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Information on public transport: a comparison between information systems at bus stops

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Abstract

Bus stops are a very important element in urban mobility, linking the user to the public transport. It is essential that the infrastructure be adequate to accommodate the user with comfort and safety, providing correct information about the city and the transport system. Therefore, this article presents a small theoretical framework and performs a comparison between information panels at bus stops in five cities around the world. The aim is to analyze whether these panels have clear and objective information related to the urban transport system. It was concluded that the bus stops in Brazilian cities had a very poor performance compared with those of other countries.

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1. Introduction

Public transport plays a key role in urban mobility because it aims to meet the needs of citizens for ease of movement. The larger the urban center, the more complex it is to circulate in its areas and increasingly necessary to have an efficient public transport system. This scenario is included wherever citizens want to perform some task or satisfy a need, either in their place of work or study or at a leisure venue. Used by most of the world population,

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public transport can be divided into various categories of vehicles: buses, subways, trams and trains, with passenger terminals or stops, the most numerous being the bus stops.

Focusing on urban buses (which is the most widely used means of public transport in Brazil) and centralizing this search at the bus stops, it is observed that this type of urban equipment has several physical elements that work together seamlessly: shelters against rain and sunshine, benches, signs and information boards. In this context we include the local architecture and the physical conditions of streets and sidewalks, which are not part of this study.

At bus stops it is common to find information screens or plates. These panels contain key information so the user can be guided within the city and move independently, quickly and efficiently. This information should give the user the necessary conditions so that he will understand how to proceed to move more quickly, facilitating the users' orientation and mobility. The way to use informational elements to accomplish this task can be quite varied, according to the local culture with differences from one region to another. If panels of different countries are analyzed, differences may be higher.

This paper presents a comparative evaluation of information panels at public bus stops in five cities of four countries on three continents. The methodology consisted of exploratory visits and observation of the information contained in the panels, regardless of the physical structure of the bus stop. We tried to identify the information in the panels and whether they meet the demand users' demands, as regards the collection of information for precise movements from one point to another in the city, effectively, safely, comfortably, and in an autonomous and dynamic way.

The end result showed that there are many differences in the amount and quality of information in the analyzed panels. While some panels of some cities were efficient and complete in their aim of promoting good mobility, others did not provide minimum useful information.

2. Urban mobility

Urban mobility is one of the major problems which the world population living in urban environments face. To facilitate the circulation of large numbers of people, the public transport system is considered a good alternative [1].

Although many countries adopt public urban transport systems that favor collective circulation, in Brazil the situation is quite different. The way the Brazilian population moves within cities is usually private (using private cars), individual (sometimes one household has several vehicles), on streets and roads (railways and waterways are not used) and with most vehicles using fossil fuels) [2].

As for public transport, the most widely means used in Brazil is the bus [3]. And ordinarily in Brazilian cities there are fleets of buses belonging to private companies, which aim to profitability in the first place and are not always concerned with the quality of service. Thus many problems encountered in this system are: aging of fleet vehicles; structural problems at bus stops and terminals caused by vandalism and lack of maintenance; urban violence; low investment in the quality of information panels at bus stops and so forth. This context keeps citizens away from using urban transport.

This is common in several cities in Brazil. A special highlight is the cities with strong tourist features, receiving people from other regions of the country or even from other countries who want to see the sights using buses. Many of these tourists need an efficient and reliable information system in places intended for getting on or off buses. This system provides also local citizens requiring route guidance for destinations other than the usual.

In this sense it is possible to note that a bus stop can be used by a people with different characteristics, cultures, education, features and experiences. That is, they can be used by children, adolescents, adults, seniors, disabled people, locals and tourists. Therefore, the information is essential and should suit everyone. However, if the system of information and guidance is not efficient it can disrupt and even harm anyone needing to move from one point to another in the city.

3. Information at bus stops

In Brazil a law was created in 2012 that forced the agencies responsible for national urban transport to provide information on the transport system in the points of embarkation and disembarkation. Law No. 12.587 / 2012 refers to the "National Policy on Urban Mobility" and its purpose is to help users of public transport to have universal

access to the city. This law established that users should get free information on routes, schedules, fares, and on their rights and obligations, on service operators' rights and obligations etc [4].

Brazil's National Urban Mobility System is "an organized and coordinated set of modes of transport, services and infrastructure that ensures the movement of people and goods in the territory of the Municipality". In this context, focusing on the research object (information panel at bus stop), Law No. 12.587 / 2012 has some important information:

- Bus stops are for embarkation and disembarkation of people and are identified as an infrastructure of urban mobility.
- The nature of the service is public and collective.
- The object are passengers and the urban mode of transport are motor vehicles.

This is the minimum physical structure that should be available for the Brazilian population (or any other users) to use public transport. However, urban mobility is complex and depends on other elements that allow users to know where they are, where they want to go and how to achieve their goal, or reach their destination. An oriented user is one who knows where he/she is, either in time or space, and also what he/she can do to move and set the target location [5].

For this process to occur efficiently it is essential that the bus stop have adequate informational elements. Without this information it is possible to feel disoriented and unable to get to the desired destination [6]. For information to be effective it is very important that it is coherent and comprehensible. Also, public transport in a city with many tourist attractions must meet two types of public [7]:

- Locals - use public transport regularly, moving for work, study or pleasure, but probably not needing much information at the bus stop.
- Visitors and tourists - generally have little or no knowledge of the city and need a lot of information to get around.

The behavior of these two types of users is different and each values different attributes in the urban transport system. Below is the result of two surveys conducted in order to identify the most valued attributes in a public transport system:

- Security, scenery, flexibility, freedom, costs [8].
- Reliability, frequency, availability of stops, costs [9].

The attributes are varied and demonstrate the need for the existence of an efficient transport system to meet these demands, especially the item "costs", which appears in both surveys. It indicates that the public transport system is also valued for being a cheaper alternative for mobility. Therefore, the bus stop has become an important reference point for the population, to the point where people give twice more importance to time spent at a bus stop than the time spent on the bus during the trip [10].

In Brazil, the bus stop is the main source of information in an urban context [3]. However, the same study found that the amount of information available to the public on public transport is considered bad to very bad for the majority of the population, regardless of city size and number of inhabitants. The case study below reinforces this, showing that the information at bus stops is actually inefficient.

4. The spatial orientation process

For a better understanding of the difficulty of human beings in getting from one point to another in the city, using public transport and based on information that is set in panels of information is important to know the spatial orientation process.

This process corresponds to the individual's ability to define their location in an environment, to understand this environment and also to be able to move and get to a desired destination. During the spatial orientation process there are three aspects that complement one another [11]:

- Decision-making - the preparation and planning to define the choice;
- Implementation of the decision – how to act after making a decision;
- Information processing - matches understanding of the environment in which it operates.

One can see that the orientation process is complex and subjective, since it is related to individuals and their characteristics, knowledge and experience. There is also a strong relationship with the environment that will provide the necessary information for mobility. It is of great importance that the environment have physical media that transmits such information, for example, sheets, displays, maps etc [5].

This demand requires studies and visual perception projects. These are complex and require research studies in areas such as visibility, ergonomics, contrast, graphics, typography and colors. In this case it is important to refer to the design of information. This activity is focused on the human being and aims to transform complex content into something accessible without reduction or modification of the information content. By organizing the information it is possible to reproduce it so that it will be legible and understandable for a large number of people [12].

Following this reasoning, this discussion enters the field of ergonomics and its part which deals with issues related to the cognitive and the informational. The study and application of ergonomics principles allow the generation of solutions and improvements in the conditions of human beings' everyday life, and if it is inserted in the urban transport area, it contributes to quality service which is more convenient and secure [13].

Inserting the discussion in the visual perception of design, ergonomics takes on a double role. While cognitive ergonomics is intended to assist in the development of information systems that are compatible with the characteristics of users, informational ergonomics is involved in the analysis and design of environment information systems, taking into consideration the characteristics of the cognitive user [14]. It is understood that there is a strong relationship between cognitive and informational ergonomics.

However, discussions on the above-mentioned areas of study will not be deepened, although they are relevant in the development of public transport system projects. However, it was possible to have an idea of the complexity involved in public transport and its elements. Therefore, the aim was to compare the amount and diversity of the information contained in information panels placed at bus stops.

5. Case study

The research adopted a comparative methodology, divided into theoretical review, field research and analysis of results. A bus stop was selected in each city, with a total of five, randomly, ie, it was not necessary to determine parameters for the choice of the point of origin or destination. However, the bus stop should be close to relevant busy places.

The comparison took into consideration the amount of information needed to guide the public transport user to identify the place where he is, identify the place where he wants to go and identify the means to reach the desired location. Reasons for the trip were not needed. The questions about these three actions seek information that could meet the diversity of users, young or old, locals or foreigners, literate or not.

The cities chosen were Recife and Rio de Janeiro (Brazil), Cruz Quebrada / Oeiras / Lisbon (Portugal), Toronto (Canada) and Sydney (Australia). The bus stop in Portugal is not located within the city of Lisbon, but in the municipality (county) of Oeiras, in the district (parish) of Cruz Quebrada. So this site will be mentioned here as "CQ / Lisbon". Table 1 contains information on the location of bus stops chosen:

Table 1. Bus stops analyzed.

City / Country	Bus stop number	Bus stop address	Point of reference
Sydney / Australia	2031168	High St near Prince of Wales Hospital, New South Wales, Sydney	Sydney Children's Hospital
Toronto / Canada	Unidentified	Queens Street, 509 – Street car Route	Harbourfront Centre
CQ/Lisbon / Portugal	04301 (776)	Estrada da Costa, s/n	University of Lisboa, School of Human Kinetics and Jamor Park
Rio de Janeiro / Brazil	BRS 2 – Garcia D'Ávila	Rua Visconde de Pirajá	Ipanema Beach, Ipanema Station, Amsterdam Sauer Museum
Recife / Brazil	180301	Av. Conde da Boa Vista	Post Office Building, Recife Plaza Hotel, Atacadão dos Presentes

Generally, cities have several types of bus stops. To create a standard of comparison, those with a physical infrastructure containing a road sign, an information panel, seats and a shelter against rain and sunshine were chosen. The information boards should have an area above 1m²:



Fig. 1. (a) Recife, Brazil; (b) Rio de Janeiro, Brazil.



Fig. 2. (c) CQ/Lisbon, (d)

Portugal. (e)



Fig. 3. (d) Toronto, Canada; (e) Sydney, Australia.

The formal configuration is similar, with color panels, located in a central position, behind and above the seats and a transparent protection. Looking at the layout of the elements one observed differences in color and size of the letters and various pictograms. However, Table 2 indicates the information required to be compared.

It is important to inform that in the "type of information" column the attributes related to time and space are listed. They can be used as a single set or not depending on the user's needs, but each has different characteristics and the more attributes the panel has, the more efficient it will be in fulfilling its purpose: to inform about the urban transport system.

Table 2. Desirable information at bus stops.

Type of Information	Sydney	Toronto	CQ/Lisbon	Rio	Recife
Bus stop identification (<i>number or name</i>)	X	X	X	X	X
Exact location (<i>street, ZIP code</i>)	X	-	X	-	-
Numbers / names of the bus (<i>bus lines passing there</i>)	X	X	X	X	X
Full itinerary of the line (<i>time leaving the terminal</i>)	X	X	X	-	-
Map of area (<i>neighborhood details</i>)	X	X	X	X	-
City Map (<i>a general map of the whole city</i>)	-	-	X	X	-
Attractions in the surroundings	X	X	X	X	-
City Sights (<i>the most important ones</i>)	-	-	X	X	-
Additional public transport (<i>proximity or connection to subway, train, tram etc.</i>)	X	X	X	-	-
Emergency contact numbers (<i>local transport center</i>)	X	X	X	X	X
Night itineraries (<i>bus stops of night lines</i>)	X	X	X	-	-
Tips for use (<i>how to use the system properly</i>)	X	X	X	-	-
Tour tips (<i>alternative routes to attractions</i>)	-	-	X	-	-
Information on accessibility for disabled	X	X	X	-	-
Bus fare (<i>day and night</i>)	X	X	-	-	-
Alternative access to information (<i>QR Code</i>)	-	-	X	X	-
Information in English (<i>for foreigners</i>)	X	X	X	X	-

Through the data contained in Table 2 one can observe large differences in the amount of information about the urban system in the cities chosen. Although in one city there may be several types of bus stops, some infrastructure requirements were specified and adequate. However, there are many different types of information. The following considerations are made on each of the panels evaluated.

Sydney, Australia - The information panel only has an image and the rest is text information. The map corresponds to the region around the bus stop, containing the name of the main streets and many geographical features and landmarks (parks, hospitals, supermarkets, schools). There is data on the bus routes or on the environment, including timetables and destinations separated by day of the week. There are also connection points between trains and buses etc. The information in this panel allows the user to move within the city, especially inside the limits displayed on the map.

Toronto, Canada - The information panel is rich in information. It has a city map of the downtown area and virtually all bus stops are identified, including the number of bus lines. The data is organized on notice boards and includes airport transfers, train itineraries and night buses, instructions on how to understand the routes, personal safety information, transfer of routes, geographical features, landmarks, routes to the islands of Lake Ontario, the names of the companies that perform all routes etc. There is a panel of information that enables efficient mobility to the user in the area covered by the map panel.

Cruz Quebrada / Lisbon, Portugal - Although it is the smallest city among the five chosen, its information panel has many details. It includes the pass system of the Lisbon region and identifies the tram, train and bus stops, plus the itinerary with times. The map displays transfers (connections) between the metro, trams and buses, and includes transfers to the boats and the bus to the airport. There are also geographic features, landmarks and information on using the bus system. This is a great example of information panel.

Rio de Janeiro, Brazil - Rio is one of the most famous and visited cities in Latin America. But the analyzed panel has little information with blanks without any data. It brings only specific information about the lines of the rapid bus system (BRS) passing at that stop, including the line number, itinerary and some sights. There is a map of the city and the region, but it has few details. No information regarding use of the transportation system, or transfer (connection) with the subway. It is possible that some users will encounter difficulties when using the panel as a source of information.

Recife, Brazil - The information panel of this city has only one item: the numbers and names of the bus lines that pass at that bus stop, and nothing more. Recife is one of the major cities in Northeast Brazil, has an important political, academic, economic and touristic function in the region and also has a subway and an international airport. However, nothing is informed at the bus stops, making the location and mobility very difficult. Even being located in the central area of the city where there are major bus corridors, the panel does not provide details on the urban transport system. It is very likely that most users cannot find their way and move around in the city.

The bus stops of the two Brazilian cities had a much lower than expected result and require their users to search information from other sources, usually the Internet or by asking other users or even the bus drivers. However, cities outside Brazil met expectations, having panels with many information for an effective, fast and safe mobility. An example to be followed.

6. Final considerations

As we observed, the information panels at bus stops are critical to the use of public and collective transport with ease and efficiency. One of the causes that hinder the user of this type of transport is the poor quality of their services. And the information is included in this context. An effective information system is one of the improvements in the system of measures that can attract more users, regardless of the city and its regional or national influence. In this way, it reduces the number of cars on the road, the traffic flow and air pollution.

An important factor that needs to be highlighted is that each of the chosen cities have important differences between them, such as the number of inhabitants, the tourist profile, economic, social and cultural importance, and policy for the region and the country etc. However, the study served to bring up the discussion about the importance of the quantity and quality of the information contained at bus stops.

Despite the differences mentioned above, the need for information is essential for anyone who uses the public transport system, regardless of the reason and time that the user has in the city. That is, both a tourist who will enjoy a few vacation days and a local who was born and lived for decades there may depend on information to move around.

It is expected that in Brazil the Urban Mobility Law will be fulfilled and that users will be assisted in their needs. This is a complex process that involves knowledge and professionals from various fields, including graphic design, information design, informational ergonomics, environmental ergonomics of the built environment, traffic engineering, architecture etc. However, if a bus stop is well laid out and allows users to obtain the necessary information for their trip, it has certainly achieved its main goal: urban mobility and the use of urban space.

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References

- [1] V. H. M. Bins Ely, J. M. Oliveira, L. Logsdon, A Bus Stop Shelter Evaluated from the User's Perspective, *Work* 41, 1226-1233, 2012.
- [2] Instituto de Pesquisa Econômica Aplicada, *Brasil em Desenvolvimento: Planejamento e Políticas Públicas*. 2v. Brasília: Ipea, 2014.
- [3] Instituto de Pesquisa Econômica Aplicada, *Sistema de Indicadores de Percepção Social (SIPS): Mobilidade Urbana*, 2 ed, Brasília, 2011.
- [4] Brasil. Lei nº 12.587, de 03 de janeiro de 2012. *Diário Oficial [da] República Federativa do Brasil*, Brasília, DF, 03 jan. 2012.
- [5] V. H. M. Bins Ely, *Ergonomia + Arquitetura: Buscando um Melhor Desempenho do Ambiente Físico*, Anais, Ergodesign, 3, Rio de Janeiro: LEUI/PUC-Rio, 2003.
- [6] C. S. Silveira, M. Dischinger, A. Debatin Neto, *Sistema Informativo no Transporte Público Urbano: Requisito Imprescindível para a Mobilidade dos Usuários*, Anais, Ergodesign, 14, Joinville: UFSC, 2014.
- [7] C. R. Garcia, R. Pérez, F. Alayón, A. Quesada-Arencia, G. Padrón, Provision of Ubiquitous Tourist Information in Public Transport Networks, *Sensors*, 12, pp.11451-11476, 2012.
- [8] S. G. Stradling, J. Anable, M. Carreno, Performance, Importance and User Disgruntlement: A Six-step Method for Measuring Satisfaction with Travel Modes, *Transportation Research Part A*, 41(1), pp. 98-106, 2007.
- [9] L. Eboli, G. Mazzulla, Service Quality Attributes Affecting Customer Satisfaction for Bus Transit, *Journal of Public Transportation*, 10(3), pp. 21-34, 2007.
- [10] N. Oort, R. Nes, Service Regularity Analysis for Urban Transit Network Design, In: *Proceedings of the 82nd Annual meeting of the transportation Research Board*, Washington, D.C., 2003.
- [11] P. Arthur, R. Passini, *Wayfinding: people, signs and architecture*, Oakville Ontario Canada: Focus, 2002.
- [12] J. Visocky O'Grady, K. Visocky O'Grady, *The information design handbook*. Cincinnati, Ohio: How Books, 2008.
- [13] I. Iida, *Ergonomia: Projeto e Produção*, 2ed, São Paulo: Edgard Blücher, 2005.
- [14] M. F. X. M. Almeida; G. S. Ribeiro; V. M. Villarouco S.; L. B. Martins, *Avaliação Ergonômica dos Recursos Utilizados na Orientação e Mobilidade de Pessoas com Deficiência Visual*, Anais, ENEGEP, 27, Foz do Iguaçu, 2007.