STUDY FOR MODAL CHANGE OF URBAN BUS USER TO THE TRAIN

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RESUMO

Este artigo apresenta um procedimento que se baseia na técnica de Jensen (1999) para estabelecer categorias de usuários de acordo com o grau de fidelidade aos trens e ônibus urbanos e, assim, contemplar quais segmentos de passageiros (ônibus e trem) estão mais sensíveis à transferência modal. As três categorias – Cativo, Tradicional e Seletivo – mantêm relação com a natureza da viagem e com o perfil socioeconômico. A revisão na literatura sugere uma maior ênfase ao atributo acessibilidade como um atrativo de passageiros. Neste sentido, o artigo segue uma abordagem simples, modular e gradativa que reúne elementos para a definição de estratégias visando a estimular os usuários a utilizar o trem. A pesquisa exploratória realizada com os usuários dos ônibus apontou que os segmentos mais sensíveis para trocá-lo por uma modalidade mais conveniente são os com maior nível de renda e que realizam viagens mais longas.

Palavras-chave: Transferência modal, Qualidade de serviço, Percepção do usuário.

ABSTRACT

This article addresses a procedure based on Jensen method (1999) to establish user categories in terms of the degree of loyalty to urban buses and trains, and therefore to consider which passenger segments (bus and train) are more sensitive to modal change. The three categories – Captive, Traditional and Selective – maintain a relation with the travel mode and socioeconomic profile. A review of literature suggests a stronger emphasis on the accessibility attribute as attractive to passengers. On this point, the article takes a simple, modular and gradual approach that combines elements for defining strategies to encourage users to go by train. The research survey involving bus users indicated that the segments most sensitive to changing to a more convenient modality are those with a higher income level and who travel longer distances.

Keywords: Modal change, Quality service, User's perception.

1. INTRODUCTION

The implementation of the railway system in the mid-19th century was fundamental for urban growth worldwide. Trains contributed to territorial organisation of the cities, representing a symbol of modernity. The international experience confirms that this is a reliable and quality passenger transport system and has huge potential for socioeconomic development and for creating jobs.

Cities with transport systems based on the metro-railway mode have better performance (Cardoso *et al.*, 2009). Moreover, they show that a well-planned system focusing on people is irrespective of the prevailing economy of the place, in the case of Stockholm and Singapore (Gonçalves, 2006). Studies prove (Nabais, 2005; Brons *et al.*, 2008; Lara *et al.*, 2008; Silva & Taco., 2008) that, in addition to quality service, modal integration and allocation of businesses and homes around metro-railway stations are factors intervening in the process of attracting passengers.

In Brazil, for many decades, the railways were a driving force in the evolutionary process of the major metropolitan regions, guaranteeing conditions of accessibility to travel and communication between territorial units. However, since the 1980s, the suburban railway services deteriorated faster due to the implementation and advance of the car industry and financial mechanisms to build and repair highways (César, 2000). According to ANTP (2008), only 3.5% of all travel in Brazilian cities is by modalities on rails.

Unlike the highway mode, which predominates the Brazilian transport sector, but does not structure the urban grid or play an integrating role between transport modes, the metro-railway systems tend to encourage more predictable land use and are concentrated in the vicinity of the stations, generating not only a more efficient system at lower costs with less pollution, but also the region's development (Gonçalves, 2006; Litman, 2008).

According to TTI results (2003), the costs of traffic jams considerably increase with the size of the city when they have a transport system that is based solely or predominantly on buses. Unlike cities structured on a large integrated railway system, such as New York and Chicago, which, for example, have around half the costs of Los Angeles, as Figure 1 shows.
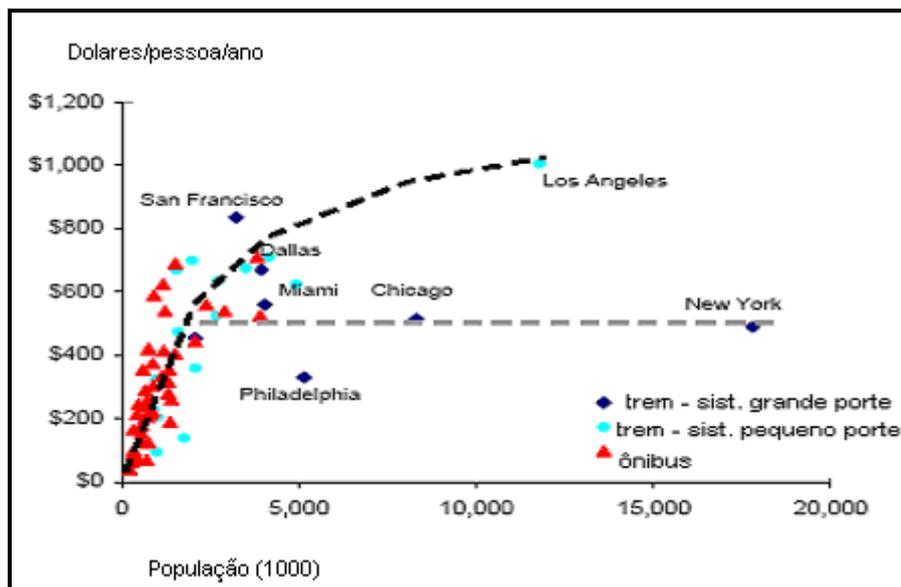
Figure 1 – Costs incurred in traffic jams
Source: TTI (2003).

On the other hand, in twelve Brazilian metropolitan regions (Porto Alegre, São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Maceió, Recife, João Pessoa, Natal, Fortaleza, Teresina and Brasilia), the metro-railway systems have been operating in a grid totalling 29,817 km (ANTP, 2008), a sign of its potential. However, they do not play the structuring role that they should in the cities. It is noticeable that even with recent policies of reviving the railways, due to investment restraints, the railway system is not being fully utilized.

In an attempt to minimise this situation, this article will discuss a procedure based on Jensen method (1999) to identify the level of dependence of train and bus users and determine the user segments that are more prone to making the modal change (from bus to train). In the procedure, user categories were created that express the degree of loyalty to the train and bus modes. These categories were then submitted to exploratory research with both modes, in order to determine the socioeconomic profile, nature of the travel and the possibility of changing to the train. It should be mentioned that this article will present only the results obtained from the survey with bus users.

2. CHARACTERIZATION OF THE PROBLEM

The railway system in the Brazilian metropolitan areas has been undergoing a revival period, so far without much success. If, on one hand, its causes are associated with high operating costs, the low income, degraded image, poor quality service and incompatible capacity, on the other, the underuse of the system is closely linked to the lack of modal integration, job and service concentration around the terminal stations and the dependent periphery (Gonçalves, 2006).

This situation shows that there is growing dissatisfaction of the users who need passenger trains to get about and they eventually look for alternative transport, which reinforces and increases the dependence on going by bus as collective transport.

According to ANTP (2008), the total operating data of collective transport indicated that in Brazil the number of passengers carried by bus per year (14.8 billion) is significantly higher (around seven times more) than the number of passengers carried by rail (two billion). A situation that contributes to making a city's traffic sheer chaos, principally considering that the buses operate typically in the country in an irrational manner and do not circulate in exclusive corridors as in the case of BRT (Bus Rapid Transit) – which has already been operating in, for example, Curitiba and Criciúma. Consequently, traffic jams punish passengers and drivers alike, pollute the air, cause accidents and serious damage to the economy (Ribeiro, 2007 *apud* Sá, 2007).

To reverse this situation and make the railway system more attractive, it is necessary to find which user segments are more prone to modal change so as to learn their characteristics, priority attributes and which strategies are usually recommended in this matter. Such as, for example, considering factors that influence modal change.

3. APPROACHES TO FACILITATE MODAL CHANGE

3.1. Traditional approaches

According to Ortúzar & Willumsen (2002), literature specific to the transport area often presents two classic models to represent travel-related processes of choice, such as that of the modality to be used. The models are Logit and Probit. These models consider that a user's choice process is governed by a decision function, characterised by each available alternative's own explanatory variables. Both tools study the behaviour of users in situations where they have to choose one among various options. This choice depends on parameters that seem subjective but that can be represented by the decision function (Nielsen *et al.*, 2002).

The Logit model has simpler mathematical treatment and representation than the Probit model, justifying its greater practical use. Moreover, the two models have other theoretical differences. Logit considers independence between the alternatives in the decision-making process. Probit, on the other hand, considers the existence of some correlation between the alternatives, hindering its use, since this correlation has to be explained. Although both are usually employed, their applications are restricted like any probability model (Greene, 2008).

3.2. Other approaches

There are other techniques (McDaniels & Gates, 2004), although not explicitly formalised or focused on modelling and investigating modal change, which can be adopted for this purpose. They may include considering advertising campaigns, service marketing actions and focus group procedures.

- Advertising campaigns – they are a set of goods and services transmitted by mass media. Their main characteristic is endomarketing (institutional marketing);

- Service marketing – it is a set of activities for analysing, planning, implementing and controlling programmes. Strengths: It integrates objectives, policies and sequences of action (tactical), effectiveness and efficiency. Weaknesses: cost and need for constant investments (long term);

- Focus groups – they represent a dynamics for in-depth qualitative investigation (further understanding) of responses and a combination of behavioural groups. Strengths: cost, opportunity (fast performing), flexibility, direct link with the beneficiary public and absence of technical facilities. Weaknesses: it is addressed as a quantitative study, relating to subjectivity, and a skilled moderator must be present (Debus, 1988).

Recently the use of cognitive approaches was observed to indicate preferences and explain that there are different perceptions and the reason for such. Scherer (2009) used the Theory of Planned Behaviour (TPB), based on the combination of beliefs that form an individual's attitude on the way to specific behaviour. The TPB justifies that representations of image and memory reflect the assessment and knowledge of the individual or specific attributes.

In his article on public transport in Stockholm, Diziekan (2008) defends that with the representation of memory (Fujii & Kitamura, 2004), public transport routes are easier to be resumed if they are more visible in urban streets; if they operate on the main roads and if they are sign-posted.

TPB is successful on certain questions of the surveyed modal choice and travel behaviour (Heath & Gifford, 2002; Bonsall *et al.* 2004; Beale & Bonsall, 2007; Karash *et al.* 2008). Nevertheless, so far there is no empirical evidence that this approach is appropriate for demand models that consider public transport modes to be similar, such as rail and buses. And first and foremost, because of the fact that cognition influences behaviour and vice-versa and is accepted by psychologists. On the other hand, cognitive theories when choosing the transport mode promise a better understanding of the observed trends.

Pertinent questions on the user's perception and satisfaction are usually considered and will come up against the problem of suitably grouping the user's view. The user's perception is the basis for classifying the service levels. Accordingly, attempts are made to incorporate the perceptions more closely with the strategies in the Transport Engineering area. Some have perfected a forecast of the rates of service level combining the Theory of Culture and application of Fuzzy Logic (Romney *et al.*, 1986).

On the way to understanding whether users are intending and willing to change a transport mode to reduce impacts on the environment, Jensen (1999) developed research methodology using interviews and a qualitative approach to people's behaviour in relation to the role of transport in their lives. His focus is centred on the explanations and perceptions of behaviour and attitudes that the individual provides and divides in two stages.

Based on the bibliographic review, it was found that some techniques reach the perception and, thus, make the modal change, although not explicitly disseminated. However, they do not effectively represent a methodology, namely, for example, the Logit and Probit models.

Today many research reports are published in scientific journals and seem to meet not only the theoretical interests of academicians but also those of professionals who use focus groups (a qualitative investigation technique committed to the understandable meta-scientific approach), as a management and decision-making tool and to support the intervention programme in different areas.

In this context, the method developed by Jensen (1999) is of a qualitative character, and stands out for its originality and capacity to adapt its central characteristics to other studies, and whose focus is on understanding people's behaviour regarding the role and dependence of transport in their everyday lives in Denmark.

4. JENSEN METHOD (1999)

4.1. Description

The procedure developed by Jensen (1999) has a sociological approach of a qualitative nature and its focus is on people's behaviour in relation to the role of transport in their lives, and is concentrated on the perception and explanations of the attitudes provided by the actual individual.

The purpose of the study is to learn how transport has become an integral part of the life of these people, their behaviour, attitudes toward the habit of use, consciousness about environmental preservation and its integration in modern culture. Contradictions between the commuting habit and concern with the environment were analysed and some possibilities of a change in behaviour were also discussed.

The study was divided into two blocks. A qualitative study based on twenty questions to 30 users accustomed to driving on roads, was performed to learn the types of users and to express their opinions and ideas that are valid in Denmark. And a quantitative study consisting of interviewing 1,000 people, based on the interviews carried out during the qualitative study, in order to know how transport has become an integral part of people's lives.

The qualitative part of Jensen method (1999), which is the focus of interest in this article and proposal to apply it in the case study (trains and buses), categorised the users on a scale that identified the degree of the user's dependence on other modes. The six categories presented are: passionate car drivers; everyday car drivers; the leisure time car drivers; public transport users of heart; public transport users of convenience; and public transport users of necessity.

Figure 2 shows the division percentage of the six categories, emphasising that, even with the quality of public transport in Denmark, only around 1% considered itself "passionate car drivers".
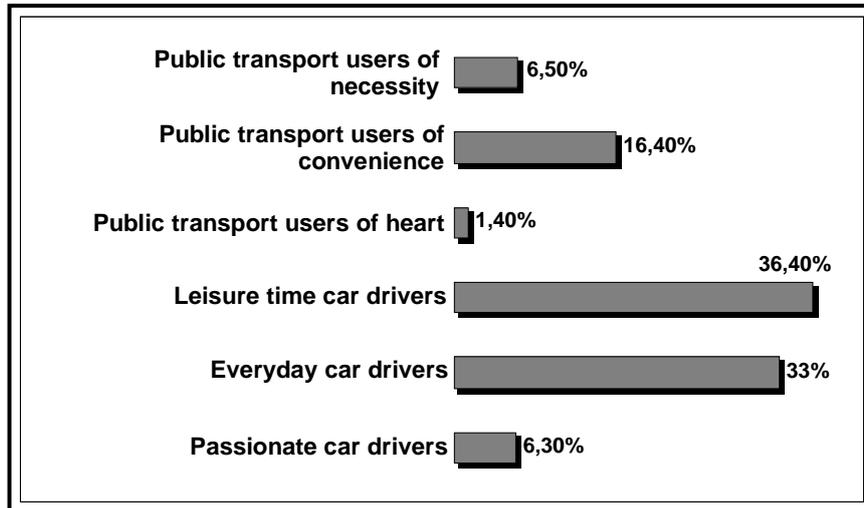
Figure 2 – Percentage between categories
Source: Jensen (1999).

From analysing the interviews, it was confirmed that the development of concepts for understanding transport behaviour must be based on specific questions. The analysis also showed some basic contradictions in the behaviour between people and their attitudes to transport. It is therefore important to look carefully at some concepts that can contribute to understanding these contradictions. They are the so-called conceptual pairs freedom/ restriction and dependence/independence.

A bibliographic review was used to find that the method developed by Jensen (1999) has been widely mentioned, the Scopus database (http://www.scopus.com/) having recorded 27 articles, among them: Hiscock *et al*. (2002), Ellaway *et al*. (2003), Tapio (2005), Anable (2005), Ory & Mokhtarian (2005), Steg (2005), Loukopoulos *et al*. (2006), Beirão & Sarsfield Cabral (2007), Dickinson & Robbins (2007), Gatersleben & Appleton (2007) and Stradling *et al*. (2007).

It is noted that it is common only to reference Jensen's study (1999), emphasising it as a successful example in studies on mobility management and in studies that address people's behaviour toward transport in their everyday lives. Moreover, her method is mentioned in studies that address people's perception on the quality service of public transport, the reasons for using a private car, benefits associated with the use of the car and also in studies that consider modal change from the private car to bicycles. As well as when passengers' satisfaction is investigated in relation to the role of public transport in their lives.

On the other hand, a relatively recent application of Jensen method (1999) was found in Brazil in an academic paper by Velloso *et al*. (2004), having as a population the Technological Centre (TC) of the Federal University of Rio de Janeiro (UFRJ), confirming its potential and possibility of similarly reproducing other studies on Brazilian reality, as in the case of urban buses and trains. However, no study used the categories presented by the author to study the prevailing competition between public transport modes.

It should be mentioned that, although it was not used as a tool, this does not mean its use is infeasible. Since these categories can strengthen demand for train travel, they can also

attract bus users to the railway system, since from them the segments prone to change are identified and priority attributes for establishing quality service are discussed.

4.2. General characteristics of the categories presented by Jensen (1999)

Among the aspects reported above, interviews to learn about the users (qualitative research) provided a user classification in six categories:

Passionate car drivers – Take care of the car and loves to drive it. Mostly men but could be women who never use public transport and cannot even imagine doing so. They go by private car or on foot. They are inveterate drivers who always drive and do not intend to stop doing so. They usually listen to music or the radio while driving. They do not get stressed while driving in the rush hour. Time spent in the car is not considered time wasted but rather time to be used constructively: planning chores and looking for creative ideas to solve problems. Passionate car drivers regard their vehicle as a symbol of freedom and believe that the car brand is a strong sign of their personality and those certain brands (expensive with sophisticated technology) reflect success;

Everyday car drivers – They drive the car to go and return from work because it is easier, faster and often cheaper. Also, perhaps they do not have alternatives, since they are accustomed to driving the car, which gives them a sense of independence in their everyday life and it would therefore be hard to live without. Even so, they are not inveterate but drivers of habit, who probably drive for many years;

Leisure time car drivers – They use the car in their leisure time. The car is hard to substitute especially in relation to shopping. Carrying children to and from institutions or recreational activities, weekend visits to the summer home, visiting friends and family and similar activities are much easier, more comfortable and faster by car than by public transport;

Public transport users of heart – They voluntarily choose public transport. Their choice is based on their own act of using public transport as a desire not to have or drive a car;

Public transport users of convenience – Urban dwellers, the majority in large cities. They are often young people, but may belong to other age groups. They use public transport because it meets their requirements;

Public transport users of necessity – First, they may not have money to buy a car. They are also people who, for some reason, cannot drive, are disabled, at an advanced age or have no driver's licence.

4.3. Compatibility in train and bus cases

Jensen method (1999) is based on the car and public transport, unlike this article that concentrates on public transport, namely bus and train. A justification for concentrating on bus users is that they tend to be more easily attracted to trains than car users. Moreover,

Gonçalves (2006) mentions that the car was predominantly the modality to which former train passengers changed. In turn, Pinheiro Jr. (2004) found that the potential integration of a railway station is reduced when competing bus routes are available. Which gives good reasons for attracting their passengers to the train and thereby strengthen their structuring and key role in the transport system.

The method in question has not yet been used to assess the propensity to modal change in the case of trains, but its concept is relatively simple and helps establish, from the user categories, which segments are most sensitive to change, as well as defining which of its characteristics are most important. It is possible by making the necessary adjustments for its use to reach a scale representing bus and train users, with emphasis on the level of their loyalty and consequent propensity for change.

In this case, "public transport users of heart" will not be considered, mainly because it is understood that there should not be a significant number of them, particularly within the current flaws in public transport in Brazil. Moreover, Velloso *et al.* (2004) listed the opinions obtained using the modal choice by the survey to characterise user profiles and did not obtain elements to determine the validity of the "public transport users of heart", confirming that keeping this category is not sustainable considering the Brazilian situation.

The proposed scale, according to this study's objective, considers three categories for train and bus – Captive, Traditional and Selective – shown in Table I and which are related to the nature of travel and socioeconomic profile.

Table I – Categories of bus and train users

T r a i n U s e r s	**Captive Users –** They do not have the money to buy a car or bus is not an alternative form of transport. They are people who are unable to drive, namely the elderly; those without a driving licence because either they do not know how to drive or do not want to learn; and those who have a licence but do not feel at ease or not willing to do so (safety).
	Traditional Users – They know the alternatives but cannot change. It is possible that they do not have a car. The bus is an option but they do not want to use it. Perhaps they do not go by bus because it is crowded and does not stop, travels on congested roads, takes too long, does not go near, they have to take two buses or integration is not interesting.
	Selective Users – They choose the train because it meets their transport requirements. They use it not only as transport but also as an end in itself, which is an important characteristic of public transport: leisure (shopping and other). These users can have a car but do not use it or do not use it for short distances. They use any kind of transport depending on their origin an destination.
B u s U s e r s	**Captive Users –** In financial terms they cannot have a car or the train is not alternative transport. People who are unable to drive; such as the elderly; or those without a driving licence. They may have a driving licence but choose not to drive. They may be elderly (free transport);who do not know how to drive or do not want to learn since they do not feel safe to do so.
	Traditional Users – They know the alternatives but cannot change. It is possible that they do not have a car. The train is an option but they do not want to use it. Perhaps they do not go by train because they had short term experience and did not adapt, or then have never gone or do not want to go by train because of an unfavourable image of the railway system.
	Selective Users – The bus meets their transport requirements. They go by bus not only as transport but also as an end in itself, which is an important characteristic of public transport: leisure (shopping or other). This user may own a car but do not always use it, or do not use it for short distances and on congested routes. They use any kind of transport, depending on their origin and destination.

The first category characterises everyday users (or not) because they do not have a reasonable commuting option. The second category, however, describes the user who, although having alternatives, uses the same modality every day. The third distinguishes users with alternatives, but who makes their choices, every day or not, depending on their purpose and convenience. The last two are more emphasised because of their willingness to change, highlighting the loyalty level, which varies from moderate to low.

The categories established conceptually were submitted to exploratory research, involving a sample of users of trains and bus potentially in competition with each other. This contributes to identifying and classifying the user segments prone to modal change.

It is considered that this approach facilitates the selection of the priority segments for interviewing, reducing the data collection effort and increasing its feasibility with restricted resources.

5. PROPOSAL FOR TRAIN AND BUS CASES

Figure 3 considers the way in which this study has developed, including structuring the user category scale described herein and that acts as a basis for formulating strategies to provide the change of passengers from buses to trains.
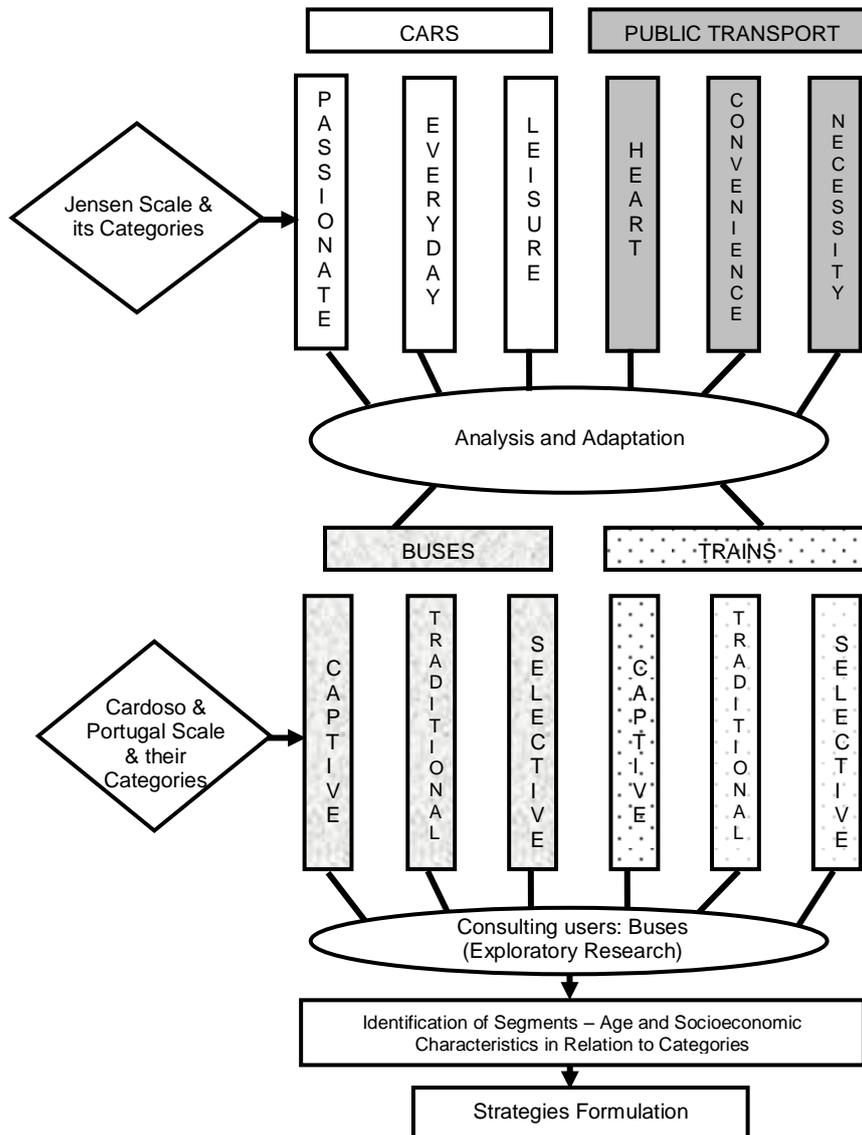
Figure 3 – Flowchart representing the stages of methodological procedure

The categories developed by Jensen (1999) were analysed and adapted to this study for buses and trains. The scale in question (Captive, Traditional and Selective) helps define the segments – relating to the nature of travel and socioeconomic profile – to be prioritised in modal change strategies. It was adopted using questionnaires and interviewing the users, in a corridor in which both bus and train operate, in order to understand the reason for their choices.

The exploratory research is the key-element found in Figure 3, since it establishes segments linked to each category and defines in which category the user is included and if the user travelled by the competitor. Accordingly, it helps in preparing strategies from elements considered with the analysis of its results.

6. EXPLORATORY RESEARCH

In order to establish the segments relating to each category, the users were interviewed. To do so, a questionnaire was prepared, addressing items that could define the user profile (age group, socioeconomic level, level of education, car ownership, home address and so on) and questions that express the users' behaviour and their reasons for choosing their transport mode.

The questionnaire was prepared based on the questionnaires used by Jensen (1999). In each modality (bus and train) 120 users were interviewed. This first survey was carried out in a corridor where there are the two transport modes as alternatives for the users, thereby justifying the content of their choices.

With regard to the place of research, the reasons for choosing the Santa Cruz-Central Station corridor are based on the fact that it is one of the two most important urban train branches in the Rio de Janeiro Metropolitan Region, covering a long distance of 54.77 km (SuperVia, 2009), and has enormous growth potential. Today its area of influence has around 2,200,000 inhabitants (IBGE, 2000) and, according to Andrade & Portugal (2009), can accommodate up to 540,000 new dwellers, using the area around its stations as alternative areas to meet a basic housing deficit of over 275,000 homes, according to a housing policy relating to the transport sector.

Furthermore, it is possible to learn the commuting dynamics by observing origin/destination surveys (OD). First and foremost, the corridor has stations in Greater Rio de Janeiro and, as shown, both transport modes (bus and train) operate as options for the users, which is why it is an appropriate environment for the purpose of this study.

To apply the developed method, sub-stretches were selected: Deodoro-Santa Cruz, including 17 stations covering a distance of 32.71 km, and Deodoro-Central Station, which involves 18 stations over a distance of 22.06 km – a total of 35 stations.

In order to establish which bus routes compete with the train along the branch line, the proposal by Cardoso *et al.* (2009) was adopted, based on the proximity of the bus itineraries to the main railway stations. The eleven stations considered for a study were selected taking into account the turnover of passengers (travel demand) and the aspect of integrating with other transport modes (Figure 4).

With regard to the area of influence of the stations in determining the bus routes circulating by the given stations, 400m (or approximately four streets and/or blocks) in their vicinity were considered (Vuchic, 1981; Villela, 2004; Nabais, 2005; Gonçalves, 2006).

Figure 4 – Routes through sub-stretches formed by the stations

After consulting specialists from CET-Rio and Rio Ônibus, it was possible to determine that 227 municipal routes operate in the corridor and go by at least one station. Of these, 64 routes (28.19%) are in accordance with the set criterion and go near to at least two stations (Cardoso *et al.*, 2009).

This application was restricted to the municipal context and regular routes, according to the names given by SMTR (1994), decree no. 12.713, no variations being considered.

It should be mentioned that rail travel tends to be more recommended as it covers longer distances (Vuchic, 1981). However, it is found in the corridor studied that many of the 64 bus routes are relatively long. Arbitrating 15 km as a limit distance typically observed in bus commuting (VTPI, 2009), it is found that 21 routes (corresponding to around one third) have longer itineraries than that level, which accentuates a certain irrationality of these competitors.

By examining the results from the exploratory research and noting the difference between the percentages distribution in the category in relation to that found in the sample, it was possible to determine which socioeconomic characteristics of users relating to each user category are more prone to modal change. Therefore, the wider the positive difference, the higher the level of predominance of that characteristic present in the category under analysis. This difference is expressed in this paper at three levels: slightly predominant, moderate and predominant. Consequently, these characteristics can be combined to form user segments sensitive to certain quality attributes and service conditions. These elements will be considered when establishing the strategies that make the train an attractive option for users more prone to change (in this case, the "Traditional" and principally "Selective").

With regard to the user categories of each modality, in the case of the bus, it is intended to bring users with aptitude for change back to the railway, and in the case of the train, to attract new passengers, as well as keeping and satisfying the regulars. However, the article, as

already mentioned, only considers the results of bus users, since the survey with train users suggests another article.

Table II – Results of the analysis between the average percentage of the sample and the percentages of the categories

	CAPTIVE	TRADITIONAL	SELECTIVE
GENDER	Female (*)	Female (*)	Male (*)
AGE GROUP	25-34 (*) >65 (***)	25-34 (*)	16-24 (*) 35-49 (*)
INCOME	no income (***) 1 - 2 (**) 5 - 10 (**)	1 - 2 (**)	2 - 5 (*) >10 (**)
EDUCATION	Primary (***)	Primary (**)	Secondary (*) University (*)
RESIDENCE	West Zone (*)	North Zone (*)	West Zone (*) Barra/Recreio (*)
PURPOSE	Leisure (**) Health (***)	Work (*) Visit (***)	Study (**)

Legend:
(*) slightly predominant;
(**) moderate;
(***) predominant.

Table II illustrates the results from the analysis between the average percentage of the sample and the percentage of each category to find the user's socioeconomic profile.

Women predominate as users in the "Captive" and "Traditional" categories. In turn, the male predominates in the "Selective" category.

With regard to age, it is noted in "Captive" that the ">65" age group is predominant and the "25-34" age group is only a discreet presence. In "Traditional", there is a uniform distribution between the age groups and the "25-34" age group is moderate. In the "Selective", however, no participation of the ">65" and "25-34" age groups was found.

Concerning income, there is a predominance of those with "no income", although moderate in the "1 – 2" and "5 – 10" bands. In "Traditional", the "1- 2" band continues moderate, while in "Selective", the "above 10 wages" is moderate and the "2-5" band is discreet.

On the educational level, the "Captive" and "Traditional" categories expressed Primary, predominantly for the former and at a moderate level for the latter. However in "Selective", the bands show a higher level of education (Secondary and University).

With regard to home address, among the five options given (North Zone, South Zone, West Zone, Barra/Recreio and Baixada Fluminense), the three categories are distributed between the North and West Zones (including Barra/Recreio). This classifies a user segment that travels longer distances because they live in more distant neighbourhoods.

Lastly, in relation to the reason for travel, in "Captive" health care is predominant and leisure moderate. In "Traditional", visiting is strongly expressed. And study is expressed moderately in "Selective".

The questionnaire of the exploratory research had an open question directly addressing the bus user's willingness; in this case, to use or return to using the train and what are the reasons for this. If the answer is positive, it was noted that:

a) Most of the users included by the survey in the "Captive" category would choose the train because it is faster or also if the system was reformulated (integration);

b) The majority of users included by the survey in the "Traditional" category would choose the train because it is faster. Some mentioned the fare as a limiting factor (dearer). Others mentioned the companies where they work as a strong component for choosing the bus (they do not reimburse train fares). Some suggested reformulating the system (integration) as a reason for change. The question of accessibility (the station is not nearby) was also mentioned;

c) The users included by the survey in the "Selective" category state that they would use the train if its conditions were upgraded, because the train is faster transport. Some mentioned the issue of violence and truculence as an element for rejecting rail travel. Some said that their choice was based on destination. Others suggested reformulation of the system (integration) as a reason for choosing rail travel and suggested a later assessment of this change in the system. Some users also mentioned the firms where they work as a strong component for choosing bus travel (they do not reimburse train fares).

7. POTENTIAL STRATEGIES

After identifying the segments most prone to modal change, the characteristics expressing the "Selective" category are found to be: higher income level, higher education level and living in the West Zone, Barra and Recreio. In other words, longer distances generate longer travel and an environment favouring rail travel. In turn, this presupposes that railway administrators take a closer look at these users and the system's image.

Scherer (2009) says that the incentives to catch people's attention are relevant when these elements affect individual perception and are a representative part of the memory of the service. The preferential, therefore, for train users and to attract passengers to this modality are distributed by motivating factors, among which are the following:

- New and modern vehicles, special design, route visibility, presence of media during assessment and construction process;

- The quality attributes 'reliability' and 'comfort' must be associated with the system's characterisation;

- The characteristics of the surroundings to the area attended by a specific travel mode affect the perception, opinion, confidence and assessment of this kind of transport.

According to Scherer (2009), these factors are not usually included and listed in the basic models of modal choice.

Another element to be considered in drawing up strategies is access to the station, since people spend time to reach the station; a fact that tends to be given little value.

In the opinion of Brons *et al.* (2008), access to the station is relegated to a secondary level or fails to be addressed according to its importance. However, they say that the choice of the metro-railway travel mode may be related to quality service, easy access and population.

Access to the metro-railway station, according to Gonçalves *et.al.* (2009), is one of the aspects to be observed for attracting passengers to the system. In the process of assuring a sustainable environment, it is also valid to analyse integration with socioeconomic development.

Proof of this is Nova America Shopping outlet, located in the neighbourhood of Del Castilho, with direct connection by footbridge to the metro station and proximity to the surface railway station, in addition to bus-metro integration with Ilha do Fundão (site of the Federal University of Rio de Janeiro – UFRJ) (Gonçalves *et al.*, 2009). A study undertaken by Lara *et al.* (2008) shows that this is one of the most significant examples for increasing the flow of passengers in the railway system of the Rio de Janeiro Metropolitan Region (RMRJ). In other words, the presence of integrated bus routes and Traffic Generator Poles linked to the stations.

8. CONCLUSIONS AND RECOMMENDATIONS

This article presents a qualitative scale adapted from Jensen (1999), but with different characteristics adapted to the requirements of this study, since the categories were structured with a view to modal change.

The purpose of this study considers a differential between two public transport modalities and guarantees a commitment to the specificities of them both. In this case, the bus is not only the major competitor of the train but also a predatory competitor since, as observed, there are many long and mid-distance routes that should not but do compete with the train.

It is found that the change in behaviour implies overcoming a set of resistances linked to each other by an equation that does not have a solved formula. In order for the result to be satisfactory, it is hardly likely that changing only one factor would be enough. It is necessary to create ground-breaking solutions in line with the range of variables existing in the field of public transport and with intervening players in this process of change.

There are very few studies addressing change to rail transport (Givoni & Rietveld, 2007), which reinforces the importance of studying this modality, using a methodology that provides the acquired information, giving support to decisions and strategies to settle any possible problems and limitations that will be encountered and created in the progress of the activities in the transport sector.

After looking at the partial results, it is found that such strategies are inserted in an integrated environment of the train with the other modalities. As in the case of the transport sector with the housing policy and development programme around railway stations. The importance of changing the train's image is also stressed, to combine with its increased capacity and better quality service.

Even when acknowledging the simplicity and interactivity of the proposed approach, it needs to be considered in depth to permit future enhancements.

It is desirable that this study is employed in a larger sample and at points along the corridor so as to find users of routes with possibly different characteristics. It should be explained that the proposed procedure is comprehensive and this article corresponds only to one stage in the process under study.

One survey has been carried out but another survey (bus and train) is suggested, which will interview the bus user segments sensitive to change, in order to obtain a more objective and in-depth idea of their characteristics and attributes of interest. In this context, an analysis is recommended in conjunction with the Discourse Analysis (Theory of Argumentation in Language – the Topoï Theory), in order to identify the linguistic variables that express susceptibility to change and the attributes that are considered as most important. This tool has already been used successfully in recent studies (Cardoso, 2006; Guiver, 2007).

By comparing the most important attributes, emphasis will be given to similar points and differences expressed by the users' perception. Lastly, coordinated strategies will be proposed in order to improve the quality service to attract new passengers (bus) and satisfy the regular users (train).

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