Design of a Route-Planner for Urban Public Transport, Promoting Social Inclusion

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Abstract. People that do not have access to the transport system and therefore, a facilitated access to goods and services essential to daily life, can be regarded as transport-related social excluded. This is a big issue, namely for groups of people that have physical, sensorial and/or cognitive limitations. This paper provides guidelines to design route planners for socially excluded groups, by promoting social inclusion in public transportation. For this purpose, a set of mock-up user-interfaces of an inclusive inter-modal route planning application were developed. These interfaces will deliver ready availability of information about infrastructures and other journey related data.

Keywords: Information · Public transport · Social exclusion

1 Introduction

Public transport play a big role in today's society, especially because it facilitates the access to goods and services as health and education. As a result, transport-related social exclusion is part of our reality, since individuals that do not have access to the transport system can be regarded as excluded.

The term social exclusion was initially introduced in the European policy domain during the 1990s [1] and it was perceived as some sort of happening that stroke the poor exclusively. In the literature, the terms social exclusion, poverty and deprivation have often been used interchangeably [2]. These terms have been exhaustively discussed throughout these last decades, and, in its essence, they can be understood as the process whereby and individual becomes deprived, and not the actual deprivation itself, and in fact, poverty and deprivation can be argued as the outcomes of that process [2]. This means that the socially excluded are the ones who are not only poor, but also those who lost their ability to get a job or proceed education. Mackett et al. [3] explain that the exclusion process covers various circumstances where individuals or groups of people are unable to participate in activities or to access certain goods (e.g. services, work, school, etc.) that are available to others as a fundamental part of belonging to society [3]. Additionally, Kenyon et al. [4] state that mobility-related exclusion is the process by which people are prevented from participating in the economic, political and social life of the community because of reduced accessibility to opportunities, services and social networks, due in whole or in part to insufficient mobility in a society and

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environment built around the assumption of high mobility. Thus, social exclusion is directly related to social disadvantage, transport poverty and transport disadvantage [5].

In Europe, especially in Hungary, Bulgaria and Romania, 90% of the citizens perceive poverty to be a widespread phenomenon, this value being considered the highest registered. In Denmark, Cyprus and Sweden mark the lowest values as 38%, 38% and 33% respectively [6]. According with the Eurobarometer [6], elderly, disabled and long term ill person, children and young people, and women are some of the groups most risk of social exclusion.

For social excluded groups that have physical, sensorial or/and cognitive limitations, the level of quality of information provision is quite important since strongly restrict its mobility. Park and Chowdhury [18] explain that the main barriers for physically impaired people are related to the urban environment, terminals and stops, services, and quality of footpaths, while the main barriers for visually impaired users are the poor presentation of information and obstructions on footpaths. Also, the common barrier for both groups is the bus driver's attitude and unawareness of their needs. Similar findings were found for other social groups with disadvantages [10, 14]. However, these barriers can be minimized if relevant, simple and reliable information is provided in order to allow passengers to travel as fast, comfortable, safe and cheap as they possibly can, while at the same time being able to easily access certain core information about the trip [7].

A trip planner can be considered a smart travel assistance tool, which can provide certain information to the passenger for a given origin and destination stops [9], minimizing thus, its social exclusion. However, sometimes such information needs to be provided contextualized, taken into consideration the needs and limitations of each travel profile. Houghton et al. [8] explain that advanced technologies can be used to collect more and better data, and the process of analysis can be also enhanced to create an end result that is more efficient, effective and targets services for passengers.

Cheung and Sengupta [11] assessed 20 popular route planners considering its features, usability and popularity. Bearing in mind a high level feature evaluation, Google Maps, TripGo, Here WeGo, Citymapper and TfGM have the best score. Concerning the usability evaluation, three main features have been considered: effectiveness, efficiency and satisfaction. The top five apps in usability are Citymapper, Traveline GB, TripGO, London Journey Planner and Transit, while the highest popular applications are Google Maps, MAPS-ME and HERE WeGo.

Note that not all the applications analysed support all public transport modes. For instance, 'MAPS.ME', 'Voyager' and 'Maps, Navigation & Directions' do not own information regarding trains, trams, buses and others. Meanwhile, 'Transit: Real-Time Transit App', 'Journey Planner (TFI)', 'Offi - Journey Planner' and 'London Journey Planner' are able to provide information about trains, trams and buses, but they do not support information about car, walking or bicycle trips. Among all the applications analysed, only 'Maps' by Google, 'My TfGM', 'TripGo' and 'HEREWeGo' are the only ones that, in addition to being considered multi-modal, also manage to create viable travel routes using car, walk, bicycle, train, tram, bus and other modes of transport available (i.e. scooter, boat). However, information regarding accessibility is not provided by these applications.

Besides these general and popular applications, few mobility applications have been developed taking in mind social excluded groups of people. HKeMobility [19] is a route planner for Hong Kong. This is an all-in-one mobile application integrating three previous mobile applications ("Hong Kong eTransport", "Hong Kong eRouting" and "eTraffic News") that offers an elderly friendly user interface. HKeMobility displays concession fares for the elderly and has simple user interface with high colour contrast. Also, Wu et al. [20] build a barrier-free and friendly environment for the disabled people, by using information and communication technology (ICT) based on past experience. These authors design a customer-centric transportation service platform. The platform enables customers to access diversified services, such as Reha-buses, LTC-buses, barrier-free taxis, Welcabs, and general taxis, through mobile applications, phones, websites, and convenience stores.

The literature review allowed to conclude that a substantial amount of groups of people are excluded in today society since they having particular needs and limitations that restrict its mobility. At this level, the main factor of social exclusion is the limitation to information access. Several applications for route planning of public transport were accessed; however, few barriers that limit the mobility of several groups of people are addressed by these applications. In order to promote social inclusion, this work aims to define a set of guidelines to design route planners of public transport for socially excluded groups with physical, sensorial and/or cognitive limitations. For this purpose, several interfaces that can allow for improving the experience in public transportation use for these groups will be designed and evaluated. Thus, the main questions of this research are:

(i) What are the main current social excluded groups with physical, sensorial and/or cognitive limitations and why?
(ii) Which necessities and limitations do those groups have?
(iii) What kind of information regarding mobility do they need the most?
(iv) In what way should the information be organized and delivered?

The paper is organized as follow. Section 2 presents the data collection and the methods applied to conduct the study. Results and discussion are presented in Sect. 3 and the main conclusions are outlined in Sect. 4.

2 Material and Methods

This section presents a three-step methodology to define a set of guidelines to design route planners of public transport for socially excluded groups.

2.1 Scope

This work is focused on excluded groups with physical, sensorial and/or cognitive disabilities, henceforth, elderly, disable and people with reduced mobility (i.e. pregnant women, cane or crutches users, or people with physical or mental disability as blind and handicapped). This selection was based on four main criteria:

(i) *Some diseases can provoke mobility restrictions in particular groups of population:* Several diseases can provoke severe damage in the humans basic organs and lead to defectiveness such as: hearing loss (presbycusis), decrease of visual acuity (presbyopia), muscle loss, lower walking speed, mobility disability, cognitive aging, dementia and depression [15]. This means that physical obstructions as be steps, edges, steep lopes or simple obstructions on the pavement take a role on stopping the mobility reduced people from accessing public transport.

(ii) *The elderly population is growing fast:* The world's population aged 60 and older were numbered 962 million in 2017. This population increased more than twice in less than three decades and is expected to double again by 2050 [21]. In Europe, the elderly people (65 and older) will almost double from 87.5 million in 2010 to 152.6 million in 2060, growing from 19% in 2017 to 29.5% in 2060 [22, 23]. With life expectancy increasing in the coming decades the age structure of the European population will change significantly with the demographic old-age dependency ratio (people aged 65 or above relative to those aged 15–64) increasing from about 25% in 2010 to 51.2% in 2070 [22].

(iii) *The elderly can acquired with age more than one limitation:* Accessibility is rather affected as functional limitations become more common with age, and many older people will have acquired more than one such limitation [13]. The elderly social exclusion is related to long-term illness or disability, social isolation and lack of independence [12]. Other factors of elderly social exclusion are related with the loss of mobility due to the onset of partner illness or death, severe senescence or inability to drive [14].

(iv) *Some particular social excluded groups has particular needs of mobility:* Follmer et al. [16] found that shopping and leisure are the two most prominent motives for people above the age of 60 to travel. Many facilities such as food shops, libraries and town centres are believed significant for this group to have easy access to, being the healthcare services considered extremely important in this matter [10]. In addition, physical excluded people as pregnant and disabled records high access to health services.

2.2 Methods

The ISO 9241-210 was followed to ensure that the design created for an interface is user-centered. This allows to develop interfaces that address the user limitations and needs and therefore enhances efficiency as well as effectiveness of the interface and promotes well-being, satisfaction, accessibility and sustainability to the users [28]. This standard is supported in six main principles [29]:

(i) The design is based upon an explicit understanding of users, tasks and environments;
(ii) Users are involved throughout design and development;
(iii) The design is driven and refined by users;
(iv) The process is iterative;
(v) The design addresses the whole user experience;
(vi) The design team includes multidisciplinary skills and perspectives.

Based on these principles, a three-step methodology was defined: (i) requirements elicitation, (ii) interfaces development, and (iii) usability evaluation. Next sections presents a description of each of these steps.

2.2.1 Requirement Elicitation

Requirements elicitation were defined based on the identification of limitations and needs of physical disability people. Such analysis was supported by the results of: (i) literature review and (ii) data collected in the field.

In a first step, the literature review allowed to conclude that, people with sight problems might have a hard time seeing the letters or numbers and also colours, so the information has to be provided in a simple and intuitive way, utilizing icons and distinct colours to improve contrast [25]. Hounsell et al. [10] state that a wide range of information may be needed to attend the people needs, namely:

(i) Bus and subway networks and routes;
(ii) Stop locations, like bus stops, in order to promote a better overall intermodal experience;
(iii) Schedule timetable of all the public transport services;
(iv) Ticket price for each trip;
(v) Pavement conditions;
(vi) Overall accessibility in vehicles and stations.

The list of information stated by Hounsell et al. [10] is significant to any individual who uses public transport. For groups of people social excluded, the route planner should not, for example, merely describe a bus network or the fastest route. In this case, the application should provide the traveller information about routes that meet the individual capabilities, needs, preferences and restrictions of the users addressed [26]. In the case of elderly, these ranges from avoiding overcrowded buses to the inability of stair usage or simply having trouble understanding complex subway, bus or train stops.

In a second step, interviews and a survey were used to collect data in the field and to understand if the findings obtained from the literature review were in line with the observed in the field. Data was collected from users of a public transport network from a medium-sized metropolitan area (Porto, Portugal). This network is distributed along 1,575 km^2 and split into 26 zones, it serves 1.75 million inhabitants. The network is based on an intermodal system that includes: 126 buses lines (urban and regional), six subway lines, one cable line, three tram lines and three train lines [17].

The interviews were conducted in order to identify what features of a route planner for public transport would matter the most, what information they would seek and how they would like the information to be presented (i.e. icons or sentences). The questions ranged from the individuals personal use of public transport to the experience of using a route planning application. Appendix I shows the script followed. To easy conduct of interviews, three scenarios were defined in order to place the respondent in different situations:

(i) a trip to go to a shopping mall just opened: extract information about which applications the person will use to find the route towards the mall. It will also inform us of which transport is preferable to the individual;

(ii) a trip to go to the beach in a hot summer day: identify which transport would be more suitable for trips in a heat climate;
(iii) a trip to go work: identify what transport people use the most, and what bothered them while in that trip (i.e. overcrowd, loudness, heat, etc.).

The participants were selected considering three main requirements: (i) being the use of public transport, (ii) being the use of a smartphone and (iii) have more than 60 years. All participants in the interviews received information about the purpose and aims of the study and signed an informed consent form.

Interviews were conducted in presence and individually (N = 10) and each one had from 10 to 20 min long. Notes were taken during the interviews. Participants in the survey reveal that usually travel 35 min daily (90%) on buses (40%) or buses and subway (30%).

The survey was conducted to understand why or why not people use applications for route planning, in particular, to collect the feedback on what features and information would be important to implement in these apps so that it would make the person start using them. Four sections were defined, namely: (i) General approach and basic requirements; (ii) Route planning usage; (iii) Application disusage; and (iv) Application improvement. Appendix II displays the survey applied. The participants were selected considering two main requirements: (i) being the use of public transport, and (ii) being the use of a smartphone.

The survey was distributed by email to students and workers from the university as well as for several non-profit associations related with social inclusion of people with reduced mobility (e.g. Associação Salvador). Data was collected (N = 30) from people that travel daily, between 10 to 30 min each trip (50%), by bus. Data from people from different age ranges were collected ($N_{[18;30[} = 7\%$, $N_{[30;40[} = 27\%$, $N_{[40;50[} = 33\%$, $N_{[50;60[} = 17\%$, $N_{[60;100[} = 17\%$). From these, 36.7% have physical, sensory or cognitive limitations.

Data collected from interviews and from the survey have allowed to obtain valuable insights on what people consider useful and useless information in a route planner. The results from interviews and the survey are in line with each other.

In general, people seek an intuitive and reliable route planning application, which needs to be able to: (i) define in real-time the estimated time arrival of vehicles; (ii) state information about routes and schedules; (iii) maintain coherent schedules depending on traffic; (iv) alerts/notifications in case of traffic suspension, route or schedule changes; and the (v) indication of the existence or nonexistence of accessibility for wheelchair users or baby carriages. People that use route planning applications (80% and 60% of the participants in the interviews and survey respectively) mostly use it to gain information about estimated travel arrival, bus schedules (in particular during vacations and on holidays) and sometimes route planning. Information about malfunctions in the vehicles and other equipment, overcrowded transport, crosswalks near each stop and station, pinpointing ramps and elevators with the hypothesis of them having to use a wheelchair or a baby carriage, and detailed information about their location and how to reach a destination was also identified as information important to be included in route planning applications.

About 80% of the interviewed want to be notified mostly about whether the bus is going to miss or not and whether the vehicle is overcrowded or not. Prices are not considered as valuable information to obtain, but an online payment method should be integrated. Only 10% of the interviewed did not feel the need to use an application to help either create a route or check schedules and 40% of the survey respondents of the survey do not use any app to check schedules or plan routes. Most of the people do not feel the need to use while some use the website of the transport company, or simply do not believe in the information provided by the applications. Few point out that apps do not inform people about the accessibility of the vehicles and so they have no use for it. No differences were found between answers between people who or who do not use apps.

The data collected both from literature review and data collected in the field, allowed to identify what kind of information is lacking in route planners towards socially excluded groups selected in this study, particularly elderly. Based on that, some requirements to define the interfaces were defined:

(i) *Vehicle:* information about the type of vehicles that are touring through a route should be provided (e.g. the vehicle has or has not equipment to access a wheelchair).
(ii) *Stop/station:* information that help people locate themselves in subway stations or other locations that are part of the journey, for example, in which side of the street is the stop or how to get to a certain station should by delivered.
(iii) *Pavement:* while trying to access a station or moving inside it, information such as the location of crosswalks with light and sound signals, traffic lights, automatic stair cases, elevators, bathrooms, ramps and steps need to be considered.
(iv) *Schedule:* when travellers are on a station/stop waiting or a public transport or already in a vehicle they should be warned about multiple events that are happening or will happen in a near future, for example when to leave the vehicle, which stop comes next, how much time until the connecting vehicle arrives and which vehicle to enter and when.
(v) *Ticket price and purchase:* if a person is able to purchase a ticket in an app, it will reduce moving.

2.2.2 Interface Design

A web app called Figma was used to create the mock-up interfaces. This is an app that it is possible to run it in a browser and therefore on most operating systems. Figma provides all the tools needed for the design phase of a project, including vector tools which are capable of fully-fledged illustration, as well as prototyping capabilities and code generation for hand-off [24]. Figma also promotes team collaboration. Since it is browser-based, teams can collaborate as they would in Google Docs.

To design the application, first, a visual terminology to define equipment as stairs, elevators and crosswalks, and warnings as overcrowd places was established. Figure 1 show this terminology. Additionally, a crowdsourcing concept, that aims to improve the experience of people with reduced mobility in the use of public transport was defined. The interfaces cover multi-modal public transport information, in particular, information regarding the use of subway and bus. Information provision also includes information of how to arrive or leave a station or stop.

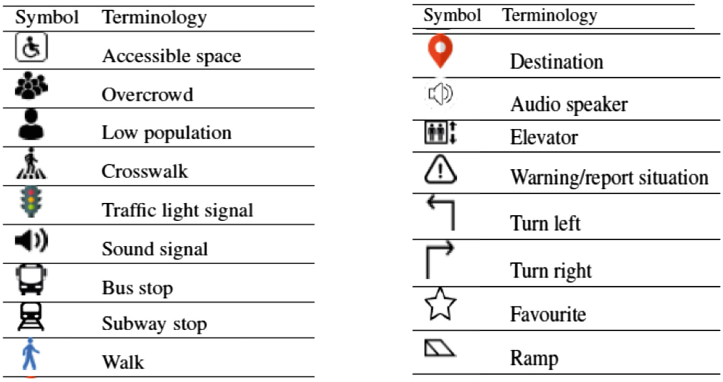

Fig. 1. Main elements terminology.

2.2.3 Usability Evaluation

The usability of an interface is closely associated with how easy it is for a user use it and it can be considered a quality attribute. Usability can be defined by five quality components [27]: learnability, efficiency, memorability, errors and satisfaction. To identify and understand what needs improvement regarding the interfaces developed previously, and if what has been done is viable or not, in this work, the effectiveness of the user interface of the low-level prototype, was assessed following the recommendations of Nielsen and Budiu [27]. Two stages were followed:

(i) *A session with experts:* a one-hour session was conducted with software developers experts for route planning of public transport. The session was organized in three steps: (i) an introduction to what had been done; (ii) a free exploration through the interfaces by the experts; and (iii) a discussion about the design and the information provided by the interfaces. Four experts participated in the tests.

(ii) *A survey:* the survey had the main objective to grasp how easy it was for the population to understand the information contained in the various interfaces. This survey contained most of the interfaces that were developed. For each interfaces responders were asked to access if the interfaces were easily perceived or not. For this purpose the Likert scale was used, ranging from 1 to 5, where 1 represented very easy and 5 represented very difficult. People that participated in the requirements elicitations was invited to participate in this survey. We collect N = 30 answers (one of the samples was disregarded due was incomplete). People from different age ranges ($N_{[18;30[} = 7\%$, $N_{[30;40[} = 17\%$, $N_{[40;50[} = 21\%$, $N_{[50;60[} = 28\%$ and $N_{>60} = 28\%$) and mobility experience was considered. Close to a third of the participants refer to had physical, sensory or cognitive limitations.

3 Results

The results of this work consisted in developing the interfaces for the inclusive and intermodal route planner and then evaluate their usability with experts in applications for public transport as well as a survey towards the population. Next sections present the main results obtained.

3.1 Interfaces

In Figs. 2, 3, 4 and 5, it is possible to see some of the interfaces that were developed and assessed on the usability survey. The symbol terminology previously defined is now clearly visible as an integral part of these interfaces. This allows for an intuitive and easy understand of the information that is being provided, as well as it helps develop a more interesting appeal.

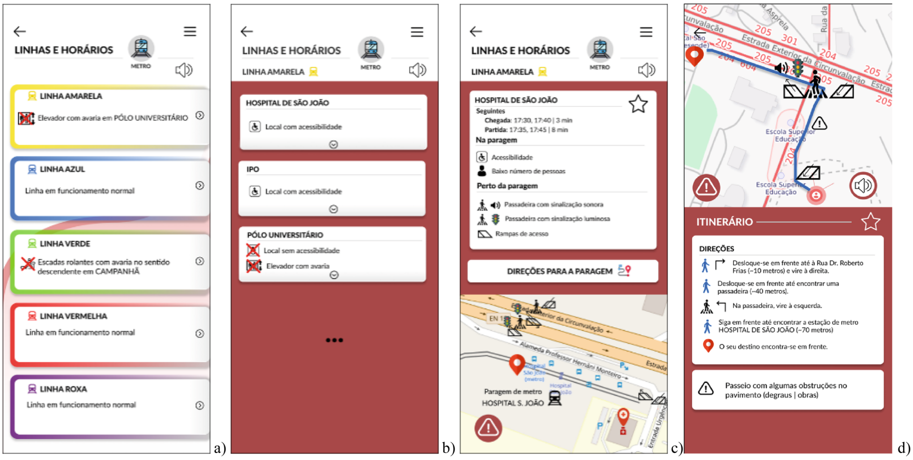

Fig. 2. Main screen mock-ups of the interfaces developed for subway.

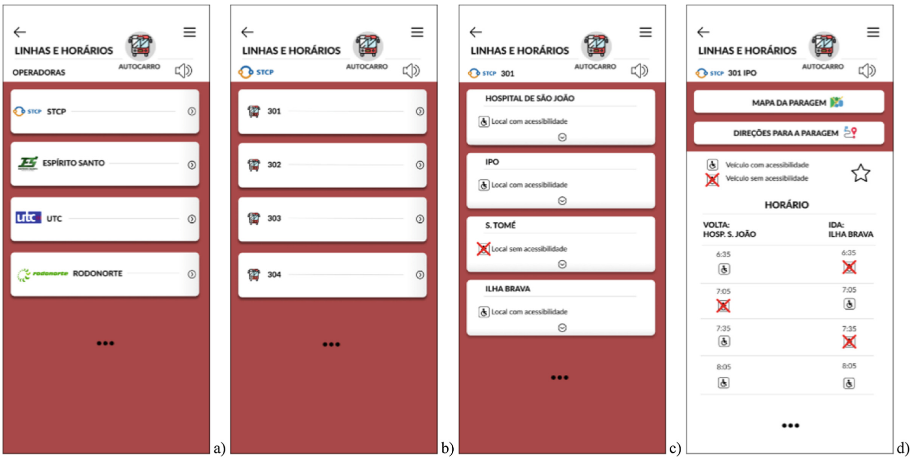

Fig. 3. Main screen mock-ups of the interfaces developed for buses.

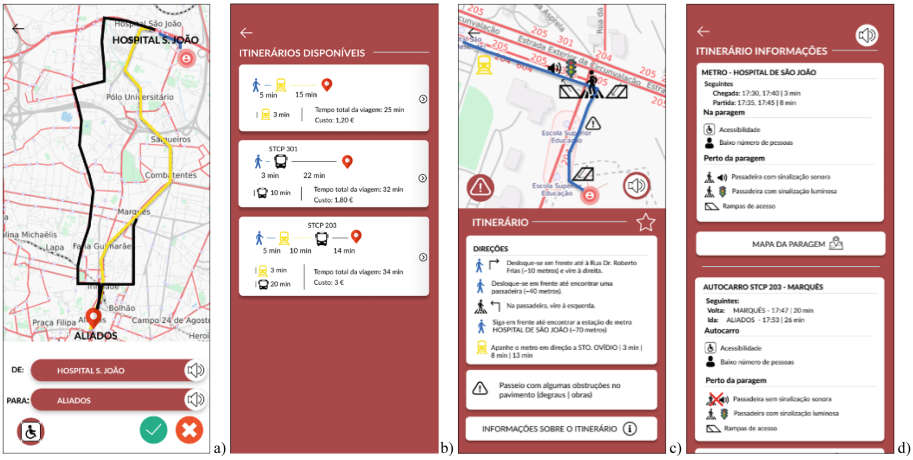

Fig. 4. Main screen mock-ups of the interfaces developed showing intermodal route-planning and several accessibility levels to the stops and vehicles.

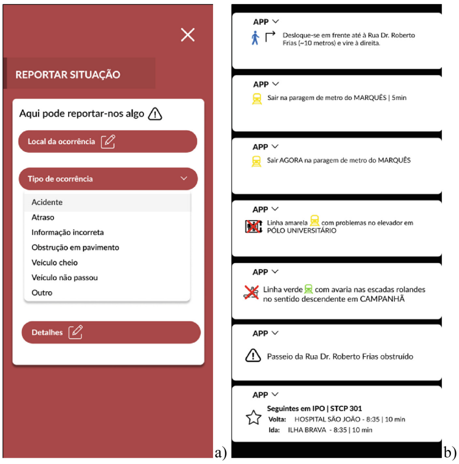

Fig. 5. Main screen mock-ups of the interfaces developed applying the crowdsourcing concept.

The results of usability evaluation, both with experts and with the general population through the survey conducted, allow to conclude that the interfaces are very intuitive and easy to interact with. Table 1 outlines the main results obtained with the survey.

The responders of the survey scored the interfaces around 1 and 2, that means that interaction with users is easy or very easy. This is extremely important in this work, as it has the objective to create simple and intuitive mock-up interfaces that contained a substantial amount of information towards mobility reduced people and people in general. Overall, most people considered the design appealing and intuitive. Only the interfaces with a bigger amount of information had a score of 2 or higher (i.e. easy, medium, difficult or very difficult). The survey had an open question after each interface, but barely anyone wrote any comments besides the good choice in colours and clean design.

Experts highlighted that users want information fast. Some interfaces, as the used to check schedules, demands too many button clicks. To solve this, they suggest add in the main page map a near the user location (also suggested by two responders of the survey). This way, the user could press the desired stop and instantly see the lines passing there, and with a second click check the schedules.

Table 1. Results of survey for the usability evaluation.

Variables		Screenshot	Average score
Terminology		Figure 1	2.0
Subway lines interfaces	List of lines	Figure 2a	1.1
	List of stations of a line	Figure 2b	1.1
	Station information	Figure 2c	1.8
	Route creation	Figure 2d	1.7
Bus interface	Operators	Figure 3a	1.9
	Lines	Figure 3b	1.2
	Stops of a line	Figure 3c	1.4
	Stop information	Figure 3d	2.0
Route planner interface	Map	Figure 4a	2.0
	Itinerary options	Figure 4b	2.1
	Itinerary to walk to a public transport stop	Figure 4c	2.4
	Itinerary in a public transport	Figure 4d	2.5

3.2 Guidelines

During the various research phases, including literature review, user observation, mock-ups design and usability tests, a number of usage patterns, themes and recommendations started to arise. The compilation of these findings resulted in a set of guidelines for designing mobile applications that may be used as guidelines for software developers and policymakers to support information exchange in public transport. Such guidelines can be described as follows:

(i) *Incentivise user participation:* user participation is crucial in developing interfaces both for the requirements elicitation as for the usability evaluation phase. Without the interviews and the survey conducted, the requirements specifications would only be dictated by the literature review, and there is a need to know people's opinions and compare them to the bibliography. For the usability evaluation, the best way to improve the design and identify what information is lacking is to promote feedback within the users. This will help future iterations to be more successful.

(ii) *Contextualization motivates the participation of users:* different environmental and/or personal conditions (e.g. sunny day vs. rainy day, working day vs.

holidays) may influence the use of different mobility ways. Nevertheless, during data collection people is mostly caught off guard and usually can´t define quickly the influence of some of these factors on its daily mobility. In order to help participants in this process, mobility scenarios could be defined to help people to imagine different mobility situations.

(iii) *Information complementarity:* the requirements elicitation must be based on different data sources and using distinct data collection methods in order to be robust and complementary;

(iv) *Weight the data:* a wide variety of information can be initially thought and discussed, but it is essential to keep in mind what information are the users most interested in. This means that it is important to not overboard the interfaces with unnecessary data.

(v) *Ensure an intuitive design:* despite the age range that an app is oriented to, it should always be intuitive to provide high usability. Information must be clear and the icons should be carefully chosen;

(vi) *Information sharing:* The participation of passengers with their own knowledge about the transportation network is central to the success and usefulness of a mobility information-sharing platform. In this way a certain level of participation of users is required for the application to be useful and appealing as a source of public transport information. In order to leverage the vast crowd of consumers as providers, some gamification must be included.

4 Conclusions

A user-centered design was followed to define a set of guidelines to design route planners of public transport for socially excluded groups. To achieve this goal, a three-step methodology was defined: (i) Requirements elicitation; (ii) Interfaces development; (iii) and Usability evaluation.

In the first phase, a literature review and data collected in the field, through interviews and a survey, in a medium-sized European Metropolitan Area, was conducted. This allowed to identify the main social excluded groups, its main limitations and needs, and the information that is lacking in route planners of public transport. Based on the information collected, a set of requirements to design the user interfaces were defined. Then, the mock-ups were designed following these requirements. Lastly, the usability evaluation was accomplished by promoting a session with experts in software development for public transport and by conducting a survey to the population. In this process, the difficulty in perceiving the information was evaluated.

The social excluded group selected to study in this work were the people with physical, sensorial and/or cognitive limitations. This group was selected based on four main criteria: (i) Particular groups of population are affected by some diseases that can limit the perception and their mobility when physical obstructions as steps or edges are present on the path; (ii) The elderly population is growing at a fast rate; (iii) The elderly can acquired with age more than one limitation; and (iv) Some social excluded groups has particular needs of mobility, sometimes limited by their inability to drive.

The results achieved demonstrate that the methodology defined in this work was coherent and robust. The overall results demonstrate that the information provided to the users, especially to mobility reduce ones, was well handled and extremely accurate. Most people considered the design appealing and intuitive. This work covered most of the information needed to improve social excluded people public transport usage experience. Based on the findings, some guidelines for software developers and policymakers were defined.

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Appendix

Appendix I: Interviews script

(i) Which modes of public transportation do you utilize and how often?
(ii) What is the average time of each trip?
(iii) How do you get information about the schedule?
(iv) Name one positive and one negative factor about public transport.
(v) Do you utilize a route planning app?

- If the individual said no to question 5, then:
  – For any specific reason?
  – What information would you like to receive in order to make use of a journey planner?
- If the individual said yes to question 5, then:
  – Which application do you use?
  – Which information do you retain as most important?
  – What attracts you the most about the design?
  – Which features do you consider very important in the app?
  – Which features would you like to see included in the app?

Appendix II - Survey script (requirements elicitation phase)
Part 1 - General approach

(i) Which age range do you belong to? ([18;30[, [30;40[, [40;50[, [50;60[and [60;100[years old)
(ii) Do you use a smartphone? (Yes or No)
(iii) With what frequency do you use public transport? (Daily, Sometimes per week, Sometimes per month or I do not use public transport)
(iv) Which transport do you utilize? (Bus, Train, Subway, Private vehicle or Others)

(v) Do you have any kind of physical, sensory or cognitive deficiency? (Yes or No)
(vi) Average time per trip? (<10 min, 10 < 30 min, 30 < 60 min or >60 min)
(vii) How do you obtain information about schedules? (Mobile app, Website, Bus stops, I do not need to know or Others)
(viii) Indicate 1 positive and negative factor about public transport. (Open answer)

Part 2 - Application usage or disusage

(i) Do you use any app to route plan or check schedules? (Yes or No)

Part 3 - Application disusage (if answer No on Part 2)

(i) What is the reason for the disuse of an app related with public transport? (Open answer)
(ii) Indicate 2 features that would make you use the an app. (Open answer)

Part 4 - Application usage (if answer Yes on Part 2)

(i) Which application related to public transport do you utilize? (Open answer)
(ii) Which information do you consider most important in the app? (Schedules, Prices, Routes, Delays or Estimated time of arrival)
(iii) What other information do you consider important? (Open answer)
(iv) What attracts you the most in the design of the app? (Open answer)
(v) What do you dislike the most about the design of the app? (Open answer)
(vi) Which features do you consider the most important in the app? (Open answer).

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