journey plan (4)
Multi-modal transport (2)	End-to-end journey (4)
Personalized service (2)	User experience (3)
App-based service (2)	Access on-demand (2)
Interface interaction (1)	Plan B (2)
Personal data collection (1)	IoT (Internet of Things) (2)
Service package (1)	Easy payment (1)
Virtual journey (1)	Before and After experience (1)

	Car sharing and recruiting (1)
Others (3)	Sustainable business (2) Additional revenue (1)

Table 2 Data conclusion arranged by contents - Workshop presentation

From the table, it can be observed that, stakeholders' knowledge upon service content is relatively more clear than their understanding about users. From this, two hypotheses can be made are:

- The exploration and development of MaaS service is more basing on technology or enterprises' development strategy rather than data collected from user investigation.
- Their cognition about user's value proposition hasn't accessed to essential of users' requirements.

If arrange the same data under the criteria of identities (actors) of MaaS system defined by CATAPULT (2015), the data collection would tell a different story (Table 3).

Transport Operators (22)	Data Providers (23)
Integration and collaboration (8) Journey plan (4) Travel modal shifts (2) IoT (Internet of Things) (2) Sustainable business (2) Safety and security (1) Save time and money (1) Car sharing and recruiting (1) Additional revenue (1)	Integration and collaboration (8) Journey plan (4) User experience (3) Plan B (2) App-based service (2) Safety and security (1) Interface interaction (1) Personal data collection (1) Additional revenue (1)
Users/Customers (28)	MaaS Providers (34)
Journey plan (4) End-to-end journey (4) User experience (3) Travel modal shifts (2) Eliminate pain-points (2) Multi-modal transport (2) Access on-demand (2) IoT (Internet of Things) (2) Plan B (2) Car sharing and recruiting (1) Virtual journey (1) Easy payment (1) Hidden disabilities (1) Before and After experience (1)	Integration and collaboration (8) Take users' requirements at center (4) To think wider (4) Journey plan (4) Eliminate pain-points (2) Co-design (2) Application of design thinking (2) Sustainable business (2) App-based service (2) Understand users' motivation (1) Service package (1) Save time and money (1) Additional revenue (1)

Table 3 Data collection arranged by actor identities– Workshop presentation

The same key words under different category means this item is a common consequence but might be seen it in different perspective according to different value propositions. On the initial phase of developing a new business model, it's natural for different actors to pay most of the attention on the similar side, for example, the system operation and design process. But it also indicated that the responsibilities of actors are not yet clearly defined, the focus has staying on a general level that have not been discussed in depth. In the presentations, some participants mentioned the specific requirement of different traveller groups (e.g. children and older generation), but the current conditions seemed to be unable to support them to refine the service offering as the service capability has not fully developed.

3.3 What do they think about older people using MaaS?- Workshop Group Discussion

In order to obtain the targeted data, study collected and analyzed the data from two of the focused group who specifically discussed the older travelers related issues. It was an open discussion the content is mainly concern about the participants' worries and questions about older travellers' involvement in MaaS.

The data were generally divided in to two topics: the general questions about MaaS and the concerns about relate to older users.

General Question. The general questions could be literally concluded into the intangibility of the concept, customers' requirements and way of operation (Figure 10).

Figure 10 Summary of General Questions

Referring to these questions, what can be confirmed is, the emerging of MaaS is driven by the development of new technologies, rather than human requirements of mobility. Stakeholders are thinking of “What can we do with this technology?” before concerning about the inconvenience and requirements in real life. It leads to the phenomenon: Firstly, because of the uncertainty about its potential possibilities, the outline of concept would unlikely be defined; Secondly, the new-technology based emerging services or products would likely break people’s original habits and mode of thinking. These questions from a side explains, in present condition, the exploration of MaaS and users’ requirements in both market and academia are not carried out simultaneously or reached to a same level. In other words, the directions of future research for designer need to concentrate more on users themselves and their requirements to seek for the breakthrough points and to positively connect demands with technologies in order to explore novel opportunities.

Older Travellers-related Questions. Questions relate to older users are gathered around 3 themes: Motivation, Challenges and Implication (Figure 11).

Figure 11 Summary of Older Travellers-Related Questions

Older travellers-related questions should be regarded as the extension of general questions rather than a separated research area. The context for older travellers are more complicated because they have to overcome the reluctance to “going out” and “use new service”- the double obstacle, so most of the questions here are unanswered. In addition, it’s unclear whether the new service will affect the older people more positively or negatively. Without this data, service providers will have a hard time persuading older people to attempt adopting it.

Consensus Acquired. In the open discussion, the participants have generally reach the following consensus.

Firstly, traveller’s pain-points should be the basis to shape how the service should be looked like. Service touch-points should respond to traveller’s pain-points during journey either reduce the difficulties or improve the original experience, so that the understanding of each pain-points are the key evidence to set the scenario and characteristics of touch-points.

Secondly, Systematic Integrative Thinking is needed in MaaS eco-system. It contains two aspects, one is to the collaboration of different organizations, such as real-time information, easy payment and multi-modal transport; the other refers to the systematic service, which not only covering the cooperation of all the service channels, but is also reflected on the connection of difference experience phases, for example, the “pre-” and “after-” trip experience are equally important with “during-” trip experience for travellers’ overall satisfaction.

However, comparing to the traveller categories proposed by CATAPULT earlier in 2015- “Traveller Needs and UK Capability Study”, concepts about travellers’ identity during journey has updated. The consensus obtained is, the same person could be classified into different traveller categories depending on the condition he/she is in. Many variants could effect on the condition, for example the mood, travel purpose, person accompanied or time allocation.

A question was raised during discussion is “Are the travels all necessary?”. Virtual trip would release people from the travels of “what need to do” to “What want to do”. Take older travellers as example, such “need to do” things as go to hospital or go regular shopping could be replaced by online activities, therefore, MaaS can help people to get flexibility to reschedule their daily routine, which is agreed to bring benefits to their QoL.

Summary. The proposition that is discussed in this exploration study is whether older people and their requirements have been considered in MaaS. However, “whether it has been considered “in this research does not equate to the fact that “older people not engaged” or “ the low inclusiveness of MaaS”, but can only be regarded as an reference when analyzing the results in later process, because there is no

direct evidence that can indicate to the conclusion.

Through the presentations, the data such as “what they are saying”, “what are they caring about”, and “what is the position of design for the older users in their strategy” of stakeholders are obtained by data collection of presentations. Then in the primary data analysis, it can be observed that, older people and their requirements were not considered by the most of stakeholders. Then the result of group discussion proved that, the common concern of older people using MaaS is the co-exist of opportunities and challenges. Because of a lack of understanding of older people’s travel behaviour and requirements, it’s difficult to estimate the impacts of MaaS on older users, such as motivation to travel or the difficulties brought with new interaction modes.

The inclusiveness of service possesses a bi-directional nature. As a good inclusive service, on one hand, it should lower the level of task demands to make it being appropriate for wider audience, which reflects in the service’ penetration; on the other hand, it need to be able to provide necessary support to users’ original capabilities to encourage higher involvement (e.g. UbiGo Call Services for older people). It can be identified on this stage, “penetration” is a market-oriented concept, whose audience is a group of users. However, “involvement” describes an individual subjective action, which would be largely effected by user’s personal propensities. For this reason, next research orientation would focus on stakeholders, to understand their efforts in inclusiveness of seniors’ market.

3.4 What is the proposition of stakeholders? How to understand older travellers are ignored?

– Follow-up Interviews

To further explore the different stakeholders’ proposition and their understanding of older travellers’ involvement issue, a semi-structured interview was taken to get the multi-angle opinions. The 4 participants in the interview are all from the workshop and have different identities.

- Transport solution Specialist– Transport Provider
- Service Design Specialist – Service Designer
- Research Fellow - Academia
- Product Manager – Vehicle Manufacturer

Through content analysis, study proved that the ignorance of older travellers’ requirements in current market is the recognized fact, and most of the stakeholders have already aware of the issue and have willingness to involve older travellers in their service through later iteration. But due to the lack of knowledge and resource, pilots and trails have been promoted so far are mainly “testing the water” to seek the possibility for further cooperation, and this process take time.

They mentioned the importance to include older travellers participating in the design process would be the effective way to enhance the service inclusion, because nobody would know their requirements better than themselves. However, there are few experience could refer to about the innovative thinking and design methods.

The stakeholders expect the new service can be user-centred and also business-oriented to ensure the continuous development, but have not found an approach to satisfy both sides.

From the perspective of market, private and public enterprises are offering various service natures, which are just “fragments” and haven’t come into integrated system. The uncertainty of future market of MaaS would be vital for the promotion of MaaS among older travellers, it might need to add other actors participating in the system to bridge the service delivery, for example, the NGOs and government.

3.5 Understanding and Discussion

The gap between existing knowledge and application. The various dimensions that affect individual mobility have been relatively well-discussed in previous literatures. The influencing factors of mobility can affect every aspect of travel experience, and the influence is not limited within trips, but the associated life as well. The complexity of the study on MaaS lies in the fact that experience evaluation involved both “service” and “trip” with physical and psychological dimensions. As shown in the Figure 12, experience is divided into 4 themes, the characterizes discussed in each themes are different.

Figure 12 4 Themes of MaaS Experience

However, as the stakeholders in workshop mentioned, the current condition cannot support the personalized service offerings of each traveller segmentation. But the existing theories and data are directly accessible, and what is missing is the design method to apply them reasonably. In the Follow-up Interviews, participants mentioned that the different design for older and younger generations should only be reflected on the service offerings, but also in the methods of doing research and New Service Development (NSD). The designers should learn to explore the real needs of different groups.

Fostering travel behaviour. As discussed in previous literature review, the development route that MaaS proposed for future urban transports is to some extent contrary to existing travel pattern of older people. Therefore, the initial task of MaaS development is to make the short-term and long-term plan to ensure the simultaneous change of travellers' behaviour and service development. It can encourage people to better fit in the new service eco-system, but also leave room for service innovation and control it within a reasonable scope.

Market competition. Market competition in the future would occur among strategic alliances. Because of the trend of multi-modal journey, individual transport systems would not only need to consider their own operating manner, but also the way to coordinate with others. On this basis, the competitiveness would also reflect in one system's flexibility and coordinate ability.

Data sharing.

Data Sharing. Although data sharing remains a challenge for MaaS integration, but to customers, appropriate data could help them make decisions. More data items means more choices. Stakeholders would make alliances depending on the overlapping but individual database they grasped with the intention of providing seamless travel experience. On this basis, it can be understand as the data and the collaboration of different stakeholders that work together on building the market in travelers mind.

4 Conclusion

This paper indicates the issue that the emerging concept of integrated transport service might have ignored some specific groups' requirements in the business-driven market environment. For older travellers, the travel behaviour proposed by MaaS may cause new barriers, which not only occur in human-computer interaction or physical environment, but also affect the elderly's travel planning, the choice of activities to participate in, and even have an impacts on the QoL. Previous studies have provided a relatively comprehensive understanding of travel characteristics of the older people, but in the context of new services, new dimensions were added which needs to be further explored. The older travelers have to learn about how to adapt to the new travel logic while overcoming the travel difficulties they used to have. Based the global aging trend, this service, designed for the younger generations, is not benefit those who really need it.

The exploring study described in this paper verified the potential exclusion issues caused by MaaS and proved the lack of deeper understanding of this issue among stakeholders in current MaaS ecosystem. Furthermore, given the lacks of previous experience and evidence, the direction of future iterations cannot be clearly defined.

In the view of this, this paper suggests that stakeholders in the system should consider the different requirements of various groups at the early stage of the service development, and open their thoughts in design process, instead of sticking to the conventional thinking in current context. Make plans to ensure that the travelers and transport service can learn from each other and keep in the same pace, and strengthen communication among different stakeholders to coordinate value propositions, in order to realize the sustainable development of urban transport system by iterating the service with the user-centered perspective.

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