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Placing users at the core of mobility products development: the case of VoxPop in Lisbon

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Abstract

Carris, the bus and tram operator of Lisbon, identified the need to deliver improved information for people with reduced mobility, which would enable them to better plan and navigate their trips involving the use of buses or trams. In the frame of the Voxpop project, a wide reaching project to promote a better use and sharing of mobility data, Carris and other project partners carried out a study on the information needs of people with reduced mobility which led to the design of features to be included in trip planning and navigation applications that deliver on those needs. This document presents the objectives, methodology, developments and results of this project which will lead to the testing and delivery of new information features to make mobility more accessible and convenient to people with reduced mobility.

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1. Introduction

The City of Lisbon and several major mobility players in its area (Metro de Lisboa, CARRIS, EMEL, TML) designed the UIA initiative VoxPop as an undertaking aiming to foster the sharing of data and information between mobility stakeholders, to enable the design and implementation of new mobility services. The focus of the initiative was not on new data collection mechanisms, but instead on making a better use of existing data sets. Starting from the perception that different stakeholders have access to relevant data sets that would be more valuable if shared between different players, but because of commercial interests, data protection regulations or technical reasons remain closed within each organisation.

Whilst the focus is on making available and sharing existing data, from an early phase of the project it was observed that in some areas relevant data gaps persisted. These included two aspects related with public transport operations of major relevance to the VoxPop approach: the provision of information to support the navigation of vulnerable city users; and the collection of feedback from public transport customers.

Regarding the mobility of vulnerable city users, this is considered as a highly under looked aspect, given not only the amount of people that have temporary or definitive limitations that hamper their mobility but also the fact that by designing a system that can answer the need of the most vulnerable we are able to offer a mobility experience that fits everyone's needs.

It is relevant to note that the methodological approach to develop these two tools - feedback platform and navigation support for vulnerable city users - in the framework of VoxPop was similar and largely implemented in parallel by CARRIS and other project partners, having many contact points. This document in particular will look at the development of the navigation support tool for people with vulnerabilities.

A first aspect that needs to be underlined was the need to focus on a particular subset of 'vulnerable users', as this can cover a wide range of people. The decision was to focus on people with blindness or visual imparity and people on a wheelchair. This selection of target groups was based on the both on the amount of people affected and the perception that such groups of vulnerable users had substantial mobility problems that can be addressed by a digital solution such as a navigation support tool, and the fact that CARRIS was already working with these groups following its engagement with the TRIPS EU-Project.

This document looks at the processes implemented to address the data gaps faced by wheelchair and blind users. In line with the overall VoxPop project approach the development of these two tools was to be performed whilst placing users at the core of the development processes, which was particularly challenging for two major reasons: i) the specificities of the 'products' to be developed; and ii) the need to engage users' in the context of a pandemic and social distancing. The next section will present the methodology applied.

2. Methodology

The methodology employed to develop the navigation support tool for vulnerable city users was founded on the people-centricity concept of the VoxPop project. Every development in the project should have users involved and should be focused on their needs.

In the development of information tools for people with reduced mobility, the process followed a design thinking approach whereby a large set of users was initially involved through semi-structured interviews and workshops to identify and understand their basic needs (a work led by EMEL, Lisbon's mobility agency). In parallel with this early work with users, a review of literature on user needs, particularly in the context of earlier work by the team of the Lisbon Accessibility Plan, which also cooperated in the task A long list of user needs and requirements was built.

The long list of information needs was analysed both from the point of view of the importance of the needs and the technical viability of building features that would deliver those needs. From this assessment, a prioritisation of features was defined, and a shortlist of priority elements was finally settled for further work.

The next phase was to develop and iterate on a prototype of a user interface with the selected features, involving users on a workshop for experimentation of the prototype and identification of potential elements of improvement, which led to adjustments to the prototype.

The features designed had specific requirements either in terms of provision and maintenance of data or in terms of technological delivery. A service design thus had to include the development of processes and organisational setups for delivering those requirements, a task which is currently ongoing.

The next phase will be the experimentation in a pilot. For such, specifications of an application were developed which will be the basis for a call for tender on the development and piloting of a trip planning and navigation application trial in Lisbon, including the development of open source IT tools for a future Carris application as well as the integration of feature by third party applications.

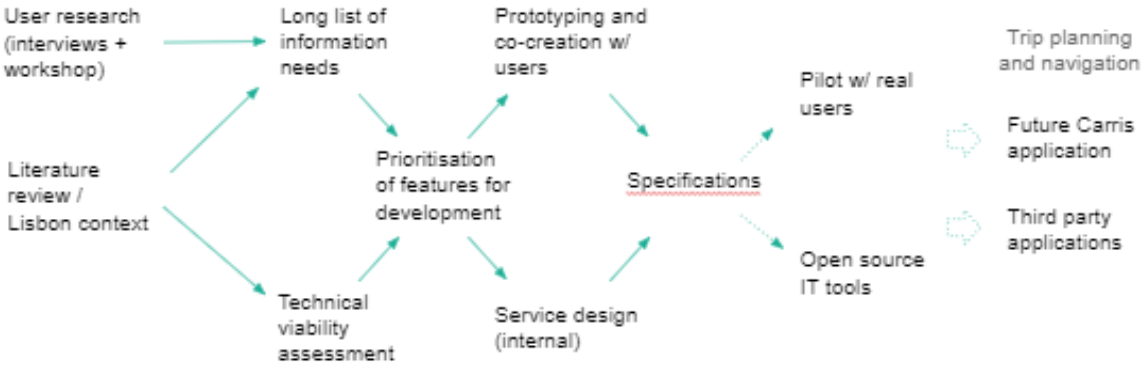

Fig. 1 Design process of tools for trip planning and navigation for persons with reduced mobility

3. User needs and requirements

The user needs and requirements process to support the development of a navigation support tool for vulnerable users, was implemented in 2020 and 2021. This initial research for development of a navigation support tool for vulnerable city users four-step method was applied, consisting of: i) a review of bibliography; ii) user research; iii) user journey and iv) benchmarking of digital support tools. The bibliography review, combined documents focusing on existing local insights – such as Lisbon's pedestrian accessibility plan – and the analysis of outcomes of other EU initiatives – such as the MOVE, TRIPS and SIMON projects. The user research was largely based on semi-structured interviews with vulnerable city users or their caretakers, focusing on people with visual impairment and users of wheelchairs. In these interviews a deep understanding of users' mobility and their interaction with public transport systems was achieved, which proved to be a critical component to identify challenges and needs. The user journey was then used to cross the information collected in the interviews with the actual public transport service offering. This was useful to depict opportunities for improvement within the current services and led to the identification of possible quick wins. The benchmarking exercise was used to provide insights on the current offer of digital navigation tools. An important conclusion from this phase was the existence of several offerings in the market that meet some of the user needs, suggesting a need to focus not only on the development of a new tool but also on the process to make more data available, aligned with the initial 'spirit' of the project

The general conclusions of this process were the following:

- Approximately 1/5 of the population of Lisbon report at least one difficulty in performing activities because of health or ageing problems; 62% of these people are aged 65 or older; 10% of Lisbon's population reported in the 2011 Census to have difficulties in walking and 9% reported difficulties in seeing.

- Most people with difficulties note that they only understand the challenges associated with mobility after experiencing the vulnerability themselves; there are widespread complains about a lack of empathy from other city users.
- Road crossings are the situations in which visually impaired people and wheelchair users feel at higher safety risks; these groups also felt particularly vulnerable to Covid-19 related risks.
- Visually impaired people tend to only prepare their mobility movements with anticipation for the first few trips; after some times they get confident with the urban environment and tend to have lighter planning procedures; however, wheelchair users reported to prepare in detail all their trips, given the lack of reliable data and real-time information. Most trip planning activities are performed at home, before leaving.
- Users had a relatively high level of digital literacy; the most used mobility app was Google Maps, which has the advantage of being functional offline.
- Within public transport buses are recognised as the most accessible mode, but there is a preference for the reliability of Metro. Most wheelchair users prefer to use private cars.
- There is a widespread feeling that information available regarding public transport is currently insufficient to meet the needs of these two user groups.

To these general conclusions, a long list of needs expressed by wheelchair and blind users, directly or indirectly related to travel information, was developed.

4. Technology assessment and prioritisation of features

The prioritisation of features to be developed considered both the user needs and a technology viability assessment. On the user needs side, two dimensions were considered: i) how critical was the trip information need for the users, ii) how relevant was the gap in information (i.e. could the users access the needed information through alternative channels, or was it completely absent). The assessment of the importance of these two dimensions was based on the results of the user research and led to a general scoring of the importance of each need and related prospective feature.

On the other hand, a technological viability assessment was made to consider how distinct possible features could be addressed and whether they would be viable in the short and medium term. The level of easiness / viability of the implementation was hence also scored.

Both assessments considered not only the possibility to include features in Carris' own applications for users, but also to supply data and IT resources that could be made available and used by other trip planning and navigation tools available in the market.

The joint consideration of user needs and technical viability gave way to a prioritisation of the listed features. A final list of seven features has been prioritised. They are identified in the following table, with the identification of the most relevant target groups. While wheelchair and blind users represent the most common and, within their dimension of mobility conditioning, they represent the most extreme cases of limitation, the features are also relevant for user groups with similar or partial limitations, like the elderly, parents with baby trolleys, or partially-sighted people. Additionally, as identified in the table, some of the features are naturally useful for all user groups, in which case their development will benefit a broader user base.

Table 1. Prioritised features and their target groups

	Target groups		
	Step-free	Blind	All
F1: Bus stop accessibility	x	x	
F2: Availability of shelter in the bus stop	x	x	x
F3: Accessibility of the vehicle (ramp availability)	x		
F4: Level of occupation of the vehicle	x	x	x
F5: Information of arriving vehicle		x	
F6: Identification of exit stop	x	x	x
F7: Identification of precise stop location		x	

5. Co-creation process and design

After the list of features to be developed was prioritised, and technological options for some of the features were considered, a digital prototype of a trip planning and navigation tool was designed. The prototype was then shown and discussed with users, who gave feedback and alternative suggestions for the design, Several improvements were introduced to the prototype following these interactions.

The design of the features had to consider the technical and data collection options for their development. In some cases, the intended developments implied also the design of new operational processes within Carris and the public space manager (the Lisbon Municipality). Some issues and potential solutions have aroused that are worth mentioning:

- Objective information on bus stop accessibility (F1) had to be gathered and synthesized for users. This triggered a side project in cooperation with the Municipality of Lisbon to develop a methodology and process of stop accessibility assessment, a development with a potential significantly beyond the scope of the product design, possibly impacting the process by which the municipality intervened to prioritise improvements in bus stop accessibility. As part of this stop assessment process, both the methodological development process and the product design included the possibility for end users to validate and propose improvements to the assessment.
- Availability of bus ramp information (F2): the existing databases and data collection processes only included the information of whether each bus had a ramp, not whether the ramp was properly working and requiring maintenance (a very common event with bus ramps). The service design thus foresaw the need for the later data to be included and updated.
- Level of occupation of the vehicle (F4): while trip planning and navigation aggregators (like Google Maps or Moovit) are already trying to record data and provide estimations on the level of occupation foreseen in each itinerary, it was conceived that operations data of the company could be used to provide additional and possibly more precise estimations. A methodology to estimate occupation rates based on historical data was initiated to address this feature.
- Communication between the user device and the vehicle (for F5) needs to be sufficiently precise for a correct indication of the next bus number even in situation where several buses are arriving at the same time. The solution identified was to establish this connection via BLE (Bluetooth Low Energy), a hardware that is in the process of being introduced in the Carris fleet validators.

6. Product specifications for a pilot

Based on the user interface and service design developments, functional and technical specifications were written with the objective of running a pilot to test the features developed. The pilot results and evaluation will feed the improvement of the design of features and underlying service operations, both for the introduction in a future integrated Carris application for users and for open source and open access provision to other trip planning and navigation applications available in the market.

7. Conclusions and next steps

The user research on people with vulnerabilities confirmed that they face not only significant physical barriers to their mobility but also that these barriers are exacerbated by the lack of information within trip planning and navigation tools. A long list of information needs was obtained after a literature review and an extensive consultation of users, focusing predominantly on wheelchair and blind people.

The long list of needs was coupled with a technical viability assessment to prioritise features for development with the objectives of both being made available in Carris planning and navigation tools and in external applications available in the market. A list of seven features was closed for design and potential development.

An exercise of co-creation was then elaborated with a set of wheelchair and blind users to inform the design of the features. This exercise involved the creation of a digital prototype of a trip planning and navigation tool that would include the selected features. Users brought several ideas from improvement which led to adjustments of the prototype.

Besides the design of features and interface from the perspective of the end-user, the development of the features required a service design to make sure that the data and information required by the application is made available and has the necessary quality. Two side projects were initiated to develop such data collection and treatment mechanisms, particularly with regard to level of occupation in vehicles and the assessment of the accessibility of bus stops.

The project finally reached the stage of development of specifications for inclusion in a call for tender for implementation of pilot to test the features in question and development of open source software tools to be used both in a future Carris user application and in external trip planning and navigation tools.

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