FROM GRAPHICAL PRESENTATION TO USERS´ COMPREHENSION OF TRANSANTIAGO NETWORK MAP

Silvania Avelar
Media Technology Lab
Ueberlandstrasse 129
CH-8600 Duebendorf
Switzerland
silvania.avelar@empa.ch

Jose Allard
Pontificia Universidad Catolica de Chile
Escuela de Diseño
El Comendador 1917, Providencia
Santiago, Chile
jallard@puc.cl

Abstract

A new navigation system in Santiago de Chile was introduced a few years ago. The design of Transantiago´s network map had to cope with the representation of a complex multimodal system, whose services have been in permanent change since its introduction. The network map should help people to find their way through the city and also mitigate their information anxiety, but this is not yet true. Users still have difficulties to understand the map. We analyze the experience of 18 Chilean transport riders of different ages and socio-economic conditions. Our findings on their comprehension of the graphical presentation of Transantiago show the need of reviewing design choices of the map.

Keywords: map design, information visualization, usability analysis

1. Introduction

The overhaul of the public transport system of Santiago de Chile has been considered the most ambitious transport reform ever tried by a developing country, as it involved the complete reorganization of bus routes and their integration to the city's metro in a so called "Big-Bang" strategy (Allard, 2008, Hidalgo, 2008). The new navigation system, called Transantiago, was redesigned from scratch and launched in February 10, 2007. New bus routes, new bus stops, new infrastructure, a new payment model and a new user information system were established through Santiago´s streets with large sacrifices and costs, especially for transport users. Users not only had to learn to use a brand

new transportation system, but had also to read a complex transport map, even though most of them did not have past experience with using maps for traveling to their destinations.

The navigation system was planned to count with a variety of graphic material, such as signage (for buses and bus stops), thermometer diagrams (for inside buses), "you are here" maps (for interchange points) and a network map (for metro stations, interchange points, main bus stops and personal use), each one delivering specific information on different stages of the trip. The graphical material was mainly designed while Transantiago´s operative plan was under development, but solely the network map was completely ready to be used at its starting date.

Several operational issues of Transantiago are still being discussed and gradually fixed, for example, the coverage of routes, service quality and economic sustainability of the system. Frequent changes in existing bus services and the increase of quantity of services required numerous graphic interventions in the Transantiago network map. To illustrate the dimension of such changes, the current map depicts approximately 50% more services than the original plan. As the updated network maps keep most of the original structure and graphic characteristics, there is an evident saturation of information in the maps. Transport network maps are amongst the most essential sources of information on public transport systems (e.g. Avelar, 2008, Cain *et all.*, 2007, Casakin *et all.*, 2000), however Chilean commuters still have difficulties to plan their trips with the network map of Transantiago, particularly complex trips, featuring various routes and transfers between services and transport modes (Allard, 2008).

The effectiveness of urban transport systems depends not only on a well planned and functioning system, but also on the availability of graphic material that enhance the ability of users to navigate in the system. Various studies evaluate users' comprehension of different public transport systems and maps. For example, Bronzaft *et all.* (1976) analyzed the nature of orientational problems of users of the New York City subway system. Law and Sung (2003) evaluated the online map of San Francisco. Roberts (2005) analyzes design strategies by different mapmakers to present the growing complexity of the London underground and their users' interaction and acceptance. J. Vertesi (2008) demonstrated how the London underground map became for its users the representation of the city itself.

In this work we look for the reasons why transport users in Santiago have difficulties in using the multimodal network map of Transantiago: do they make design-related errors or task-related errors? Analyzing the difficulties of Chilean public transport users to read the current map allows a better understanding of their ability to navigate through the system and gives valuable inputs for improving the map design. We provide a study to assess users´ interpretation of the network map and its graphic design features. Our results help to determine if the current network map should be only slightly modified or completely redesigned.

2. Methodology

To gather information about the interpretation of Transantiago network map, a practical test was performed with users. We prepared a route with different trip segments to test the users' interpretation of various design features of the map. The test required that users work alone, but if they considered that it was not possible to find out information only using the graphical material, they were free to find a solution, e.g. asking other people. The abilities tested were self location, identification of different landmarks, service areas and transport services, finding origin and destination points and route planning. We also evaluated the aesthetic value of different design features of the map.

2.1 Subjects

We analyzed the experience of 18 Chilean transport users to travel a route using the system and map of Transantiago. The volunteer participants had different ages, gender, occupations and socio-economic conditions, but they all live in Santiago de Chile. They did not need to have prior experience using the public transport system of the city.

2.2 Materials

Transantiago network map: It shows the whole public transport system and a legend with information about the service types and formal definitions used in the map, such as service areas, trunk and local buses. It also includes a list of payment card recharge points and Transantiago information offices. The area covered in the map is around 120 km^2. The map includes also a dense network of main streets with all their names, major urban reference points (airport, hospitals, etc.) and geographic features like the Mapocho River and different hills located throughout the city. The map background shows ten operational areas of Transantiago. They are identified each one by a color and letter. Local buses of a service area are presented in the same color of it. Trunk buses cross different service areas and are represented by black lines.
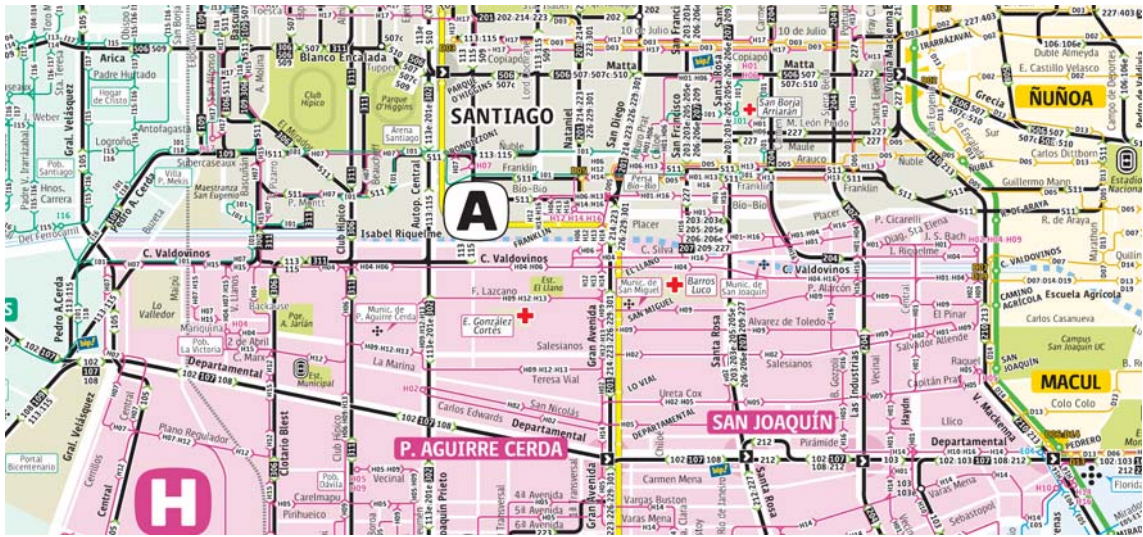
Figure 1: Illustration of Transantiago network map.

Test route: One route with trip segments between two neighbor service areas of Transantiago was prepared to test users' comprehension of the map. The route required participants to travel from one assigned starting point in downtown Santiago to the destination point with at least one change of transport service during the trip. In Transantiago commuters have more changes of services to complete typical journeys than before, as bus routes became shorter and connected to other routes through interchange points. Changing services is therefore considered undesirable by users. Many users even prefer to travel through longer routes but with fewer or no changes of transport services.
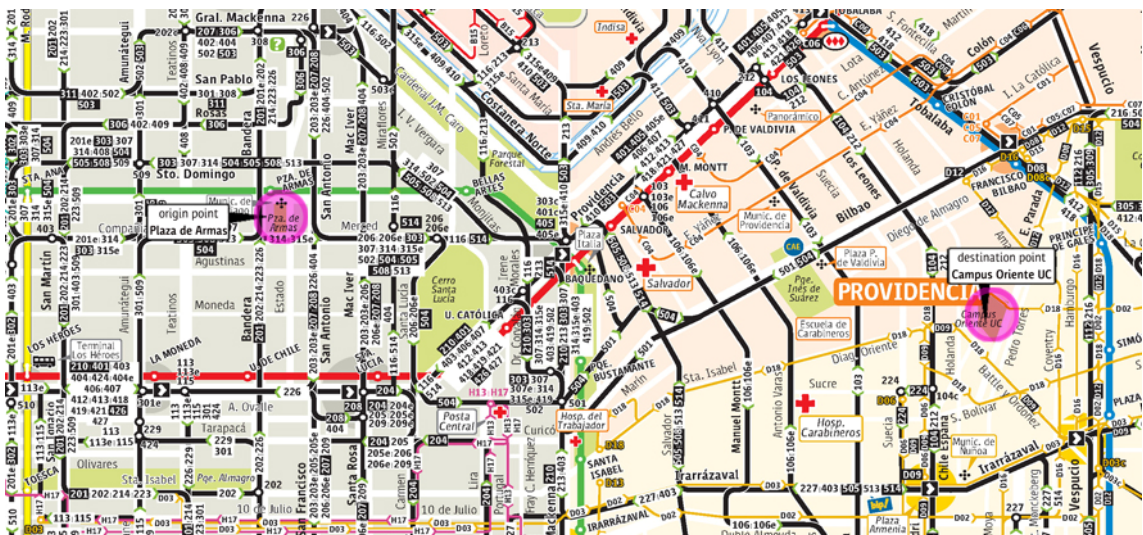

Figure 2: Test route "Plaza de Armas" to "Campus Oriente UC".

Survey Instruments:

Interviews. The interviews with participants were conducted between May 25th and June 12th, 2009, lasting around 90 minutes each. Levels of familiarity with Transantiago among interviewees varied. Similarly, levels of experience using maps varied. A conversation guided by a script of questions was carried out by an interviewer, in order to find out information on users' experience with Transantiago network map and on their comprehension of map design features.

Log sheets. We prepared log sheets, in order to elicit additional information on the traveling experience of users. The log sheets were fulfilled by the interviewers, which accompanied users during the trip. The effort of transport users to understand and use the Transantiago map were also observed and reported.

2.3 Procedure

Participants of this experiment were previously informed on the purpose of the study. They were asked to meet an interviewer at "Plaza de Armas", a central place in downtown Santiago. A short interview on the user's previous experience with maps and frequency of using public transport in Santiago was performed before the trip. Then users were given a copy of the network map on which they were asked to find their location and the route to the destination point "Campus Oriente UC". The interviewer traveled along with the users and registered all transport services chosen by the user, the times they boarded and left each service and other relevant information about their trip and how they found the necessary information to perform the trip.

Users traveled between the hours of 10 am and 6 pm on weekdays. When users completed their trips, they were again interviewed on their experience of using the Transantiago network map. During this interview, users were asked to outline strategies they utilized to construct their trips and give reasons for their choices of transport services, so that we could analyze and determine the different types of difficulties in their route planning solutions. At end they were also asked to give their opinion on different design features of the map.

3. Results

When choosing the designated test route, we consciously selected origin and destination points in different service areas of Transantiago that required users to change transport services at least once during their trip. The test route had many different options to get between the origin and destination points, as well as different possible transport modes (metro and bus services). We developed the interview script so that users could comment on various characteristics of the map after having used it to plan and carry out their trips. We got lots of useful feedback from our test participants, summarized as follows.

About using Transantiago network map in their trips, most users…

- Have no previous experience using public transport maps and have not even used the Transantiago network map to plan their trips before this experiment.
- Find the network map complex and too big for using during a trip.
- Appreciate the street network in the map background.
- Look for landmarks to find locations on the map and consider useful and enough the presented landmarks.
- Do not necessarily choose the most efficient route, but the most familiar or safer one - they prefer to ask a bus driver or other passengers for directions before to decide a route.
- Can not identify in the map the directions in which bus services operate.
- Prefer to use the metro rather than buses, as they consider the metro more reliable than buses and use metro stations as reference points throughout the city, especially the ones of the red line.
- Can not identify the express or night time services in the map.
- Are not familiar with Transantiago jargon, like "interchange points", "trunk routes", "local routes", "express services", "short services", etc. - especially non-regular users.
- Do not read the legend/instructions when using the map.

About perceiving the graphic design of Transantiago map, most users…

- Have the impression that the map is complicated.
- Can read street names, but have difficulties to find numbers of transport lines (especially in crowded areas), as well as their start and end points (terminals).
- Link the colored service areas of Transantiago to Santiago's counties - they are confused when trying to find the areas they live or work in.
- Like to have colors (service areas) in the map background, although they do not actually use them to plan their trips.
- Suggest having more color contrast, especially between neighbor areas, such as service areas I (green) and J (turquoise), or G (blue) and E (light blue).
- Do not link service areas to letters (indicated for operational reasons).
- Do not recognize the little arrows that depict direction of bus routes.
- Do not recognize the graphical presentation of interchange points.
- Can not understand the graphical presentation of trunk and local services, without reading the legend.

And some users…

- Have difficulties reading street names and service numbers due to some visual impairment.

- Would like to see the Metro logo in the metro stations.
- Would like to see bus stops indicated on the map.
- Would like to have some kind of reference for walking distances in the map, e.g. the number of blocks between avenues.

4. Conclusions

This pilot experiment does not intend to be a fully-realized final project. Due to time and resource constraints, we restricted the study to a small number of users and a route between two neighbor service areas with one interchange point (bus-metro, etc.). The interviews provided opportunities of getting users' opinions and questions on map usage. The objective of this study was to gain insight into Transantiago users' preferences for the design of graphic materials, especially for public transport network maps.

Most Chilean commuters do not have prior experience in using public transport maps and they demand location references, such as hospitals, parks and shopping malls, to support their wayfinding tasks in the map. Many users are not yet familiar with the new denominations of Transantiago and their meanings in terms of services provided. The metro system is considered a more reliable and safer mode of transport than buses and its red line is a main referential axis in the city. There seems to be a general prejudice against using the map, because of the negative reputation of the new transport system. However, after having used the map in this experiment, most users said that they would use it again when going to unfamiliar places in the future.

The network map of Transantiago is offered with a heavily rich design. Better graphical presentation is called for to improve users' comprehension of the map. The design of the network map of Transantiago should be modified, in order to simplify public transport information for Santiago riders and facilitate their sometimes hard experience of determining the best way to get from point A to point B.

Our study gives useful information on users' comprehension of Transantiago itself and encourages that further steps are taken for easier information visualization of the public transport of Santiago. Future work includes analysis and revision of all design elements of the current map, considering the findings of this study, and the generation of cartographic alternatives for presenting Transantiago (Allard, 2008, Avelar, 2008). The design process should include field tests with users, in order to evaluate legibility and effectiveness of the prototypes.

Another possible work is to optimize the current map for the online medium. Some users find beneficial to use the Web to access Transantiago information (Transantiago, 2008), but they can not print graphical information, since it is currently not ideal for digital delivery.

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