2013•2014
FACULTEIT BEDRIJFSECONOMISCHE WETENSCHAPPEN
master in de mobiliteitswetenschappen

Masterproef

Travelers' preferences regarding the interior of public buses - Making the bus look sexy

Promotor :
Prof. dr. Gerhard WETS

Emilie Couwenberg

Proefschrift ingediend tot het behalen van de graad van master in de mobiliteitswetenschappen

universiteit hasselt
KNOWLEDGE IN ACTION

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Foreword

During the two-year master course of Transportation Sciences at the University of Hasselt, I worked on this master thesis. The subject of the thesis is related to my specialization in mobility management. The first year I conducted a literature study, followed by an implementation of the investigation in the second master year. I was completely absorbed in the subject, especially during the last semester. Although I am glad the research is finished, I must confess that will I miss all the discussions about the bus design and bus facilities. The most important thing I learned is that each person has his own vision and opinion regarding public transportation.

Completing this report would not have been possible without the support and advice of some people. Therefore I would like to thank my promoter Prof. dr. G. Wets and my two supervisors M. De Jong and dr. ing. P. van der Waerden for their patience, reviews and recommendations. They helped me with the research and gave feedback when was necessary. I learned from them how to improve and optimize my research skills and to see mobility problems in the right perspective.

I also want to thank my mother, father and sisters. I bombarded them with questions and stories about the thesis and they encouraged me in difficult times. Further I am very grateful that Van Hool, VipDesign and B. Dorleman receive me for an interview. A special thanks goes to all the 592 respondents of the questionnaire, without them the research could not have been completed.

Emilie Couwenberg
May 2014

Summary

The main idea of the research is to think further than the current interior of today's public buses. The research attempts to identify the travelers' preferences regarding the bus interior. A more attractive and comfortable interior could be one of the incentives to motivate travelers to take the bus instead of their own car.

The literature study substantiated that taking or not taking the bus involves several decision moments. These decisions are visible in each stage of a bus journey and different for every type of bus user. This is the service quality gap for the user. By using infrastructural and technological adjustments, bus builders and bus operators try to lower the difficulties that are involved when choosing for a bus ride. Difficulties of a bus journey today are related to the bus stop, ticket costs, reliability, information provision, overcrowding, travel time etc. This research investigates which luxury and comfort-oriented adjustments can be made to solve these difficulties and make the bus more attractive. After all, it is the perception and the image of the bus that acts as the decisive factor for travelers.

With information of the literature study and various case studies, a list of possible and realistic facilities and services inside a bus is made. This list is completed with information conducted in several interviews with bus builders. The list is not finite and can still be topped. The research focuses on the interior of a short distance standard bus. A short distance bus can be further subdivided into urban transport (a ride up to 15 minutes) and regional transport (a ride up from 16 to 35 minutes). The sample of the investigation is the choice traveler: a middle age traveler who has a driving license, a bus stop nearby and can use the bus for home-work travel and for shopping.

A discrete choice experiment in the form of a stated preference method examines the preferences of the respondents for a set of hypothetical choice alternatives. Because of the high number of attributes and to avoid the risk of high dropouts an alternative investigation method is used named Hierarchical Information Integration. This hierarchical decision strategy is used to process information into smaller decision making tasks. With this purpose in mind six scenarios are created, called constructs: the bus as accessible vehicle, the bus as sensitive attractive vehicle, the bus as comfortable seating place, the bus as eating and drinking place, the bus as working place and the bus as relax and entertainment place.

Each construct includes five attributes and each attribute has two levels. An attribute describes a bus facility (e.g. trashcan) and the levels are pointing to the provision of this facilities in a hypothetical bus (e.g. level 1 = one big trashcan, level 2 = an individual trashcan per seat). Every construct is presented to the respondents in the form of a choice set. One choice set exists of three parts: (1) a detailed description of one construct with its five attributes and levels, (2) an overall evaluation of the five remaining constructs and (3) the question if the respondent is willing to pay more for the offered bus facilities and services. Respondents are asked to complete six choice sets, each for every construct and to give their opinion with the use of a Likert scale. A random distribution ensures that all the levels are addressed.

The internet-based questionnaire is created with the program Berg Enquête System and distributed by e-mail. The questionnaire starts with questions about travel behaviour, followed by the different choice sets of the stated preference method and closed with some personal questions. The data analysis is done by a regression analysis and multinomial logit models. The questionnaire was completed by 592 respondents. From this amount of respondents, 18% is using the bus daily and 18% is using the bus weekly. The other respondents have a lower bus use. Depending on the travel time, passengers are engaged in various activities but 80% of the passengers indicate that they are looking outside the window during the ride. Furthermore, the association of the bus with the characteristic ‘sexy’ is very low.

Two models were made using the program NLogit: one construct model and one attribute model. The models are representing the observed behaviour. The construct with the highest influence is the construct ‘the bus as a comfortable seating place’, succeeded with the construct ‘the bus as an accessible vehicle’. The most influencing attributes are ‘coat rack’, ‘television’, ‘trashcan’, ‘steward’, ‘luggage rack’ and ‘cleanliness’.

About 36% of the respondents are not willing to pay more for the offered facilities, 21% is willing to pay 0.25 euro more and 23% wants to pay 0.50 euro more for a bus ride. Only 20% will pay more than 0.75 euro for a short distance ride with a standard bus.

Samenvatting

Het doel van dit onderzoek is om dieper na te denken over het bestaande interieur van de huidige bussen van het openbare bussen. Het onderzoek probeert de voorkeur van de reizigers aangaande het interieur van een bus in kaart te brengen. Een aantrekkelijker en comfortabeler interieur zou één van de stimulansen kunnen zijn om reizigers aan te zetten om de bus te nemen in plaats van de auto.

De literatuurstudie geeft weer dat het al dan niet nemen van een bus door verschillende beslissingsfactoren wordt gestaaft. Deze beslissingen zijn terug te vinden in elk onderdeel van het verplaatsingsproces en verschillend voor elke type busgebruiker. Dit is voor de reiziger de diensten- en kwaliteitskloof. Door het gebruik van infrastructurele en technologische aanpassingen proberen busbedrijven en busbouwers de moeilijkheden die betrokken zijn bij het nemen van een bus te verlagen. Barrières die vandaag de dag aan een busreis zijn gerelateerd zijn onder meer de bushalte, kostprijs, betrouwbaarheid, overbezetting, informatievoorzieningen, reistijd etc. Dit onderzoek gaat na welke luxe- en comfort georiënteerde aanpassingen gemaakt kunnen worden om deze moeilijkheden op te lossen en de bus aantrekkelijker te maken. Uiteindelijk is het de perceptie en het imago van de bus dat voor reizigers de doorslaggevende factor geeft.

Met de informatie van de literatuurstudie en de verschillende case studies, werd een lijst opgesteld met mogelijke en realistische voorzieningen en diensten binnenin een bus. Deze lijst werd aangevuld met informatie verworven door interviews met busbouwers. De lijst is niet eindig en kan nog steeds worden bijgevuld. Het onderzoeksgebied zijn de standaard bussen waarmee korte afstanden worden afgelegd. De bussen kunnen verder worden onderverdeeld in stadsvervoer (een rit tot 15 minuten) en streekvervoer (een rit van 16 tot 35 minuten). De steekproef van het onderzoek is de keuzereiziger: een reiziger van middelbare leeftijd die beschikt over een rijbewijs, een bushalte in de buurt en die de bus zou kunnen gebruiken voor woon-werkverkeer en om te gaan winkelen.

Een discreet keuze experiment in de vorm van een stated preference methode gaat de voorkeur van de respondent na voor een reeks van hypothetische keuze alternatieven. Door het hoge aantal attributen in het onderzoek wordt een alternatieve onderzoeksmethode toegepast genaamd: Hiërarchische Informatie Integratie. Deze hiërarchische beslissings-strategie wordt gebruikt om informatie te verwerken in kleinere besluitvormingstaken. Met dit doel voor ogen werden zes scenario's opgesteld, de zogenaamde constructen: de bus als toegankelijk voertuig, de bus als zintuiglijk aantrekkelijk voertuig, de bus als comfortabele zitplaats, de bus als eet- en drinkplaats en de bus als ontspannings- en entertainment plaats.

Elk construct omvat vijf attributen waarbij elk attribuut twee niveaus heeft. Een attribuut beschrijft een bus voorziening (vb. een vuilnisbak), de niveaus wijzen op de verstrekking van deze voorzieningen in een hypothetische bus (vb. niveau 1 = een grote vuilnisbak, niveau 2 = een individuele vuilnisbak per stoel). Elk construct wordt aangeboden aan de respondent in de vorm van een keuze set. Elke keuze set bestaat uit drie delen: (1) een gedetailleerde beschrijving van één construct met zijn vijf attributen en niveaus, (2) een algemene evaluatie van de vijf overgebleven constructen en (3) de vraag of de respondent bereidt is om meer te betalen voor de aangeboden bus voorzieningen en diensten. Respondenten worden gevraagd hun mening te geven door middel van een Likertschaal. Een respondent moet zes keuzesets invullen, één keuze set voor elk construct. Een willekeurige verdeling zorgt ervoor dat alle niveaus aan bod komen.

De internet-gebaseerde enquête is gemaakt met het programma Berg Enquête System en verspreid via e-mail. De enquête begint met enkele vragen over het reisgedrag van de respondent, gevolgd door de verschillende keuze sets van de stated preference method en wordt afgesloten met enkele persoonlijke vragen. De data analyse wordt uitgevoerd door een regressie analyse en multinomial logit modelen. De enquête werd vervolledigd door 592 respondenten. Van deze respondenten gebruikt 18% dagelijks en 18% wekelijks de bus, de overige respondenten hebben een lager busgebruik. De activiteiten op de bus zijn afhankelijk van de reistijd maar 80% van de passagiers geeft aan dat men tijdens de busreis uit het raam kijkt. De associatie van de bus met de beschrijving ‘sexy’ is er laag.

Twee modellen werden opgesteld met het programma Nlogit: een construct model en een attributen model. De modellen vertegenwoordigen het geobserveerde gedrag. Het construct met de hoogste invloed is het construct ‘de bus als een comfortabele zitplaats’, gevolgd door het construct ‘de bus als een toegankelijk vervoersmiddel’. De meest invloedrijkste attributen zijn ‘kapstok’, ‘televisie’, ‘vuilnisbak’, ‘steward’, ‘bagagedrager’ en ‘netheid’.

Van de ondervraagden is 36% niet bereid om meer te betalen voor de aangeboden voorzieningen, 21% is bereid om 0.25 euro meer te betalen en 23% zou 0.50 euro meer uitgeven voor een busrit met meer comfort. Een kleine 20% wilt 0.75 euro of meer besteden aan een rit met een standaard bus voor korte afstanden.

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Abbreviations

AIC	Akaike Information Criterion
BHLS	Bus with high level of service
BRT	Bus Rapid Transit
DCE	Discrete Choice Experiment
DRT	Demand Responsive Transit
EBSF	European bus of the future
EQUIP	Extending the Quality of Public Transport
HII	Hierarchal Information integration
IIA	Independence of irrelevant alternatives
IVT	In-vehicle time
LLco	Log likelihood of the constant only model
LLf	Log likelihood of the full model
MNL	Multinomial logit model
NS	Nederlandse Spoorwegen
PRP	Problem Ranking Process method
SP	Stated Preference
UITP	International Association of Public Transport

Introduction

Due to the growing population and environmental issues we slowly come to understand that a mental shift is needed in transitions with products and services in today's society. Our present way of life and our consuming behaviour cannot continue forever. If no changes are made, the new generations will have to deal with problems that are so much bigger and substantial than the ones we have to face now.

One of these issues concerns traffic: emissions, congestion and related accidents. Cities can no longer handle the demand for parking space and the high traffic flow. It is necessary to find new solutions to make people move without using their own car all the time. One option can be to motivate travelers to use public transport more often. No matter how hard public transport companies are trying to offer the passengers the best possible service, a lot of commuters still prefer the car to the bus or the train.

The main objective of this paper is to find a way to make public buses more attractive. This can be done by introducing a lot of modifications. We should of course investigate which applications are good enough so that they can actually make a real difference in the use of public vehicles. Much research has already been done into the negative characteristics of the use of buses. It is not really the aim of this thesis to solve all the problems of the Flemish public transport companies but with this report, a more global overview of cases and qualities of a good working public transport system will be given. This report can be used by policy makers and bus companies as a frame of reference to make the bus more successful. It is our aim to present a summary of bus facilities that are needed to influence the decision of the traveler and commuter to prefer using public transport instead of their own vehicle.

What makes the bus sexy enough for people to fall in love with a seat in a public bus instead of using their car?

Chapter 1 - Problem formulation

1.1. Problem indication

Taking into consideration the growing amount of vehicles on the road and the related accidents, congestion and environmental problems we can conclude that it is a **big issue to get people on a public transportation mode instead of using their own car**. A car brings you from door to door, not like a bus or train that goes from station to station.

The transport mode that fits best with the **requirements of the individual** will be chosen. There are many reasons why people prefer the car over public transport. Preferences can depend on socio-demographic characteristics of the users or on the characteristics of the bus journey itself. Furthermore, not only has the public bus service a **bad reputation**, people also base their judgement of the bus on the opinion of other passengers. The non-users usually think that the public vehicles are old, unsafe and dirty, plus the fact that the bus is often late and overcrowded. This image of the public bus, this perception, cannot change by only improving one variable but both a global make-over and the right kind of advertisements are needed. Another challenge concerning public buses is to pay attention to **the right needs of a diverse array of users**. While public transport may suit a business man, it may be less convenient for a mother with a buggy.

It is important to get people on the bus to solve the different traffic problems that we have today. By collecting people on one system and organizing the time and frequency of the vehicles, safer and faster traffic can be created. These are just plans for the future, but by widening the field of view and looking for solutions for the different stages of a bus journey, better ideas can be found.

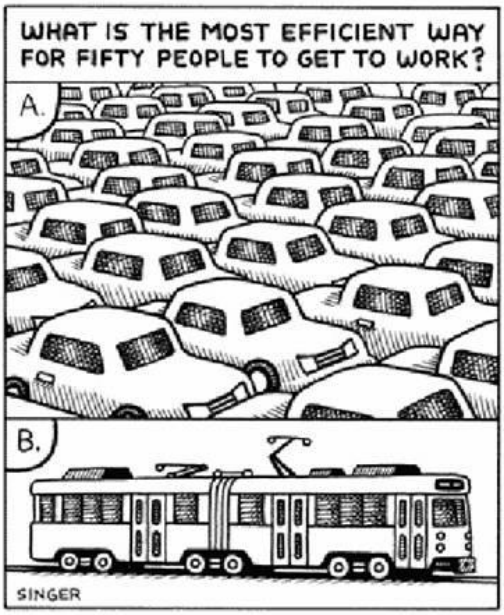

Figure 1 Efficiency between a car and public transport (Singer)

1.2. Problem statement

The title *'Travelers' preferences regarding the interior of public buses'* references to the requirements and wishes of the traveler concerning their travel behaviour. Although some may think that this topic is far from our bed, several articles suggested that the bus needs an upgrade. For example bus users in Flanders above the age of 65 years can take the bus for free. Although, they are willing to pay for the offered bus ride if there is more comfort and service provision: clean seats, more shelters and lower threshold steps [1]. Another actual example is the face lift of the double deck train in the Netherlands. The old trains will be transformed to a modern train with a quiet room for reading and working on the upper deck, and a meeting place with lounge benches on the lower deck. The train will have a working Wi-Fi connection for electronic devices and displays with actual information [2].

Meeting the preferences of a traveler can result in a mental shift, meaning that a change or alteration in the users' mind may create different travel behaviour. This report is part of the research of public transport. Although the definition of **public transport** is not a fixed definition and exceptions on the rule are more and more common, it can be defined as;

> *'a system of vehicles (buses, trams, trains, ferries or metros) which operate at regular times on fixed routes on a non-reservation basis and are used by the general public: all multiple occupancy vehicle services are designed to transport customers on local and regional routes. The vehicles are either privately or publicly owned, providing the public general or special services. The passengers do not travel in their own vehicles* [3]*'.*

Making use of a public vehicle depends on four aspects that influence the organization and the service of a bus company (Figure 2).

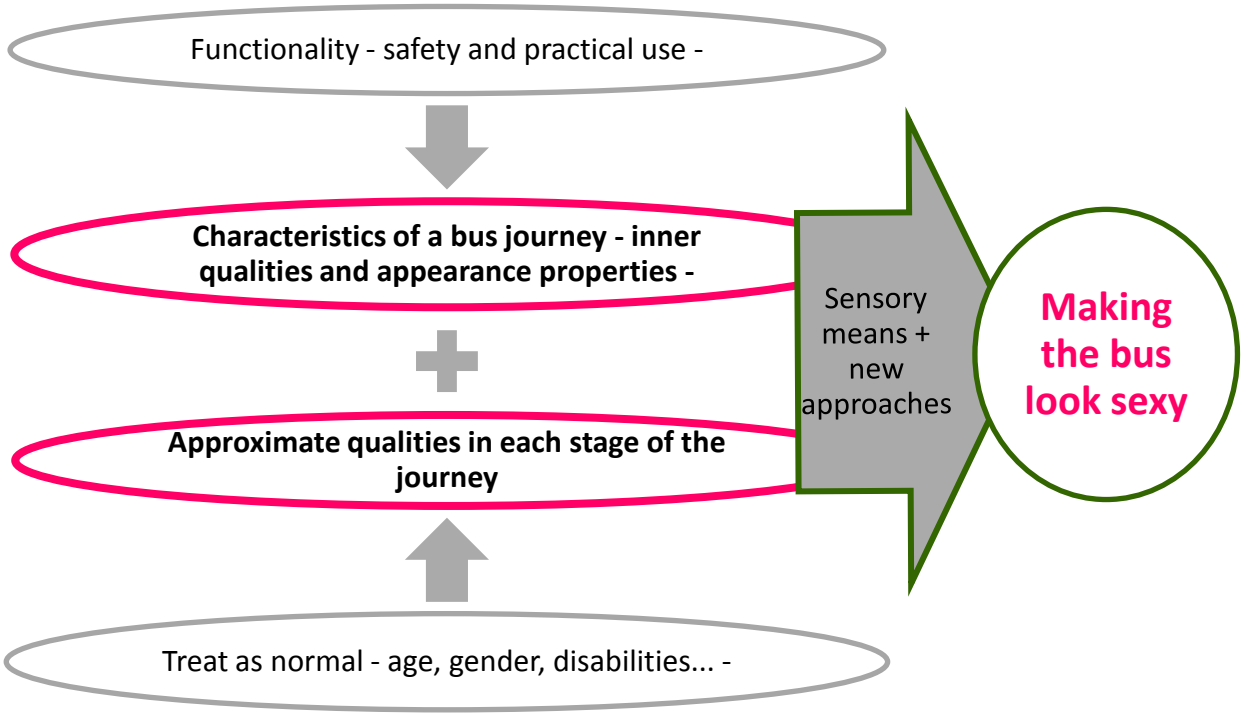

Figure 2 Influencing sensory means

1. The paper does not focus on the technical aspects but by thinking of a new bus concept, the bus still has to be **functional**: a practical use and high standards for safety. The functionality of the bus is not changeable in this paper. The functionality is approached as a number of fixed data that influence the characteristics of a bus. The construction of a bus (place of the motor, high and width...) may for example affect the capacity of the bus.

2. **Characteristics of a bus journey** are on the one hand the functional, operational aspects and on the other hand the design and the appearance. This can be realized by **the inner qualities** or by **the appearance properties** of the bus. Those two variables both need to be present on a bus journey.

3. The journey needs to be seen as one whole trip: from leaving the house until the passenger has reached his destination. **All the stages of a bus journey** must be kept in mind because they all influence the experience of the user. For example the socio-demographic characteristics of a population are unchangeable (age, home...) although they influence the accessibility to a bus stop.

4. The approach is considering all type of profiles and will join the vision of a **"treat as normal" approach**. This means that the research is looking for a universal design where social handicap situations will be ruled out. A "treat as normal" is appropriate, so that any type of user can take the bus.

The two aspects that will be treated in this paper are the characteristics of a bus journey and the qualities for each stage of the journey. A better appearance of the bus can be possible by **sensory means** that can lead to a change in behaviour and experience. A sensory mean can be: colour, light, sound, smell, design, temperature and facilities. They can be designed by infrastructural and technological adjustments, new approaches, technological applications, bus interior modifications, physical qualities of the vehicle and bus stop improvements. All these can motivate people to take the public buses [4] [5].

The International Association of Public Transport (UITP) concluded in 1999 that the bus transport sector had a very poor image and improvements were necessary to upgrade the usage of public buses. Ever since, they are investigating the functionality and design of public vehicles under the name **'European Bus System of the Future (EBSF)'**. They search for operators' underlying motives, minimal performance requirements and recommendations [6]. To generate an evolution or a mental shift in the use of buses, looking beyond the current adjustments and making use of a futuristic approach can be helpful. The design of a bus will meet the passengers' needs, keep existing passengers and attract new users.

1.3. Scope

The title of this paper can be examined from a lot of perspectives and before the research can start, a demarcation of the subject is needed:

- **Vision** of the public transport company, the public transport user or the service provider;
- **Approach** of the product or the service;
- **Treatment** as normal or as different;
- **Different profiles of passengers**: children, students, older people, businessmen, disabled persons, deaf or blind people, etc.
- **Different areas** where public transport is used: high-urban, urban, rural, etc.
- **Different types of public buses**;
- Etc.

Research has mainly focussed on the negative aspects of public transport. Many lists and investigations are available and many of those are compatible with each other. Therefore it is not necessary to examine this approach again because both the traveler and the public transport operator are aware of the weaknesses and downsides of the public buses. That is why our research will assume that we are quite familiar with all the negative characteristics. So the question arises: 'what can we do about this?' The paper will focus on 'improvement of the negative qualities' (Figure 3).

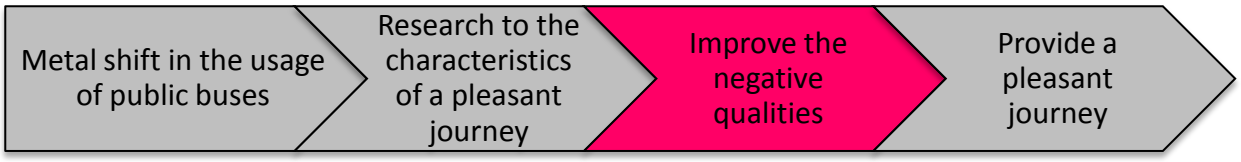

Figure 3 Delineation of the research

By having a look at **the 'gaps' model of service quality** from Parasuraman, a clear image of customers service quality appears (Figure 4). The model shows the aspects that can harm customers' satisfaction assisted by the sources of dissatisfaction: the gaps [7].

The diagram consists of two parts, on the one hand the customers and on the other the service organization. By improving the four internal gaps of an organization, the fifth and external gap can be solved. The fifth gap is known as the **'service quality gap'** and arises in the mind of the users. The gap focuses on the difference between customers' expectations and perceptions. This gap is almost impossible to solve by itself. An organization cannot look inside the head of each user to find the mistakes the company makes. Instead the organization must solve their specific gaps so they can come closer to the quality aspects that the customer had in mind. The number of gaps needs to be diminished so that the quality of the public buses can increase. The quality perception can be defined as:

Quality perception = perception of service – expectations of service

In which the perception and the expectations represent the fifth gap. The **first phase 'market information gap'** will give an idea of what the users want. Research organizations are looking for the expectations and the desires of the customers. The **second gap 'service standards gap'** highlights the fact that the standards of the organization are different from the expectations. By imposing higher standards according to the customers' wishes and so to become a better organization, this gap can be closed: quality specifications and designs. The **third gap 'service performance gap'** adjusts the issues between the standards and the performance of the organization: the implementation of all the different aspects of the organization in the community, the actual delivered service. The last **stage 'internal communication gap'** interacts between the service performance and the communication to the customers. The explanation to the users has to be clear and visible. The value of those four gaps influences the fifth gap of the customer [8].

The paper will focus on gap 2: correcting the standards of the organizations will improve the negative qualities and put a higher value on aspects that are issues, problems for the customers. Imposing higher standards according to the service level and design is necessary in order to comply with the requirements of the users. This has to be done every few years.

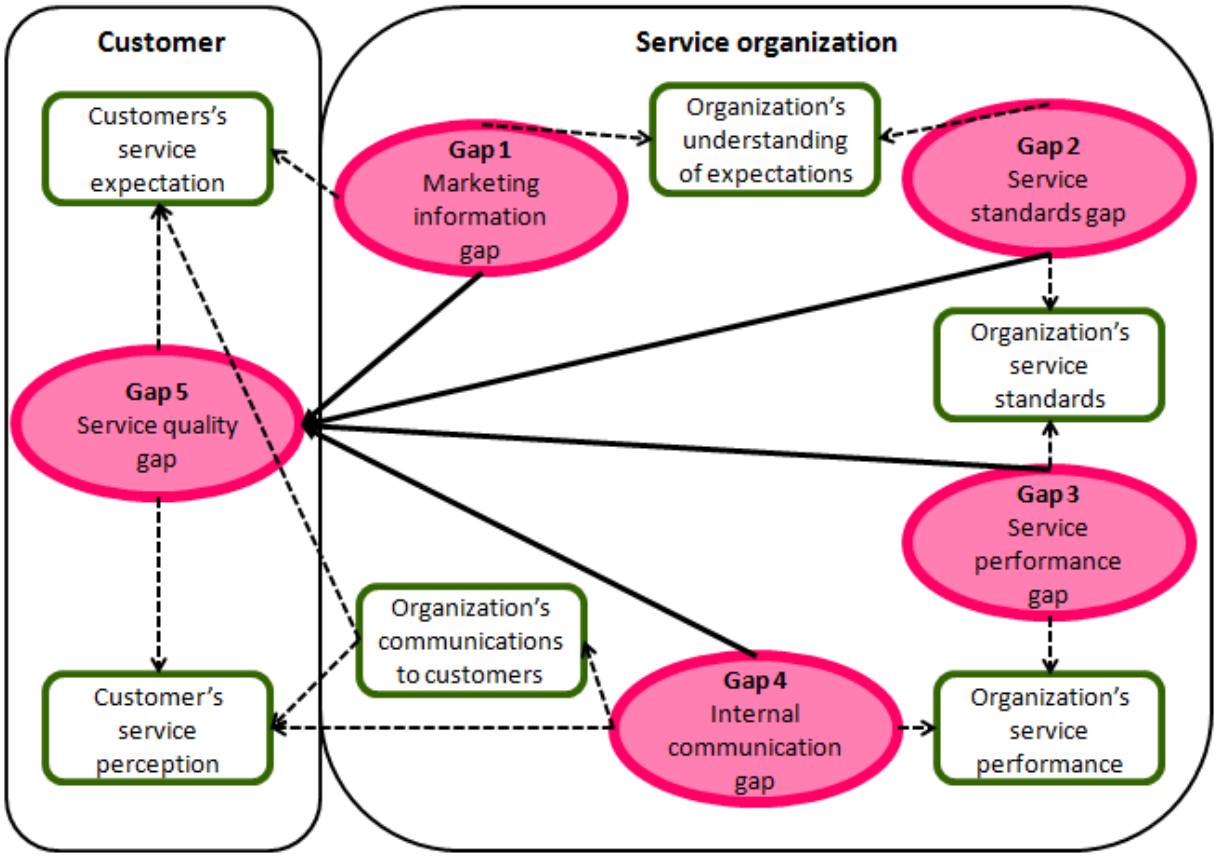

Figure 4 Gaps-model of service quality [7]

1.4. Research questions

Now that we have defined the problem formulation, a research design can be set up. The main research question in this survey will be:

How can an improvement on the interior of a standard bus change the inner qualities of the bus journey of a choice traveler?

After reviewing the listed breakdowns, the subtitle ***'Making the bus look sexy'*** was added to the paper. It is wise to focus on one, more specific subject and finding a good solution to this area, rather than discussing all the different approaches in a more superficial manner. Making the bus look sexy and attractive is exactly what needs to be done. Each passenger has another definition of 'sexy' but in general the bus has to be perceived as being trendy and interesting.

Different **sub questions** can now be added to make it easier to formulate a response to the main question. This paper is looking for different sensory means. People should not take the bus only to travel but also enjoy the ride: taking the bus should become a pleasant experience. The design of a bus, using old and new technologies, better materials and introducing various facilities can improve the relationship between the travelers and the public transport.

Sub question literature study

- **Who** is travelling with the public bus?
- What are the **negative aspects** of a bus journey?
- What is **the perception and the image** users have of public buses?
- Which **new approaches** are in operation today?
- Which **activities** are likely on the bus?

Sub question research study

- How can we **solve the negative characteristics** of a bus journey?
- Which **new implementations** of a bus concept are found to be good?
- Which **new ideas** can be created and introduced to the public transport?
- **How much** is a traveler willing to pay for new facilities?
- Can new **facilities/design** of the interior of the bus make a difference in the usage?

1.5. Outline of the report

While searching for travelers' preferences regarding the interior of the bus it is necessary to take the opinion of **the users and the non-users** of public transport into account. These target groups are the people who actually use or will use the bus and they have remarks, observations and wishes about the vehicles. By listening to them, questioning them and trying to define their desires, a good concept of 'ideal bus' can be designed.

Conducting **a thorough literature study** about the bad qualities of a bus journey is a first step towards an idea of travelers' preferences. Quality can be: value for money, conformity to specifications or even exceeding customer's expectations. The interpretation of quality is different for each person, each situation and each level and it is up to the bus company to find an overall quality plan. These quality characteristics are already defined in many studies and need to be integrated into an organized schedule. To understand the aspects, an overview of the implementation of a public transport and its stakeholders is desirable [9].

After setting up the theoretical framework, the practical research can start. The overview of characteristics will be "translated" into possible solutions to solve the weaknesses or shortcomings of the trip. This list of solutions can be questioned in a **stated preference survey (SP)** that is common in the field of travel behaviour research. A SP survey models the stated choices of travelers by asking people what they would choose in a certain situation. Comparable research was done when investigators identified the determinants of light rail as a mode choice for medium and long distances. They examined different determinants of the public transport system as well as the travelers' personal characteristics. The results were analyzed using regression models [10].

Two **investigation methods** are used:

- **Interview**: by organising a face-to-face questioning with bus drivers, bus builders and bus operators, the **attitude, knowledge and opinion** concerning different bus types can be studied. More detailed information about what is possible in the bus are reviewed, together with the list of qualities conducted in the literature study [11].
- **Questionnaire:** people will be asked to give their ideas on improvement of public transport. Each respondent can give his preferred solutions for a number of hypothetical situations and can express his own opinions, new ideas or innovative concepts [12].

Through statistical calculations (descriptive statistics and multinomial logit models) the best composition of solutions to improve the bus usage will be the result of this report.

Chapter 2 - Literature review

The general structure of public transport companies is organized on three levels: a macro, meso and micro level. Each level influences the formation of public transportation (Figure 5).

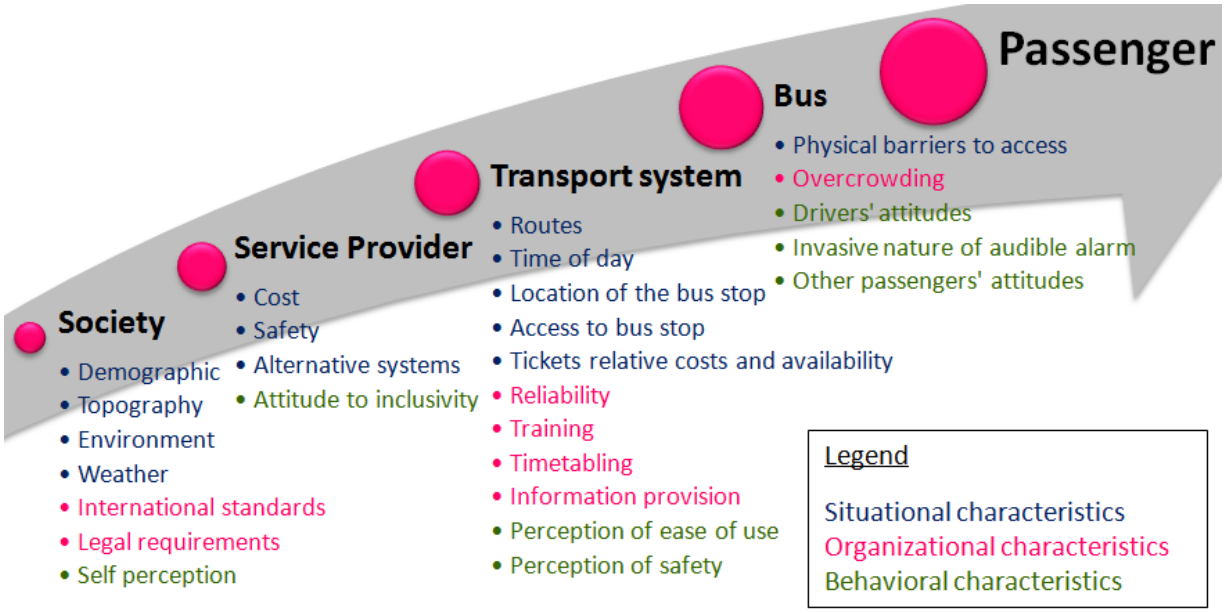

Figure 5 General structure of public transport

Public transport is organized on a macro level, depending on the construction of the society in a specific region or country. This construction depends on the **demographic, topographic, environmental and climatic characteristics of the service area**. The macro qualities depend on the **(inter)national standards and legal requirements** of the region.

On a meso level, the service provider is interested in the **costs, alternative systems and the safety of the transport system**. Before starting the company and during every strategic plan, a cost-benefit analysis will be worked out so the business will be profitable [13]. The transport system is situated on the same level: looking for the **right location**, easy access to the **bus stop**, traffic capacity of the **routes**, acceptable **ticket costs** and **availability**. The owners of the transport company need to focus on **reliability**, training of their **employees**, preparing a feasible **timetable** and providing the passengers with enough **information**.

The bus as a vehicle can be considered as an actor on micro level. The bus operator has to pay attention to **physical barriers to access, overcrowding and driver's attitudes.** Finally the passengers will be at the core of all the levels and the focal point of every actor in the structure. Apart from the situational and organizational characteristics, the behavioural aspects of the passenger and the other people on their trip can also influence the image of the passenger. These behavioural qualities can be found on all the levels: **self-perception, social inclusion, perception of ease of use, perception of safety and the attitude of other passengers.**

2.1. Society

Apart from some similarities, a lot of different **social demographic characteristics** can be determined between regions and countries. Introducing public transport depends on the

- **Spatial characteristics** of a region: in a region with high building density, public transport will have a high frequency and large amplitude, compared to a region with low density of households, where more people will own a car and who do not count on the public transport [14].
- **Environmental and climatic aspects** of a region: for instance in Rio de Janeiro in Brazil, there are two kinds of city buses available for the same route: a clearly indicated price map shows whether the bus is using thermoregulation or not.
- **Law and regulations:** the organization of the public transport and liberalization of the transport market by the government e.g. 'basic mobility' of the public bus company De Lijn in Flanders, Belgium. The exact amount and time frequency of the buses is based on the targets that were imposed for Flanders (Annex 1 - Basic mobility) [13].

Public transport can be analysed by the two **characteristics of economic business**:

- **On the demand side:** the current **users** of the public buses and potential travelers who have their special needs and wishes. Apart from the actual travelers other stakeholders can also have their influence: tax payers, communities, advertisers....
- **On the supply side: public transport operators** and **public bus services** are offering the travel services. For the bus companies it is important that travelers are willing to use the public transport, so their profit will be high enough. The operators are offering the supply including the travel speed, parking policy near public transport stations, the right promotion campaigns... [15].
- **Between demand and supply: the bus driver** can be found on both sides of the demand and supply diagram. On the one hand bus drivers are employed by the public transport operators. Operators recruit drivers to work for them. But on the other side bus drivers are also a part of the services. It is advantageous for transport operators to hire good, well trained drivers.

There is a different vision on the 'luxury aspect' of a bus between bus builders, bus operators and bus passengers. This means that **if there is no big demand for better and more futuristic improvements inside the bus, bus operators would not invest in expensive buses** (Figure 6).

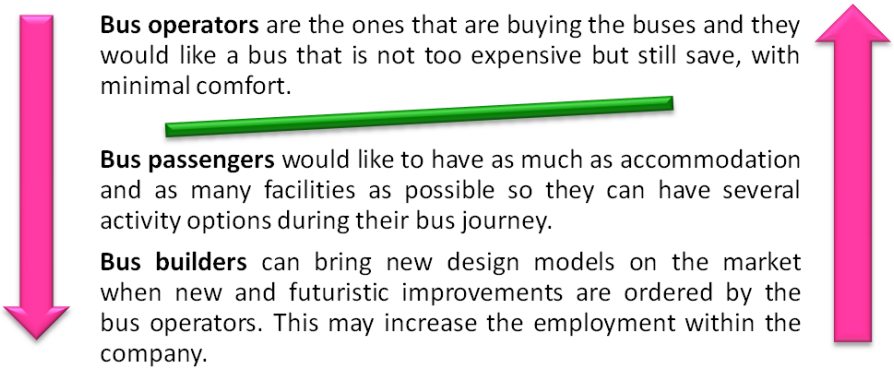

Figure 6 Bus visions of operators, passengers and bus builders

2.2. Service provider

The implementation of a bus system in a region is a rational approach of the service provider. The provider will keep in mind the **alternative systems** that are available (Figure 7).

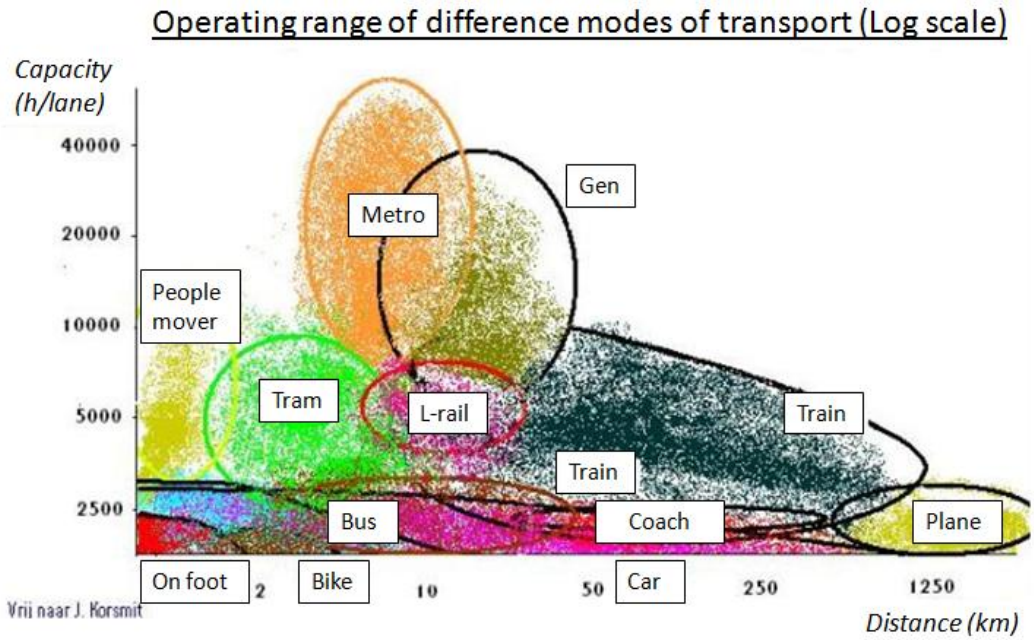

Figure 7 Operating range of difference modes of transport (J. Korsmit) [14]

Today **the tram** is once more present in the urban landscape. In terms of capacity, range and accessibility the tram as public vehicle is a competitor for the bus. After a glorious comeback, the tram is now 'the' vehicle for the modern traveler: comfortable, fast, with high frequency, recognizable and reliable. The main reason for this comeback is the environmentally friendly character and the avoidance of additional traffic on the road. The tram uses his separate lane and avoids being troubled by **congestion and delays**. Passengers can see the rails and are **sure that the tram stops will not be moved** [16]. Research in Den Haag in the Netherlands analysed why the tram has a better image than the bus using the same routes and frequency: they called it **'the tram bonus'**. The research showed that the tram is mostly used by business travelers. There is a **difference in perception**:

- The walking distance to the stop;
- The perception of frequency;
- The perception of comfort;
- The perception of safety.

One remarkable outcome of the research was that speed has no influence in the decision process. The waiting time, punctuality was considered as a more negative characteristic than the travel time in the vehicle. If the bus would have a better image regarding the punctuality, the overall image would also improve and a comparable perception as the tram may arise [17] [18].

The characteristics of a bus journey are related to **the inner qualities or requirements of the buses**. These qualities confirm the basic quality of the bus and are the beginning of the perception and attitude of the traveler regarding the use of the bus [19]. There is not a single company or research that investigated all the inner characteristics and made the result public. By looking at several studies (a customer satisfaction survey of the Dutch Railway company NS [20] and a research in Hillingdon in Great-Britain [21]) a list of the most important inner qualities can be set (Table 1). Ranking the qualities will differ from person to person and from country to country [22]. The majority of the inner qualities are connected with **operating conditions**. Transport companies should take this into account when they evaluate their company and focus a little more on the operating conditions instead of system or maintenance conditions.

Inner quality	Sub qualities	Analysis	Conditions
Travel time	Pre-service waiting time Pre-schedule waiting time Delays Search time Transfer time	In each stage of the bus journey the waiting time can be analysed. Investigators discovered that the time spent on the bus is experienced as being twice as high as the time for pre- and after transport and three times higher than the waiting time. The total time valuation of each stage can be calculated by the duration of the stage multiplied by the amenity of that stage (Annex 2 - Travel time). 'Amenity' can be defined as the value in the mind of the passengers at a certain stage. The higher the amenity, the better the quality perception and the more the traveler will enjoy the travel [20][23].	Operating conditions
Reliability	Punctuality	Reliability is the basis on which the bus companies are judged and the pressure for them is to run on time. Reliability means: requiring the same travel time each time the same route is used [12].	Operating conditions
Accessibility	Physical issues: kerb heights, ramp technology...	The way to the bus stop, the bus stop and the bus should be accessible. Travelers are often confronted by physical issues or misplaced facilities such as bicycle racks [19]. The accessibility influences the travel time [20].	System conditions
Safety	Social safety Security	Social safety is required at daytime and at evening both in the station, at the platform and on the bus. Video surveillance, security staff, exchanging information with ground based equipment are facilities that can avoid an unsafe feeling [18] [24].	System and operating conditions

Comfort	Overcrowding Drive and seat comfort Comfort of boarding Noise	Allowing too many people on the bus leads to overcrowding, no seats availability and no moving space. We should also add: the drive and seat comfort, the heating and proper ventilation on the vehicle and the cleanliness in the bus [20] [19].	Operating and maintenance conditions
Timetable	Uncertainties Frequency / regularity	Travelers are worried about when they are able to catch the bus or when they can get off [19].	Operating conditions
Price	Price – quality ratio Ticket service	Travelers are aware that if they travel a longer distance they need to pay more. If the **price - quality ratio** is not what users expected, their perception of the public service will change. Requirements for a good **ticket service** are: limited waiting time at the ticket counter and a helpful and friendly employee [25].	Operating conditions
Information	Actual information Clarity	Information needs to be available to all passengers, including disabled persons. Also the **actual, updated information** during the journey offers a better overview and informs the travelers about possible delays. If people know that the bus will have a delay of several minutes, they will use their waiting time differently [24].	Operating conditions
Driver	Drivers' attitude Behaviour of the driver Drive speed	These 'soft-issues' are associated with the quality that people experience on their journey. Problems with **drivers** vary from inconsiderate **driving, being unfriendly or gruffly attitude** [19].	Operating and system conditions
Other passengers	Friendliness of other passenger	Some **passengers** are annoyed by the behaviour of loud conversations, music being played, people not waiting their turn or the risk to sit next to a drunk or scary passenger. Passengers are often afraid to travel alone [19].	Operating conditions
Transfers	Ease of transfers Connections	Taking the bus may involve changing buses till the destination has been reached. These transfers should be **easy** and with a limited amount of **waiting time**.	Operating conditions
Cleanliness	Smell	Cleanliness inside the bus is related to trash, a bad smell, clean seats...	Maintenance conditions

Table 1 List of inner qualities

The customer satisfaction survey of the Dutch Railway company NS showed that the satisfaction of a product must increase in proportion to the perceived importance. That is why the diagram was put in a dimensional graph with the satisfaction (x-axis) and the importance (y-axis) (Figure 8). On the left-side of the pink line, the dimensions are shown with a low quality in relation with the high importance that was given. These qualities (comfort, reliability, timetable and price-quality) were found to be improved by NS. Actual information is seen as a grey area. The other qualities were found to be relatively high compared to the importance that was given to them and an improvement of these properties has no priority [20].

Figure 8 Bus importance and satisfaction (the Dutch railway company NS) [20]

In 2008 and 2012 De Lijn organised a research on the satisfaction ratio of passengers. The general satisfaction has decreased in recent years from 77% to 63% (Figure 9) [26][27].

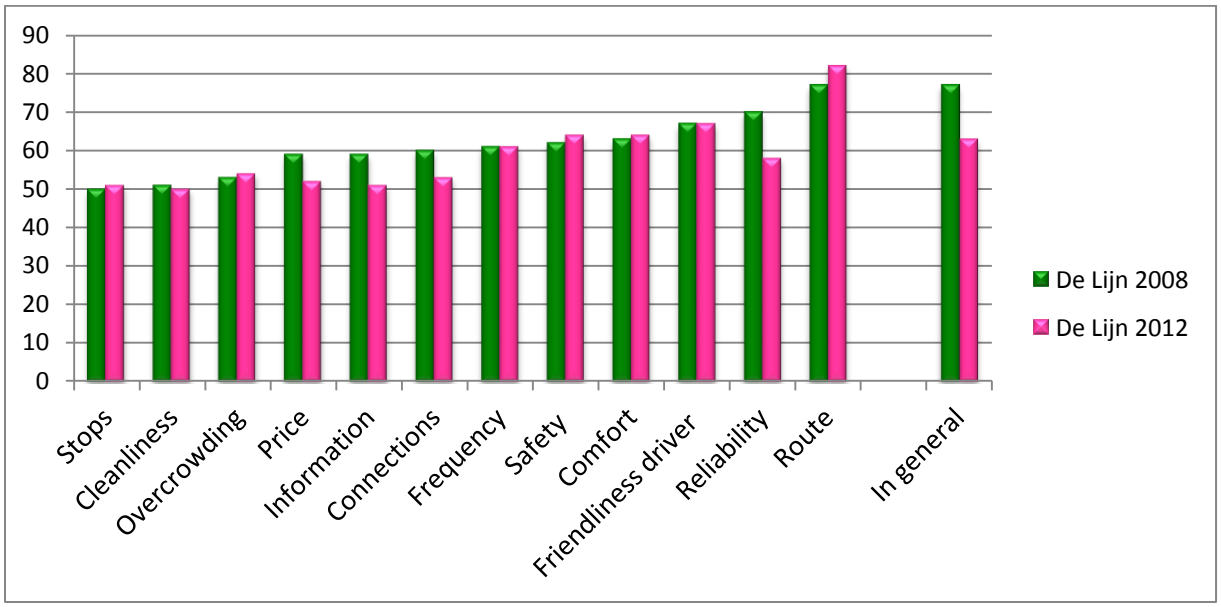

Figure 9 Bus satisfaction (De Lijn 2008 and 2012) [26] [27]

2.3. Transport system

There are eight **key stages** in a bus journey that can be examined. The first stage begins at **home** with the preparation and information provided before passengers start their journey. The second stage is **the way to the bus stop**. Normally passengers need to wait **at the bus stop** before the bus arrives. Once they can **get on the bus**, the journey continues **on the bus**. At the destination stop they **get off the bus** and the traveler **arrives at his destination**. Afterwards the passenger will **return** home. Each stage has its desired adjustments and characteristics and can be analysed more deeply. The quality of the transit at each stage has to be guaranteed to convince the traveler to take the bus (Figure 10) [21] [28].

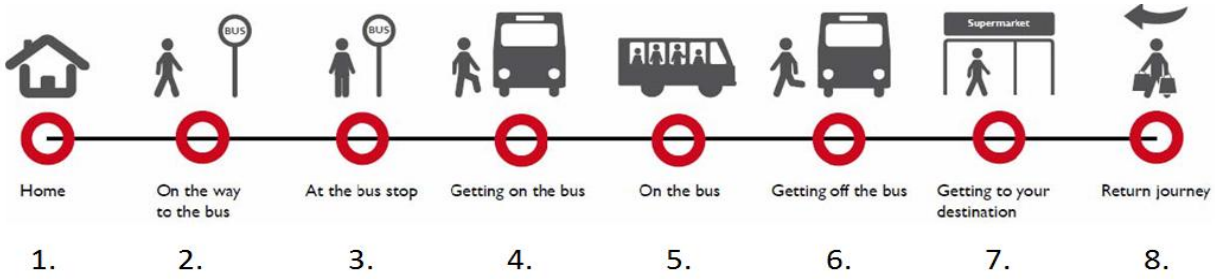

Figure 10 Key stages of a bus journey [21]

The public transport user is a **mobility-challenged person**:

> *'Someone whose mobility has been challenged due to age, physical or mental impairment, or an external physical condition: each of the above could have substantial and long-term adverse effect on the person's ability to use public transport'* [21].

Different user groups should be taken into account: caretakers with buggies, blind or visually-impaired people, wheelchair users, older people, bus drivers, pregnant women, teenagers, people with learning difficulties/social phobias, deaf people or people with hearing problems. All groups have their own special needs for the use of public service, avoiding problems as much as possible (Figure 11). Each group has different mobility restrictions that make it difficult to use public transport. This is the main challenge for the design of public buses and the public infrastructure. Two theories are possible, both have positive and negative qualities [29].

Figure 11 Key users in public transport [8]

- **A treat as normal** (macro scale) consists of a universal design, a design for all, where social handicap situations are anticipated;
- **A treat as different** (micro scale) is a categorical solution and can be seen as a 'medical model' that gives adjustments for every disable person separately.

2.4. Vehicle

A **bus** is defined as

> '*A long motor vehicle for carrying passengers by road*' [30].

In the public transport service different types of travel are known. First of all there is a separation between short distance and long distance travel.

- **Short distance: suburban and regional buses.** Competitors of these buses are the bicycle, the moped and the car. Women are more likely to use buses than men [14].
- **Long distance: long-distance buses and sleep coaches**. These buses are competing with the train, the car and the plane.

Besides this separation of distance, there are also **different bus types** (a standard bus, articulated bus, bi-articulated bus, double-decker bus, mini bus or coach) and **bus services** (traditional bus service, express bus service, night bus service, long distance transport service, Demand Responsive Transit (DRT), Bus Rapid Transit (BRT), Bus with high level of service (BHLS), tourism service, park and ride bus service and school bus service). The profile of a bus depends on:

- The **group of travelers** (tourists, commuters, private hire, home-work transport);
- The **distance** (short or long distance);
- The **quality of the routes**;
- The **region**.

2.4.1. Image of the bus

The car offers a wide range of individual benefits in contrast with the collective benefits of public transport. This can lead to a **social dilemma**. The user will either change his behaviour and make the trip using public buses, or the user will change his attitude and will consider public transport as a bad transportation mode. The image of public transport can change this effect: a bad image will strengthen the behaviour. Some people are not using public transport because of **off putting stories** that they heard from other users who had a bad experience. More than 50% of our decisions are based on emotions. Most of the time, people are aware that their choice is in contradiction with rational arguments. This is one of the reasons why people still prefer the car to the bus, tram or train [19] [31].

Correct **marketing** can play an important role in the decision process. This is not a static process. The preferences and behaviours of people are changing constantly. That is why the marketing campaign has to adapt itself to the new wishes and needs of the users every time.

Marketing can be defined as:

> *'a cyclical process that aims at reducing disparities between supply and demand by reducing the internal and external activities in line with the needs of (potential) customers'* [15].

More than 90% of all the marketing budgets in the transport sector come from car producers [31]. The car industry organises international car shows to promote new car models. The same can be done by public transport provider. A new bus route can be introduced as a special event with a show or new gadgets so people are aware that the new service exists. The new campaign is less important than the accompanying message. **Promotion on the buses** can be useful for the local traders but can also decrease the price of a ticket for passengers. Important to take into account is the legislation about advertisement on buses. In Flanders for example the visibility of the passengers on both sides of the bus has to be guarantee. An example is the line 6A in Copenhagen from the city centre to the suburb "Rødovre". The bus makes publicity for the local zoo (Figure 12). Another example is the promotion of the television show shark week. The outside of the bus is decorated as a shark swimming in water, with the doors of the bus as the shark's mouth: when you enter the bus it look as if you are entering a shark's mouth (Figure 13) [32].

Figure 13 Shark design on the bus [25]

Figure 12 Snake Design on 1671 Arriva Copenhagen

2.4.2. Design of the bus

The bus itself and the usability properties can be designed so that users are impressed by the public vehicles and ensure that public transport regains a good image [24]. Bus architecture needs to offer a basic, standard vehicle, comfortable for everybody. For example **seating, floor height, floor plan, door configuration, physical size, aisle width, number of doors and their position** have an impact on stop times, revenue service times, capacity and reliability. The interior of a bus needs to be designed so that passengers can board easily and quickly and that the internal circulation minimizes dwell times. For example the capacity of a bus is related to the external dimensions. An unofficial rule from the U.S. and Canadian BRT vehicles stated that if the vehicle length increases with 1m 10 extra passengers can get on the bus [33] [34].

The next question arises: **'Is different equipment necessary for each bus profile?'** For example a bus going from the train station into the city centre, carrying older people needs another interior than a bus transporting a lot of students with backpacks. There is a dilemma for design between these two passengers groups. The students want to get on the bus as quickly as possible and they don't need seats because of the short distance. The older people are driving a longer distance and want a comfortable seat so that the journey is not too heavy.

2.4.3. Activities on the bus

The **activities done on a bus depend on the age, gender and time of the day**. Also the **travel time** has a strong influence on what the traveler will do during the journey: longer travel times will increase the possibility for an activity. This is also related to the availability of a seat. Someone who is not **used to travel** and is unknown with the trip, will be more inclined to look outside, keeping an eye on the route and the destination [4].

There can be a difference between travelers who are obligated to take the public transport and travelers who are taking the bus for leisure or tourism. Also the activities are different: **recreational travelers** are taking the bus more for atmosphere and entertainment, **compulsory travelers** will work on the bus and are doing something functional [4].

Researchers in Wellington, New Zealand report the study of passenger characteristics and behaviour in public transport. 76.5% of the bus passengers were facing forward or were looking out of the window. On the bus 17% were listing to music, 13.5% were chatting with other passengers and 12.5% were reading. Texting (9.2%) was more often observed than telephoning (1.5%). Activities that were more frequently observed on trains than on buses are reading, using a computer, sleeping and writing [35].

Possible activities can be:

- Facing forward;
- Watching out the window;
- Eating;
- Drinking;
- Reading a book;
- Reading a newspaper;
- Smoking a cigarette;
- Chatting with other passengers;
- Telephoning;
- Sending message by mobile phone;
- Making use of a laptop;
- Working;
- Studying;
- Playing a computer game;
- Filling in a crossword or puzzle;
- Writing in a notebook;
- Listing to the radio;
- Listing to music;
- Sleeping;
- Taking a nap;
- Singing a song;
- Thinking;
- Reading promotions;
- Looking at the landscape;
- Looking at other people;
- Being bored.

2.4.4. Facilities on the bus

In a project of the European Bus of the Future (EBSF), a list of requirements that should be on board was made [24]. Together with the listed activities above, following facilities can be available **inside a bus**.

- Socket;
- Wi-Fi;
- Light;
- Reading lamp;
- Television;
- Table;
- Trash can;
- Music;
- Plug-in function;
- Toilet;
- Drink / eat machine;
- Elbow rest on the seat;
- Luggage racks;
- Fire extinguishers;
- Reading material;
- Curtains for privacy;
- Real time information;
- Visibility outside;
- Comfortable standing area;
- Free passengers flow;
- Appropriate lighting;
- Seat occupancy system.

The layout of **a bus stop** can also play a role in the decision process of a traveler. Some facilities in and around the bus stop influence the attractiveness as well as the quality of the waiting areas [13] [37].

- Seat elements;
- Weather protection;
- Trash can;
- Bicycle storage;
- Bicycle safe;
- Bicycle pump;
- Toilet facilities;
- Newspaper sale;
- Vending machine;
- Lighting;
- Clock;
- Mailbox;
- Wi-Fi;
- Parking for taxis;
- Map of the place around the stop;
- Telephone;
- Dynamic travel information;
- Info-terminals;
- Applications for Smartphone.

An overview of some popular **case studies** enlarges the current vision of a public bus with new ideas and innovative characteristics. The different facilities are listed briefly to have an idea of what is possible and available today. The full explanation of several case studies all over the world can be reviewed in Annex 3 – Bus city systems and Annex 4 – Bus concepts.

2.5. Passenger

2.5.1. Choice traveler

The users of public transport depend on the portion of public transport (y-axis) and the travel time ratio (x-axis). This ratio is the quotient of the total travel time from public transport and the car, the travel time from door to door. With an increasing travel time ratio, the portion of public transport decreases. There are three types of travelers according to the use of public transport (Figure 14).

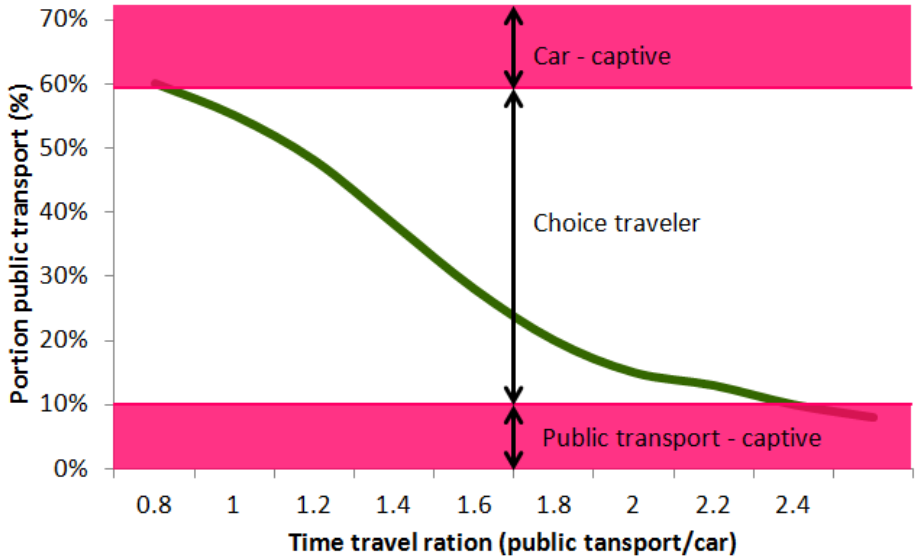

Figure 14 Relationship of travel time ratio and modal split [38]

- On the one hand the **bound, captive traveler**: travelers who rely exclusively on one travel mode to make a trip. They have no alternatives, no other vehicles as options.
    - **Car-captives:** travelers depend on the use of their car because of special circumstances. The car-captives (± 40%) are "chained" to their car for practical use, their jobs or other specific travel characteristics.
    - **Public transport-captives**: travelers can only use public transport. The public transport captives (± 10%) are for example students without a driving license or people without a car. They are already using public transport facilities and are not the target group to focus on if we want more people on the bus.
- On the other hand we have the **choice traveler:** the user of public transport who can choose between using public vehicles and taking his own car. The choice depends on the quality of the travel mode. These are the people that can make a difference in the use of public buses. They are thinking about the mode of transport and are aware of the various choices and possibilities. This group consists of almost 50% of the travelling people [39].

Not on the graph but also an important factor, is the fact that if the **travel time** ratio is too small, even the public transport captives are not willing to take the public buses or trains and will rather stay home than making the journey [40].

Choice traveler

The paper 'How choose the choice traveler?' defined the choice traveler as followed

> *'a well-educated (male) person (in the middle age category) who lives in a big city and makes use of the public transport for shopping and home-work traffic'* [15] [39]

This focus group is the most **sensitive to quality**. If the quality does not meet their expectations or is decreasing each time they use the bus, a negative effect for preferring using the bus will arise. The biggest competition between the car and public transport arises when people are going 'shopping (clothes, shoes, luxury...)' or going 'from home to work/school'. The group of choice travelers is dynamic and varies according to the **emotional status** of the traveler and the **situational position** at that moment in time and place. The characteristics of choice for one mode or another depends on the **personal attributes** of the user:

- Age;
- Gender;
- Residence;
- Disability;
- Travel motive;
- Traveler type;
- Travel frequency;
- Free time;
- Education;
- Income;
- Car ownership;
- Driving license.

Public transport captives

The most important reason for travelers to take the bus or train is to **avoid the congestion** and the time wasted by getting stuck in traffic jams. Not **finding a (cheap) parking spot** is a second reason for preferring public transport. Other reasons for choosing the bus are:

- Employer reimburses;
- Cheaper;
- Working, reading;
- Faster;
- Environmentally friendly;
- Possibility to drink;
- The car is to small;
- More relaxed;
- Social contacts;
- Less tiring;
- Safer.

Car captives

People are preferring their vehicle on the basis of a habit and they begin to think about other transport modes if their custom vehicle will have a breakdown or if their travel pattern changes [15] [39]. The main reason for preferring the car is that **the journey will be faster** and that they do not suffer from **delays**. Other reasons are:

- Too many transfers;
- Cheaper;
- Transporting luggage;
- Time moment of travel;
- Door-to-door travel;
- Lack of parking at the station;
- No seats available.

2.5.2. Perception

The **perception of public transport** is an unknown aspect. Some say that perception is influenced by design, image and lifestyle. Others say that the experience is linked to smells, colour, sound, temperature, structure, material used and layout. Perception arises from **unconscious influence of emotions**. Nevertheless perception is connected to the characteristics of the vehicles, the social-demographic characteristics of the passenger and the other passengers. Perception is present in each part of the pyramid because each quality aspect of the bus company has an objective and a subjective component in each step of the bus journey: waiting time perception, driving time perception and bus perception. The perception will rise to a maximum when the user is satisfied. The **satisfaction level** depends on the market expectations, the performance perceptions and the previous satisfaction. A satisfied passenger will use the public bus again and will slowly change his behaviour.

How people define their experience in a bus trip depends on the actual use and the judgments and opinions of others. According to psychologist A. Maslow preferences of travelers regarding public transport are based on the **hierarchy of primary needs** (Figure 15). This pyramid can define the customers' wishes and makes it easier for the public transport operators to win more passengers. The pyramid begins with the question '**why people would consider using public transport?**' If this basic request has a negative response, the layers above will become irrelevant.

The Dutch railway company (NS) researched the quality aspects of their public service. In spite of the fact that the research was based on rail research material, the same theory can be applied to public buses. NS concluded that the qualities at the bottom of the pyramid where considered as more important than the aspects at the top. Before going to the next step of the pyramid, the underlying layer (the basic conditions) has to be complete. 50% of the quality aspects are related to the 'safety and reliability' characteristics of the public service. If the vehicles are safe, punctual and easy to use, then the next challenge will be making the vehicles comfortable [41] [42].

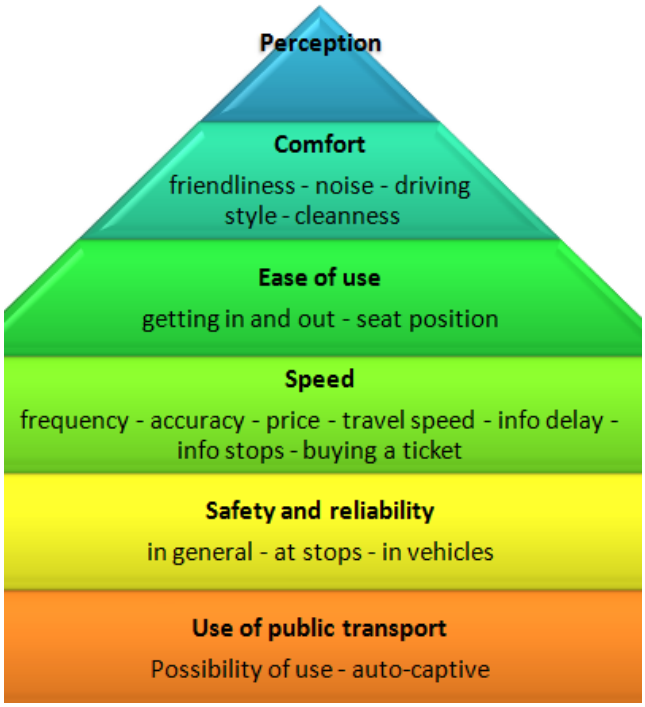

Figure 15 Customers needs pyramid [2]

2.5.3. Decision moment

The different actors to influence the choice for public transport do not all carry the same weight. Some characteristics are of more interest than others. The various stages of the decision process are cast in a diagram and every person runs this schedule unconsciously before making a journey. Most of the travelers are handling this process as a habit and are not taking every step that seriously (Figure 16).

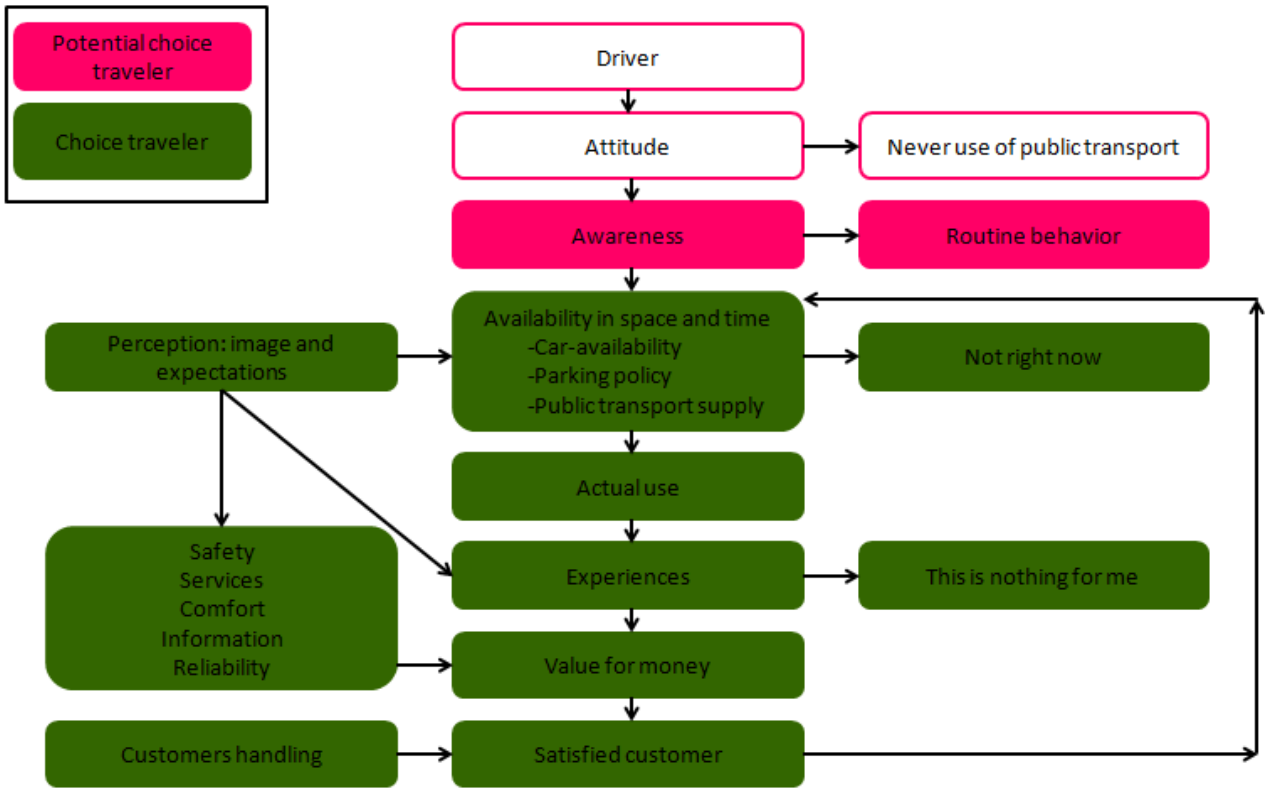

Figure 16 Decision moments of a choice traveler [15]

A first requirement is a positive **attitude** towards public transport. The attitude of a user is linked to the social position of the traveler [43]. The next aspects are the **awareness** and the habit of using a travel mode. Travelers will never examine for each trip which vehicle will be the best mode to travel. In the beginning they try out several routes but once they find 'the best route', people will stick to that route. Changing this habit afterwards is a challenge. The right moment to change a custom is anticipating on changes such as relocations, also changes in destinations, lifestyle and public transport supply. **Habitual or routine behaviour** is, directed by behavioural intentions according to the Theory of Reasoned Action from Fishbein and Azjen and the Theory of Planned Behaviour from Azjen. However habitual behaviour can prevent a traveler to try something new and can put new attitudes back in the corner [44]. Once people are aware of the possibilities of public transport, characteristics of the system are playing a role among **the availability** (frequency, walking distance, amount of transfers, information, affordability…). The user will compare the qualities of the buses with the qualities of the car. **The perception** of public transport that users have affects the image and expectations or the availability of the buses.

If the user knows all the information, he can **actually make use** of the public services. In this phase he evaluates whether the service gives value for the money he spends: comfort, safety, information and reliability. The will analyse the total trip in terms of convenience, pleasure and profit. After having used the public transport system once, the **experience** can be evaluated. If things did not go well and the passengers had problems with the usage, they will not try the public service again. If everything went well, the user will balance the price paid against the quality he got: he will check whether he got the right **value for the money spent**.

The transport provider wants satisfied customers. But a customer will take the same steps into consideration, again and again: every time he takes the bus. The conclusion of this diagram is that choice travelers are easier to persuade to make another trip with public transport than potential travelers who have never used the public buses before.

2.6. Conclusion literature study

Conducting **a thorough literature study** about the bad qualities of a bus journey is a first step to find the bus users' preferences. The literature study provides an overview of the qualities and characteristics of a bus journey and allows focusing on the different aspects that can change the use of public transport [9]. The following answers are formulated on the sub questions of the literature study.

Who is travelling with the public bus?

Travelers can be divided in: captive car-user, captive bus-user or choice traveler. To convince travelers to use the bus more often, campaigns and other investigations must focus on the choice traveler instead of e.g. focussing on young people who are already using the bus. This choice traveler can be defined as **a well-educated (male) person who lives in a big city and makes use of the public buses for shopping and home-work trips**. This focus group is the most sensitive to quality. Apart from bus users without any disabilities, the other passengers can be divided in nine categories depending on their age and degree of restrictions. This means that the bus needs to be adapted to all kind of bus users.

What are the negative aspects of a bus journey?

Previous research showed that travelers found the aspects **friendliness of the other passengers, actual information and the appearance of a bus stop** the most annoying aspects of a bus journey, followed by the **ease of transfers, overcrowding and the price**. Another main problem of public transport is the **reliability**: excessive waiting times and in-vehicle times. No matter how hard transport operators are trying to have the bus drives on time and improve the reliability, this is not an aspect that will be solved in the near future. The compacting of the road network and the congestion problems do not allow guaranteeing a fixed timetable for road vehicles. That is why an investigation focussing only on reliability and timetables of a bus company will be insufficient to raise the attractiveness of buses. Assuming that the time spent in the vehicle and the waiting time at the bus stop remain the same, one of the options that can be investigated is how to make the waiting-, travelling- and 'lost' time more interesting and comfortable. The perception of **travel time and comfort** will be the two aspects with the highest potential to be reduced by appearance qualities. The in-vehicle time (IVT) may be a small part of the total journey but it is very important nevertheless. The IVT will increase with the distance and studies showed that the IVT of bus users has the lowest value, when compared with rail- or car users [45] (Figure 17**Error! Reference source not found.**).

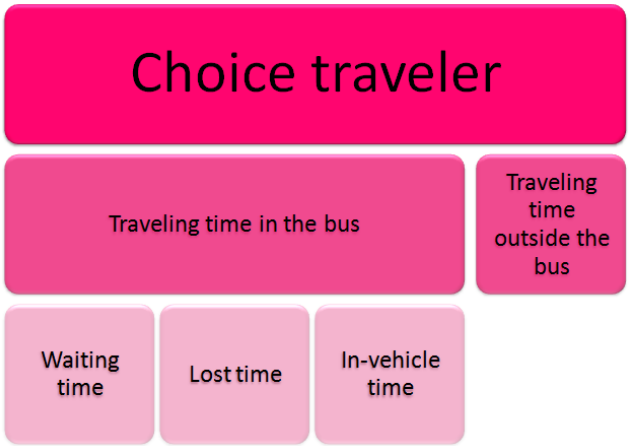

Figure 17 Perception of travel time

What is the perception and the image users have of public buses?

What a passenger feels when he is travelling is a purely personal experience. The quality of the bus journey goes hand in hand with the perception and the image of users of public buses. Besides the basic facilities: safety, speed and the easy use of the bus, the last decision point for the traveler will still be the stage of his perception. This can change each time the public bus is used and is related to the **market expectations** and the **past experiences**. Other personal aspects are the habitual behaviour and the attitude and awareness of the passengers.

Which new approaches are in operation today?

New approaches are introduced to satisfy the passengers and minimize the negative characteristics. The summary of different case studies indicates that transport operators and services are looking for **new technologies** and **a more attractive design** to convince the travelers to take the bus. For example in the Netherlands they try to create a new type of high quality public transport: buses have a nice appearance, provide the travelers with comfortable seats and improve the reliability and accessibility. Other companies are putting their focus on the accessibility and the ease of boarding and disembarking: the buses are equipped with optical guidance systems, wider doors and low floors. Buses with Wi-Fi on board and bike racks on the bus are more and more common. Other projects focus on social interaction and personal attention.

Which activities are likely on the bus?

The type of activity during a bus journey **depends on the age and gender of the user and the time of the day**. The travel time has also a strong influence on what the traveler will do, but it also depends on as the fact whether the user is **used to travel** a lot or not and **the reason why he is travelling**. Depending on the activities, other facilities may be implanted at the bus stops and on the bus: sockets, Wi-Fi, television, table, toilet, reading material...

The research will be restricted to only **the standard buses**. Research into other types of public buses would equally be interesting and may give a different result but time is limited. Analyzing the standard bus will present a nice first example for further research.

Chapter 3 - Research design

3.1. Research method

3.1.1. Motivation research method

Quality or quality measurement can be a value for money, conformity to specifications or even exceeding customer's expectations. The interpretation of quality is different for each person, each situation, each level and it is up to the bus company to find an overall quality form. Taking the opinion of passengers into account is a good measuring method for the quality and the attractiveness of the buses.

The quality and luxury aspects of a bus have been investigated before in the research '**Stadsbus van de toekomst**' ('City bus of the future'). A questionnaire was sent in 2002 by post to 3500 households. Approximate 874 respondents completed the questionnaire. The results showed the importance of 'information', 'accessibility', 'comfort', 'safety', 'standing area and seats' and 'environmental awareness'. The research method used is called 'Problem Ranking Process Method (PRP)'. The research started with in-depth interviews taken from several focus groups of bus users and bus drivers and at the end of the interviews a list of quality aspects was made. The quality aspects of this list were selected according to a questionnaire in which the respondents made statements about the importance of the existing quality aspects and desirable characteristics [46].

Comparable research was done where the investigators identified **the determinants of light rail** as a transport mode for medium and long distances. They examined different determinants of the public transport system as well as the personal characteristics of travelers. The results were analyzed using regression models [10].

Both researches resulted in the following research method, discussed in the paragraphs below.

3.1.2. Discrete choice experiment

Investigations of preferences in transportation modes are mostly done by using **discrete choice experiments (DCE)**. Discrete choice models assume that the probability of individuals choosing a given option is a function of their socio-economic characteristics and their relative attractiveness to the option. Those models have a finite number of alternatives that can be explicitly listed [47]. DCE are in this report done with a **stated preference (SP) method** in which respondents are requested to express their preferences for a set of hypothetical choice alternatives which consist of a combination of different attributes with varying levels. SP models stated choices by asking people what they would choose in a certain situation. The choice set is a fictive list of choice alternatives. In this way, a respondent can be 'used' to evaluate more choice situations [48].

3.1.3. Hierarchical Information Integration

One challenge of a DCE is the **ability to handle large numbers** of potentially influential attributes. Too many attributes in one survey can cause problems of information overload and respondent burden, which can influence the validity of the experiment. Increasing the amount of attributes will exponentially increase the size and complexity of the choice task too [49].

To avoid the risk of high dropouts an alternative method can be used namely the **Hierarchical Information Integration (HII)**. HII assumes that decision makers use hierarchical decision strategies to process information in complex decision making tasks. Accordingly the HII method relates different attributes with each other and forces the decision maker to choose between several options. The HII method relates several attributes with each other and the respondent has to give an evaluation for the combination of presented facilities. HII has been applied in previous transportation surveys: for example to define the service quality in commercial buses [50] or for modelling the effect of destination attributes on the intercity travelers' mode choice behaviour in Taiwan area [51]

The basis of HII is that similar attributes can be grouped into different constructs. A step by step plan for the construction of a HII survey can be introduced (Figure 18) [52] [53]

1) The relevant **attributes** and **attribute levels** are selected;
2) The attributes are clustered into **constructs.** The amount of attributes is categorized;
3) Separate experimental designs are constructed for each of the constructs;
4) Individuals express an overall choice among two or more alternative profiles;
5) The responses obtained in step 4 are analyzed with a multinomial logit regression. Afterwards the perceived scores of the decision constructs are integrated into an overall judgment for the alternative.

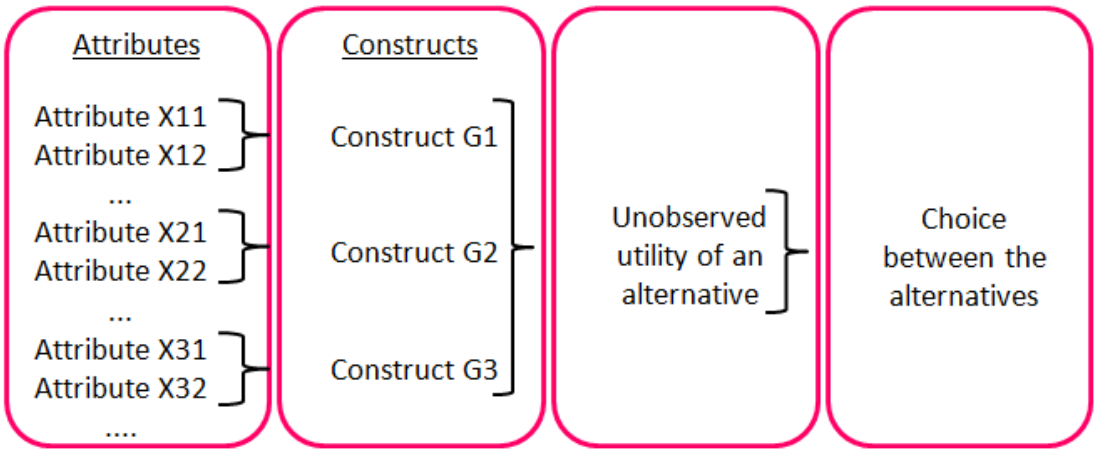

Figure 18 General relationship between attributes and constructs in HII [47]

Respondents give their overall opinion of the profile description by means of a choice task. The choice task exists of a two-step decision-making process [49] (Figure 19);

- First an evaluation takes places of the specific combination of attribute levels that describe **one particular construct**. The attributes of the choice alternatives are divided into a limited set of meaningful high-order non-overlapping set of decision attributes, called the decision constructs. Since each construct has fewer attributes than the complete design, the information overload is reduced. The clustering of these choice sets is based on logic and randomly distributed evidences. Each construct can be seen as an individual discrete choice experiment that can be conducted in accordance with the random utility theory. These experiments are directly described as the alternative with all attributes and indirectly described as part of a construct.

- Second an evaluation of **the overall constructs values** will be conducted. The constructs whose levels are summarising construct values are traded-off in a bridging experiment. The overall utility gives an evaluation of the attractiveness of the other constructs [51].

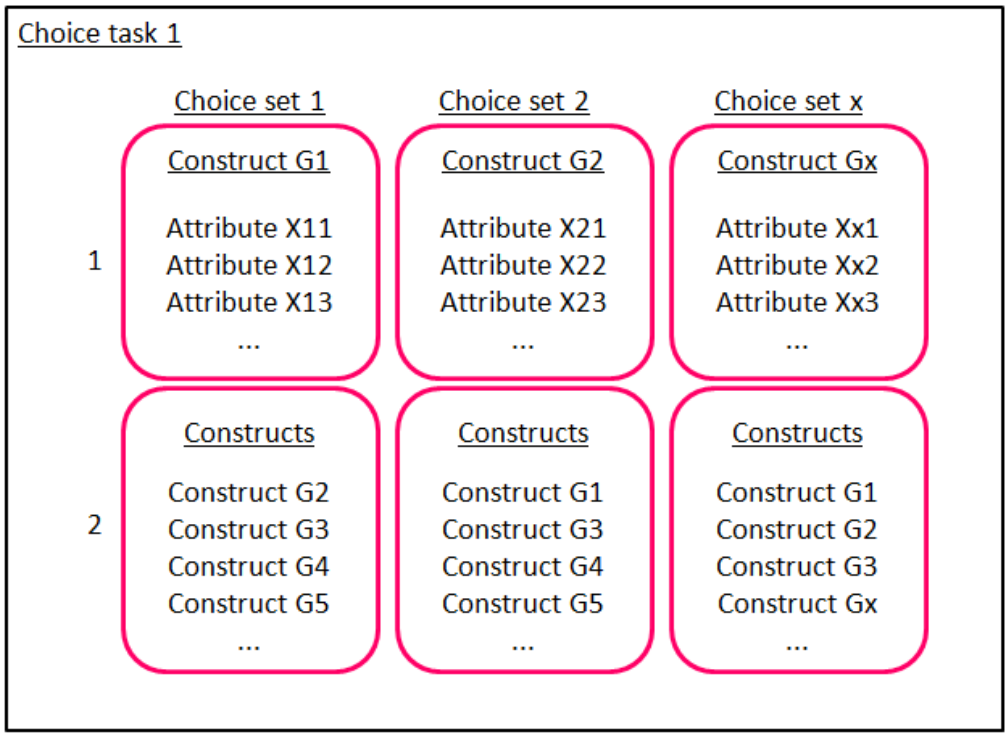

Figure 19 An example of a two step choice task

In the questionnaire each respondent gives his preferred solutions for a number of hypothetical situations during the interrogation method. Through **statistical calculations** the **best composition of solutions** to improve the bus usage can be generated. The data will be analyzed by the statistical computer program **IBM SPSS Statistics 22 Core System User's Guide** [54] and **NLogit 5** [55]. SPSS will be used to evaluate the descriptive statistics: the use of NLogit is necessary for the processing of multinomial logit models.

3.2. Data analysis

3.2.1. Multinomial logit model

A **multinomial logit (MNL) model** has traditionally been used to analyse discrete choice data with more than two possible discrete outcomes. The dependent variable (y) is categorically distributed also known as nominal. The independent variable (x) is used to predict the dependent variable. The model assumes that the random components are independently and identically double exponential distributed. Each independent variable has a single value for each case [48]. The utility function is:

$$\boldsymbol{Vj} = \sum \boldsymbol{\beta i} * \boldsymbol{Xij}$$

$$\boldsymbol{Vj} = \boldsymbol{\beta 1} * \boldsymbol{X1j} + \boldsymbol{\beta 2} * \boldsymbol{X2j} + \cdots + \boldsymbol{\beta i}\, \boldsymbol{Xij}$$

With V_j = the utility of bus type j
X_{ij} = the vector of the attributes of bus type j in experiment i
$ß_i$ = the vector of the taste parameters of the attributes in experiment i

From the utility formula is noticed that ßi is the weight of characteristic i. This has an influence on alternative j making Xij the effect of characteristic i in alternative i. To predict if an alternative will be chosen, the value of its utility must be contrasted with those of alternative options and rewritten as a probability value between 0 and 1. The logit function is the link function that is necessary to transform the range of the dependent variable from – infinite to + infinite towards a range from 0 to 1 [48]. The equation for the MNL function can be described as:

$$\boldsymbol{P(j)} = \frac{\mathbf{exp}(\boldsymbol{Vj})}{\sum \mathbf{exp}(\boldsymbol{Vj})}$$

With P(i) = the probability that bus type j is chosen by the decision maker
V_j = the utility of bus type j

3.2.2. Goodness of fit

Two measurements of goodness-of-fit are used to analyse the performance of the models. These tests tell something about how well the model describes the set of observations.

- **The Log likelihood of the full model (LLf)** says something about the accuracy and credibility of the ß coefficients for the most optimal model. The closer the value to zero, the better the model is capable of reproducing the respondents behaviour [56]. The **Log likelihood of the constant only model (LLco)** on the other hand, simply fits the intercept to predict the outcome variables, all parameters are equal to zero [48].
- **The McFadden likelihood ratio index (R^2)** compares the LLf with the LLco. The value lies between 0 and 1 and illustrates how much of the created model is explained by the dependent variable. The closer the R^2 to 1, the more is explained by the model and the better the model will be. An imperfect model will have a value of 0. In transportation research an acceptable and good model will have a value between 0.2 and 0.4 [48].

3.3. Data collection

The data collection for this research will be conducted by creating first a **matrix** with all the inner and appearance qualities inside a bus, found in the literature study. This list is not exhaustive: there are still other facilities that can be added to the appearance qualities.

Next, an **interview** with one or more bus builders, bus operators and bus drivers will be presented. Bus builders and operators will be contacted and interviewed according to their vision on the possible designs of the interior of a bus. Not only the bus operators and builders can be interviewed but also the bus drivers, community transport, accessibility associations and people from bus construction companies can be questioned [11]. During the interviews old services are revised and new facilities, possibilities and ideas will be questioned.

Lastly, an internet-based **questionnaire** will be spread among choice travelers. Users and non-users will be contacted by e-mail and will be asked to fill out this internet-based questionnaire. Also on the website of 'Trein Tram Bus' a link to the questionnaire will be placed [57]. The following structure will be used in the questionnaire.

- Firstly, the respondent will be asked what he/she would like to change inside a bus. He/she can chose from **a list with several facilities** they like to improve;
- Secondly, different luxury facilities inside the bus are questioned in a **stated preference survey** that is common in the field of travel behaviour research. Each respondent gives his preferred solutions for a number of hypothetical situations and new possibilities. The Likert scale will be used to question the respondents' opinion. A situation is shown and the respondent answers by stating their preference, appointing a number. In this questionnaire he/she has to choose between 1 (strongly favourable) and 5 (strongly unfavourable). Each respondent thus indicates his preferred bus type.
- After showing a given amount of facilities, the respondent will be asked again in an **open question** what he/she would like to change or improve inside a bus to improve the comfort of the bus journey.

By using this order of actions, people will first think about the solutions and opportunities already existing. After displaying other ideas that they never heard of before, they are stimulated to think more deeply. This may result in more extravagant concepts and ideas when the first question will be asked again. The outcome of the questionnaire will be a more detailed version of a good and attractive bus (Figure 20).

Figure 20 Process evaluation

3.4. Sample selection

The target group will be collected through a **representative and random selection**: the subject of the research is the **choice traveler** who can be defined as

- a **middle aged** traveler, between 25 and 60 years old;
- has a **car available** to travel (they have a driving license);
- has a **bus stop** near his house (basis mobility);
- can use the bus for **home-work travel** and for **shopping**.

These are assumptions on basis of **socio-demographic and behaviour characteristics** [15] [39].

While searching for the right solution to facilitate a mental shift in bus travelers, it was preferred to take into account the opinion of both **users and non-users** of public transport. These target groups are the people who actually use or will use the bus and have remarks and wishes about the vehicle services. The sample should be representative for **the Flemish population**. They will form the simple, random sample [5].

Chapter 4 – Matrix

A first step in the investigation is the identification of a set of important dimensions of service qualities and facilities perceived by current and potential passengers of a standard bus [50]. These qualities will be summarized and linked with each other in an approximated objective matrix. The column label of the matrix is called **the appearance qualities**; the row label is called **the inner qualities.**

Inner qualities

Different inner qualities came out of the literature study (driver behaviour, knowledge, pleasure, presence of other passengers, price-quality balance, safety, travel time...). Investigating all the different inner qualities would take a lot of time and a detailed and large survey. That is why the survey will immediately ask the respondent to describe the effect of the **willingness to take the bus**. The survey will review the physical environment (the appearance qualities) and measure immediately the behaviour that will occur (the willingness to take the bus).

Appearance qualities

A list of appearance qualities is made to have an overview of which kind of facilities and accommodations can be provided in a standard bus. The list focuses on the luxury items that may convince a choice traveler to choose a journey by bus. The list is based on the literature study and the different case studies. Several aspect are taken into account by the set up of the list; the provision of accessible and efficient journeys, connected and integrated system, the architectural and functional design and high quality user experience [46] [58] (Figure 21). See 'Annex 5 - List of variables of appearance qualities', for a full list of all the variables of appearance qualities.

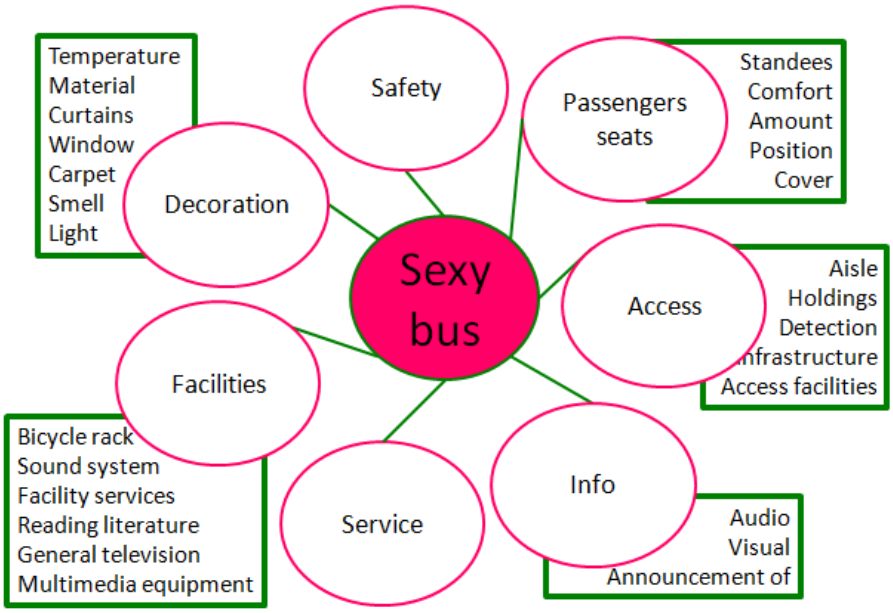

Figure 21 Main appearance qualities

Chapter 5 – Interviews

Different interviews were hold with two bus builders 'Van Hool' and 'VipDesign' and a bus driver Bert Dorleman. More questions were asked to several bus builders at Busworld Academy in Kortrijk, Belgium. Following main conclusion could be made from the interviews (See Annex 6 - Interviews for full interviews).

Safe traffic was one of the main topics at Busworld Academy. All the bus builders are convinced that **a mix of economic, social, technical and design characteristics can lead to an efficient public transportation system**. Bus builders and operators talk about a **'bus system'** because a journey starts at the departure place and ends at the arrival location: different stages are visible in between and are all connected. If one part of the chain is evaluated as negative, it may influence the entire journey experience.

In Belgium **public transport is in hands of the government** and with the current policy of cutting expenses, the development of opportunities is limited. In most cities the politics and mayors still decide what kind of public transport will operate in their city. Bus builders and drivers have to take the **legislation** and the regulations of the bus operator into account (e.g. noise standards, minimum dimensions...). Governments are introducing this type of control because public transport is more and more **the signboard of a city**. Important for a city bus is the difference between **urban and regional public transport**. The same observation can be made regarding the use of local and regional trains.

A general trend is the **individualization and the demand for more privacy**. An upcoming trend is "**the driving office**": folding tables, adjustable backrest and footrest, electronically controlled temperature.... But every passenger has another definition of 'luxury' and 'comfort'. This definition is very personal which makes it difficult for bus builders to fulfil the needs for more luxury oriented public vehicles. A bus should be comfortable, flexible and quick and the quality has to be in balance with the price. Customers' requirements depend also on the home country: for example Italians prefer plastic moulded chairs because the temperature is higher and people will sweat more on fabric-covered chairs. A new evolution is the increasing attention to **environmental friendly buses** and the **use of electronics** inside the public vehicles. For example with the provision of a 4G hotspot, Wi-Fi can be made available in a bus. The **cleanliness** of a bus, the feeling of **safety**, the **accessibility** and the **communication** … they all play a big part in the bus journey experience. Especially in cases of delays or road constructions the communication is an utmost importance to a lot of bus passengers. Furthermore, the use of correct **colours and materials** can increase the **emotional status of the passengers**. Sometimes a better design, glass roof and confidential colour tones can make all the difference.

Chapter 6 – Questionnaire

The goal of the questionnaire is to define when a bus journey will be considered as a pleasant, useful and productive trip and not as a waste of time. The basis for the implementation of set-up of the questionnaire is the **Berg Enquête System** of Design System Group of the Technical University of Eindhoven.

6.1. Selection of constructs, attributes and levels

Six constructs, related to the main characteristics of a bus journey, are created and can be interpreted as six scenarios where a choice traveler could be satisfied with (Figure 22).

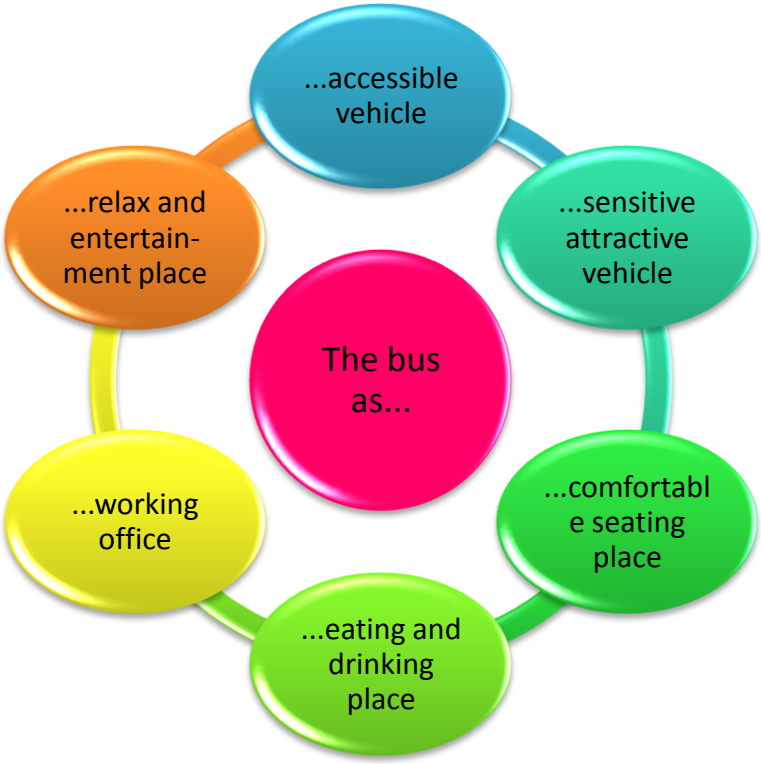

Figure 22 Six constructs - The bus as...

Each construct is subdivided in **five attributes** which are in their turn further classified into **two levels**. The questionnaire will consist of 30 attributes and 60 levels. Each attribute is part of only one construct. The minimum number of respondents depends on the amount of attributes that will be included in the questionnaire. When more levels are added to the attributes, more respondents are necessary to complete the different profiles. For this project 10 variables are shown per choice task with 2 levels each time, indicating that a minimum amount of 120 respondents is required. For a reprehensive amount of answers it is recommended to double this minimum number of respondents to 240.

A respondent will be subdivided randomly in one of the **six questionnaires**. Through a random distribution each respondent has to complete a different questionnaire than his neighbour. A random design was used to create the choice experiments (Table 2).

Construct The bus as...	Attributes	1st attribute level	2nd attribute level
"...Accessible vehicle"	**Accessibility and announcement facilities**		
	1 **Access**	Standing space: 2 passengers/m²	Standing space: 4 passengers/m²
	2 **Standees**	Backrest	Vertical seat (saddle chair)
	3 **Announcement**	Audio: speakers, microphone	Visual: display, countdown
	4 **Announcement of**	Arrival times, delays, waiting time	Available facilities, connectivity options
	5 **Bicycle rack**	In front or at the back of the bus	Inside the bus
"... Sensitive attractive vehicle"	**Sensory facilities**		
	1 **Light**	Atmospheric lighting	Accent lighting at footsteps, knobs, reading lamp
	2 **Temperature**	General heating system and air conditioning	Individual seat heating and air conditioning
	3 **Visibility side windows**	Window cleaner	Sunlight protection
	4 **Open bus**	Large window	Roof of glass
	5 **Air**	Hinged windows on the side	Hinged window on the roof
"...Comfortable seating place"	**Passengers seat comfort facilities**		
	1 **Seat amount**	More seating places	More standing places
	2 **Seat on the side**	Looking inside the bus	Looking outside the window
	3 **Seat composition**	Individual seat	Bench
	4 **Seat options**	Folding elbow/foot rest	Folding backrest 180°
	5 **Seat comfort**	Standard seat	Spacious seat
"... Eating and drinking place"	**Service facilities**		
	1 **Trashcan**	One big trashcan	Individual trashcan per seat
	2 **Cup**	Cup holder inside the table	Cup holder on the side
	3 **Catering option**	Drink/eat machine available	Drink/eat machine not available
	4 **Bathroom**	Toilet	Washbasin
	5 **Cleanliness**	Mobile cleaning service during the journey	Mobile cleaning service during breaks

"... Working office"	**Working facilities**			
	1	**Table**	Fixed table	Folding individual table
	2	**Coat rack**	In front or at the back of the bus	Coat hook near your seat
	3	**Luggage rack**	In front or at the back of the bus	Above the seats
	4	**Wi-Fi**	Free limited Wi-Fi	Paid unlimited Wi-Fi
	5	**Socket**	Free limited energy use	Paid unlimited energy use
"... Relax and entertainment place"	**Entertainment facilities**			
	1	**Television**	With news, advertisement, language course...	With movies, series...
	2	**Television through**	Individual display in headrest	Streaming options for own electronic device
	3	**Audio entertainment**	General background music	Individual audio system with music, radio...
	4	**Reading material**	Daily free newspaper	Free library
	5	**Steward**	Always on the bus	On the bus during special events

Table 2 Constructs, attributes and their levels

The questionnaire starts with a short explanation about the subject and the goal of the research. First some questions concerning travel behaviour are asked, followed by the different choice sets questions. The third part of the questionnaire investigates demographic and personal questions [4] [42].

6.2. Travel characteristics

1) How often do you travel by bus?

- 4 days a week or more
- 1-3 days a week
- 1-3 days in the month
- 6-11 days in a year
- 1-3 days in a year
- Less than one day in a year
- Never

The question will indicate if the respondent is a frequent bus user or not. With this answer a difference between choice travelers and captive bus or car users can be made. If the respondent chooses the option 'Never', he will be send directly to question 6 and does not need to answer the bus users' related questions.

2) How long do you sit average on the bus?

- < 5 minutes
- 5-15 minutes
- 16-25 minutes
- 26-35 minutes
- > 35 minutes
- I never take the bus

The research focused on short distance transport. Inside the category 'short distance' a difference can be made between **urban transport and regional transport**. A difference is made in the urban bus (0-15 minutes), the regional bus (16-35 minutes) and the long distance bus (>35 minutes). This answer is related to the following questions, meaning that the other **questions are based on the travelers' experience**. Using this method only one situation will be investigated but the interviewees will base their answers on his experience and perception.

3) Which activities are you doing on the bus?

- Using mobile phone
- Drinking
- Reading a book
- Playing a computer game
- Reading a newspaper
- Completing crossword/Sudoku
- Eating
- Using a laptop
- Listing to the radio / music
- Get bored
- Observing other passengers
- Talking with other passengers
- Looking around
- Sleeping
- Studying
- Making calls
- Working
- Other: …

According to the activities of passengers, different facilities may be integrated inside the bus. Respondents can tick several answers.

4) **To which extent do you associate the bus with the following characteristics? A Likert scale is presented: a scale of 1 means a limited extent, a scale of 5 indicates a strong extent.**
   - Reliability
   - Protection / security
   - Flexibility / independence
   - Attentiveness
   - Easiness
   - Environmental awareness
   - Pleasure
   - Rest and time for yourself
   - Stress
   - Sexy
   - Status
   - Speed
   - Challenge

The following question examines which emotional feelings come up during a bus journey. The output will show the image of the bus and the according qualities.

5) **What would you like to improve/change inside the bus?**
   - Current information
   - Behaviour of a bus driver
   - Quality of services
   - Overcrowding
   - Price – quality balance
   - Cleanliness of the bus
   - Travel comfort
   - Security
   - Disruptive behaviour
   - Accessibility
   - Lighting
   - Workspace
   - Seats
   - Other: …

Before starting the evaluation of the choice tasks with the related bus qualities, this question is asked to find out what the respondent would like to change in the bus. Multiple answers are possible.

Question 6 is only visible for respondents that never take the bus.

6) **For which main reason do you never take the bus?**
   - I have a company car
   - No freedom of movement
   - Large pre- and post transport
   - Unreliable
   - Uncomfortable
   - Uncontrollable
   - Unsafe
   - Uncertainty of a seat
   - Pleasure of driving a car
   - Poor connection
   - Disruptive behaviour of other passengers
   - Too expensive
   - Movement with luggage
   - Home at big distance from destination

For the research, it is useful to know why the bus is not used by some respondents. In the analyses it can be seen if these main reasons are related to the comfort qualities of the bus or not.

6.3. Choice task

The HII method is used for the questions related to the facilities in the bus. The respondent has to evaluate **six different choice tasks**. One choice task consists of two choice sets including **one main construct** and **five sub constructs**. Two bus types, A and B in each choice set are provided with different facilities. For each hypothetical situation the respondent has to choose between these two alternatives.

The choice tasks are first explained by an **example question**. This example question describes step by step the different parts of the choice set. Every respondent receives the same sample question (Table 3).

- **Evaluation main construct**: the respondent has to evaluate the main construct which has been divided in **five attributes of the construct**. Each attribute has two levels, visible in bus type A and bus type B. The respondent can indicate on a Likert scale his findings about the presented facilities of the bus from very favourable (1) to very unfavourable (5).
- **Evaluation sub constructs**: the second part shows **five sub constructs** to which is stated that the construct is available (+) or not available (-) in the bus. Hereby the respondents are asked to evaluate the combination of the remaining sub constructs. The respondent has to choose the bus type he prefers most.
- **Evaluation willingness to pay**: the last part of the choice task includes a question about the **willingness to pay** for the selected bus type. The standard price for one bus trip in Flanders for a small distance (one/two zones) is 1 euro: this is the minimum price a respondent can choose [45].

After the example questions, the respondent is asked to evaluate six different choice tasks so each construct is covered. This amount of attributes should be manageable for the respondents. The constructs and attributes will be randomly distributed in six groups (Annex 7 - Random distribution of attributes and constructs).

	Bus type A	Bus type B
Main construct: **The bus as ... accessible vehicle**		
Access	2 passengers/m²	4 passengers/m²
Standees	Backrest	Vertical seat
Announcement	Audio: speakers, microphone	Visual: display, countdown
Announcement of	Arrival times, delays, waiting time	Available facilities, connectivity options
Bicycle rack	In front/at the back of the bus	Inside the bus
Your opinion about the information inside the bus	**Very favourable** **Favourable** **Neutral** **Unfavourable** **Very unfavourable**	**Very favourable** **Favourable** **Neutral** **Unfavourable** **Very unfavourable**
Sub constructs: **The bus as ...**		
Sensitive attractive vehicle	-	+
Comfortable seating place	+	+
Eat- and drink place	-	-
Working place	-	+
Entertainment place	+	-
Which bus type would you choose?	○	○
Willingness to pay more		
How much are you willing to pay for the marked bus type?	**1.00 euro** **1.25 euro** **1.50 euro** **1.75 euro** **2.00 euro** **>2.00 euro**	

Table 3 Example choice task

6.4. Personal characteristics

At the end of the questionnaire there are some demographic questions. These questions are useful for the determination of representativeness of the sample and descriptive statistics.

1) **What is your gender?**
   - ○ Male
   - ○ Female

2) **What is your year of birth?**

3) **Do you have a driver's license?**
   - ○ Yes
   - ○ No

The focus of the research lies on travelers above 18 years: at this age they are allowed to apply for a driver's licence.

4) **What is the postcode of your domicile?**

The postal code is used to find out how many respondents are living in a rural or an urban area. The Flemish government calculated in 2008 that with less than 150 inhabitants/km² the area will be rural; over 150 inhabitants/km² the area will be urban [59].

5) **What is your highest diploma or certificate?**
   - ○ None
   - ○ Primary education
   - ○ Lower secondary education
   - ○ Upper secondary education
   - ○ Higher non-university education
   - ○ University education
   - ○ Other: ...

6) **Do you have a disability?**
   - ○ No restriction
   - ○ Visual
   - ○ Auditory
   - ○ Physical

More answers are possible.

After the personal questions two final questions are asked;

- **Are there any facilities in the bus that were not mentioned in the questionnaire before and that you find very important for a comfortable bus journey?** E.g. a safety belt?
- **Do you have any questions or remarks regarding the survey?**

A pilot questionnaire was made to evaluate the questions and layout. The remarks on the pilot questionnaire are showed in Annex 8 - Pilot survey. An example of the questionnaire is present in Annex 9 - Questionnaire.

Chapter 7 - Research results

7.1. Description of the sample

The questionnaire was launched on the 31th of March 2014. On the 14th of April 2014 a total number of **934 respondents** started answering the questions. Approximately **592 respondents** or 63% completed the questionnaire. The respondents that did not complete the questionnaire were eliminated for the following analyses (Table 4).

Amount of respondents that	Absolute (N = 934)	Relative (%)
○ Didn't complete the questionnaire	342	37
○ Did complete the questionnaire	592	63

Table 4 Analysis: amount of respondents that complete the questionnaire

About 41% of the 592 respondents are **men**; the remaining 59% are **female respondents**. Comparing this data with the results of an investigation of De Lijn in 2003 and the investigation of 'Stadsbus van de Toekomst', similar results came out [46].

Starting from the definition of a choice traveler, the **age categories** were divided in respondents below 24 years (52%), between 25 and 60 years (43%) and older than 60 years (5%). The respondents that completed the questionnaire were all 17 years or older, what means that they were all able of being in possession of a driver's license. Also the age category of 17-24 years old can be seen as choice travelers and are still included in the analyses. Of the respondents, 85% has a **driver's license**. This can be a motor or car license (Table 5).

	Absolute (N = 592)	Relative (%)
Gender		
○ Male	245	41
○ Female	347	59
Age categories		
○ ≥ 24 years	310	52
○ 25-60 years	254	43
○ ≤ 61 years	28	5
Driver's license		
○ Yes	503	85
○ No	89	15

Table 5 Analysis: gender, age categories and possession of driver's license

The postal code of the respondents was asked in the questionnaire. With this information the residential location of the respondents is situated in a **metropolitan area** like Brussels, Antwerp or Gent (8%), a **regional urban area** (4%), an **urban area** (28%), a **small urban area** (58%) or **an rural area** (2%) [59]. When this numbers are linked to the table of basic mobility of De Lijn (Annex 1 - Basic mobility) can be concluded that 98% of the respondents has a bus stop 500 to 650m from their home. Theoretically seen, the bus will stop here two to four times an hour (Table 6).

Residential location	Absolute (N = 592)	Relative (%)
○ Metropolitan area (>1500 inh./km²)	47	8
○ Regional area (1050 inh./km² - 1500 inh./km²)	23	4
○ Urban area (600 inh./km² - 1050 inh./km²)	163	28
○ Small urban area (150 inh./km² - 600 inh./km²)	344	58
○ Rural area (<150 inh./km²)	12	2
○ Missing values	3	0.5

Table 6 Analysis: post code

Table 7 visualize the distribution of level of education. From all the respondents the majority has a **university diploma** (41%), followed by an **upper secondary diploma** (32%) and a **higher non-university certificate** (25%). Only a minimum has a lower secondary education (1%) or a primary education (0.5%) (Table 7).

Highest diploma or certificate	Absolute (N = 592)	Relative (%)
○ None	0	0
○ Primary education	3	0.5
○ Lower secondary education	7	1
○ Upper secondary education	190	32
○ Higher non-university education	146	25
○ University education	242	41
○ Other	4	1

Table 7 Analysis: diploma

Respondents could answer if they had one or more disabilities. Approximately 96% marked that they have **no restrictions**, 2% has a **physical disability**, 2% has a **visual disability** and 1% has an **auditory disability**. No combinations of disabilities were noticed (Table 8).

Disability	Absolute (N = 592)	Relative (%)
○ No restriction	566	96
○ Visual	9	2
○ Auditory	5	1
○ Physical	10	2
○ Missing value	2	0.3

Table 8 Analysis: disability

7.2. Description of travel experiences

There is an equal distribution of the respondents concerning travel frequency. Approximately 18% travels **4 days a week or more with the bus**, 18% uses the bus **1 to 3 days in the week**, 17% takes the bus **6 to 11 days in a year** and 17% travels with the bus **1 to 3 days in a year**. Less represented is the amount of respondents that uses the bus **1 to 3 days in the month** (13%) and **less than one day in a year** (5%). 11% **never takes the bus** and are the car captives (Figure 23).

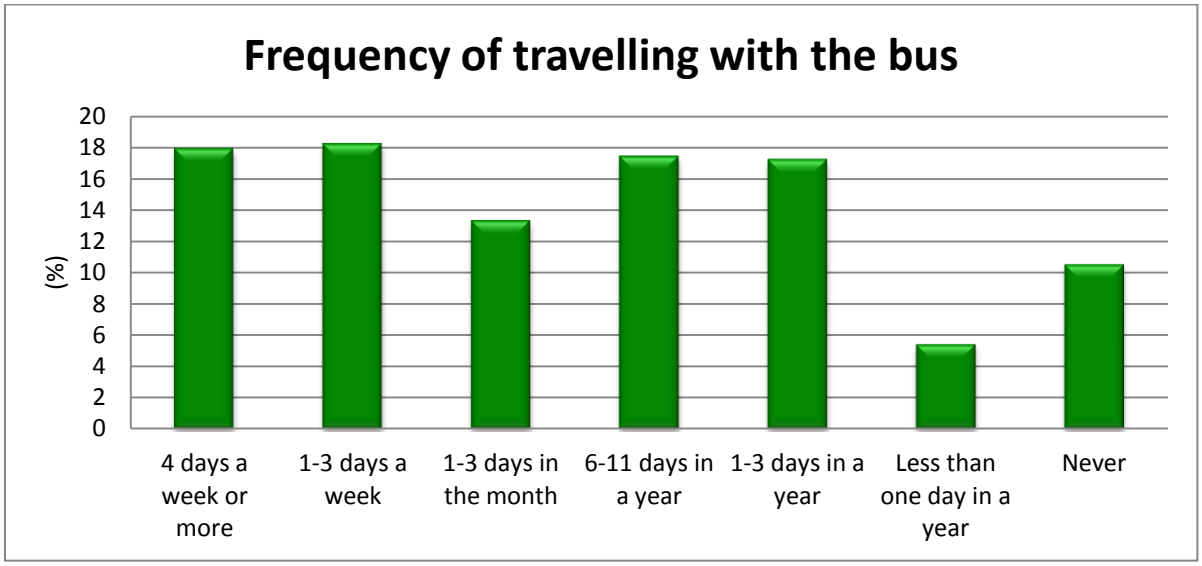

Figure 23 Analysis: travel frequency (n=592)

Travelers on regional buses is the considerable part of the respondents has an average travel time of **16 to 25 minutes** (27%) and the amount of respondents that uses the bus for **26 to 35 minutes** (14%). About 41% of the respondents is using this bus for regional transport. Urban buses are use by travelers with an average travel time of **5 to 15 minutes** (24%). Only 1% rides in the bus **less than 5 minutes**. Long distance buses have an average travel time of **more than 35 minutes** (22%) (Figure 24).

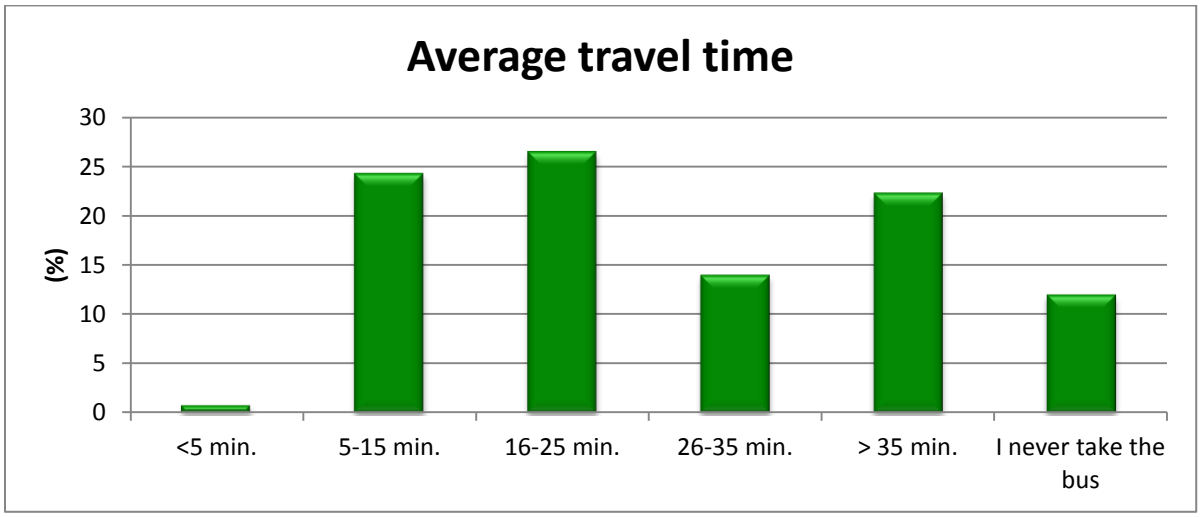

Figure 24 Analysis: travel time (n=592)

The respondents (n=61) that are never taking the bus did not get to see the following questions. The amount of respondents for the next analysis was reduced to n=531.

Respondents could select more than one activity that they like to do on the bus. Most of the people are **looking around** (80%). This high amount is comparable with the research done in New Zealand. Here 77% was facing forward or looking outside the window [35]. Other activities are **observing people** (64%), **sending message** with their mobile phone (64%) or **listing to the radio or to music** (43%). 31% of the respondents **gets bored** in the bus. Less popular activities are working (3%) or using a laptop (4%). Activities that were not listed but were mentioned spontaneously are **checking e-mails, facebook or the news** on a smart phone or a tablet and **talking with the driver** (Figure 25).

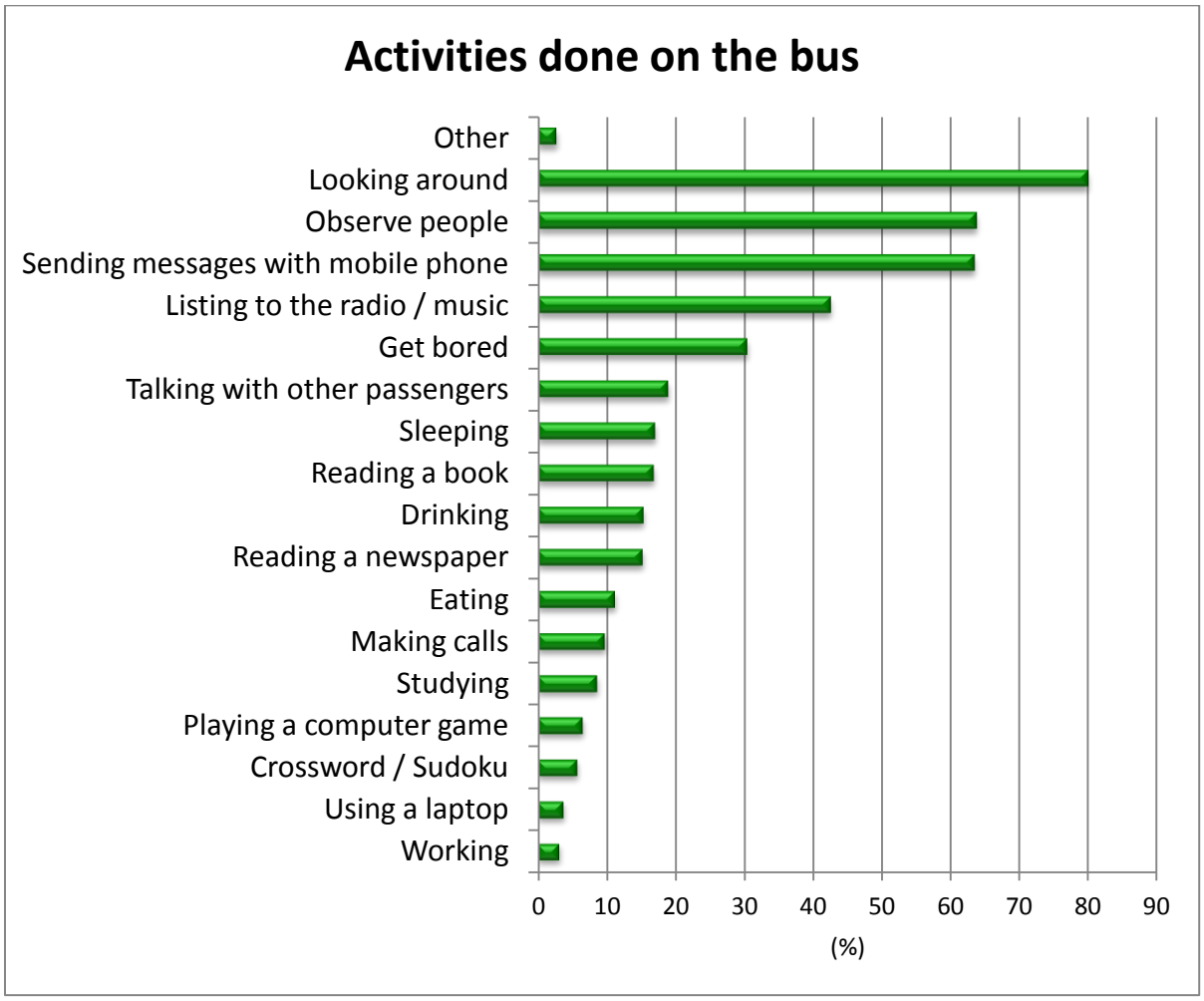

Figure 25 Analysis: activities (n=531)

In the questionnaire, respondents could select which improvements they would implement in the bus. The improvement regarding **overcrowding in the bus** (54%) is mentioned several times followed by improvements regarding the **up-to-date information and communication** (52%). Travel information can be aural or visual and includes information about connections, delays, route of the bus, stops, end destinations, traffic problems and weather information. Furthermore bus users would like to change the **disruptive behaviour of the other passengers** (39%), the **travel comfort** (36%) and the design and availability of the **seats** (31%). Facilities that were not often selected are lighting (5%) and workspace (8%) (Figure 26). Although according to one hypothesis we might expect that the accessibility (no reservations, wide doors, automatic ramps, boarding platform and bus stop at the same height, kneeling function...) would play an important part, only 14% would like to improve this characteristic. Other suggestions to improve the bus usage concern

- Availability of Wi-Fi on the bus;
- Better connections with other travel modes and less transfers;
- Contact point with the driver for travel information;
- Energy efficient and sustainable buses (replacing old buses);
- Higher frequency;
- Higher reliability of the travel time and punctuality;
- Possibility to get out the bus at all times e.g. when an accident happens;
- Temperature and air regulation;
- Universal and digital payment for all public transport modes.

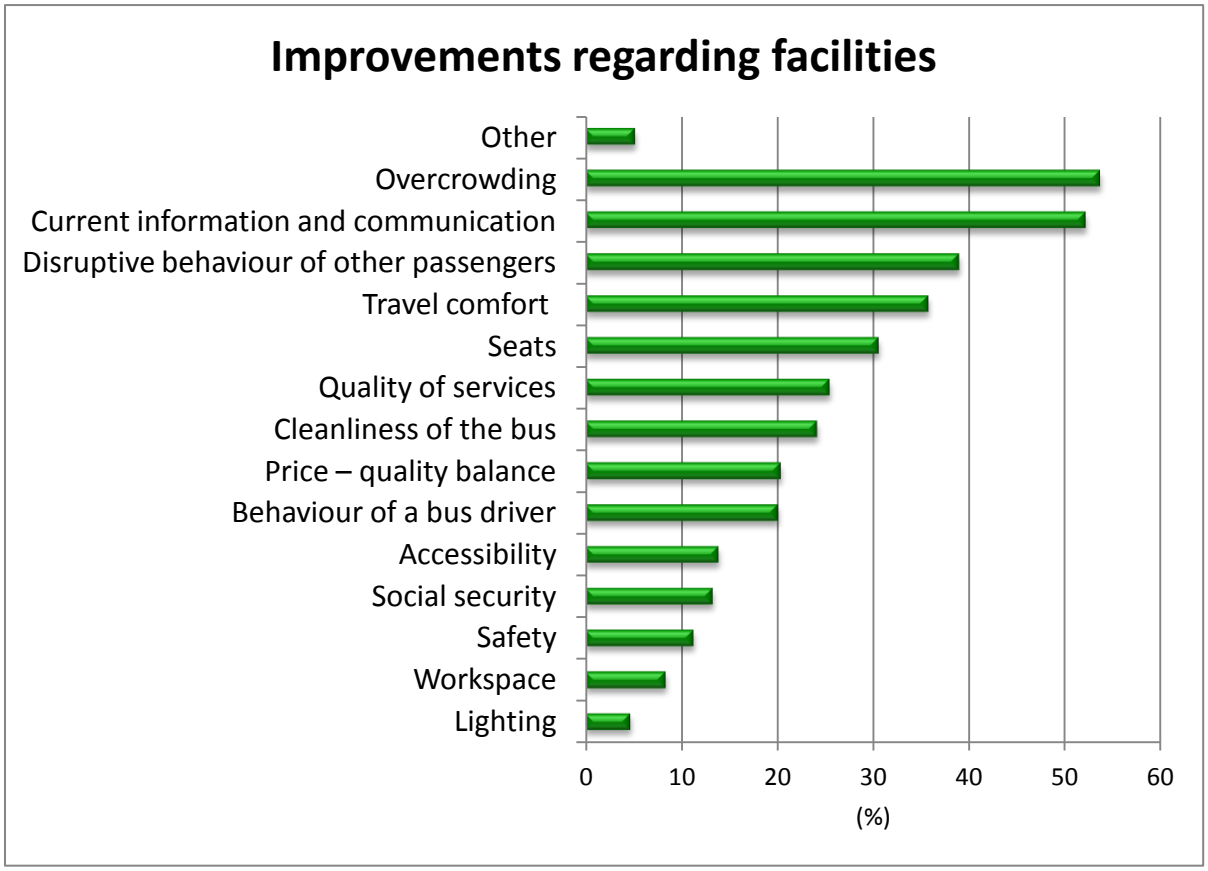

Figure 26 Analysis: improvements (n=531)

Thirteen bus characteristics were presented. Respondents had to indicate to what extent they associated the bus with following bus characteristics. Hereby a score of 1 signified a limited extent where 5 indicated a strongly extent. The graph shows the mean and the standard deviation. The bus characteristics **'sexy'** is selected as the least extent to the bus with a mean of 1.31 and a standard deviation of 0.64. Followed are '**status**' with a mean of 1.67, '**challenge**' with a mean of 1.95 and '**pleasure**' with a mean of 1.96. Characteristics that were strongly related to the bus are '**environmental awareness**' with a mean of 3.56 and '**protection and security**' with a mean of 3.05 (Figure 27).

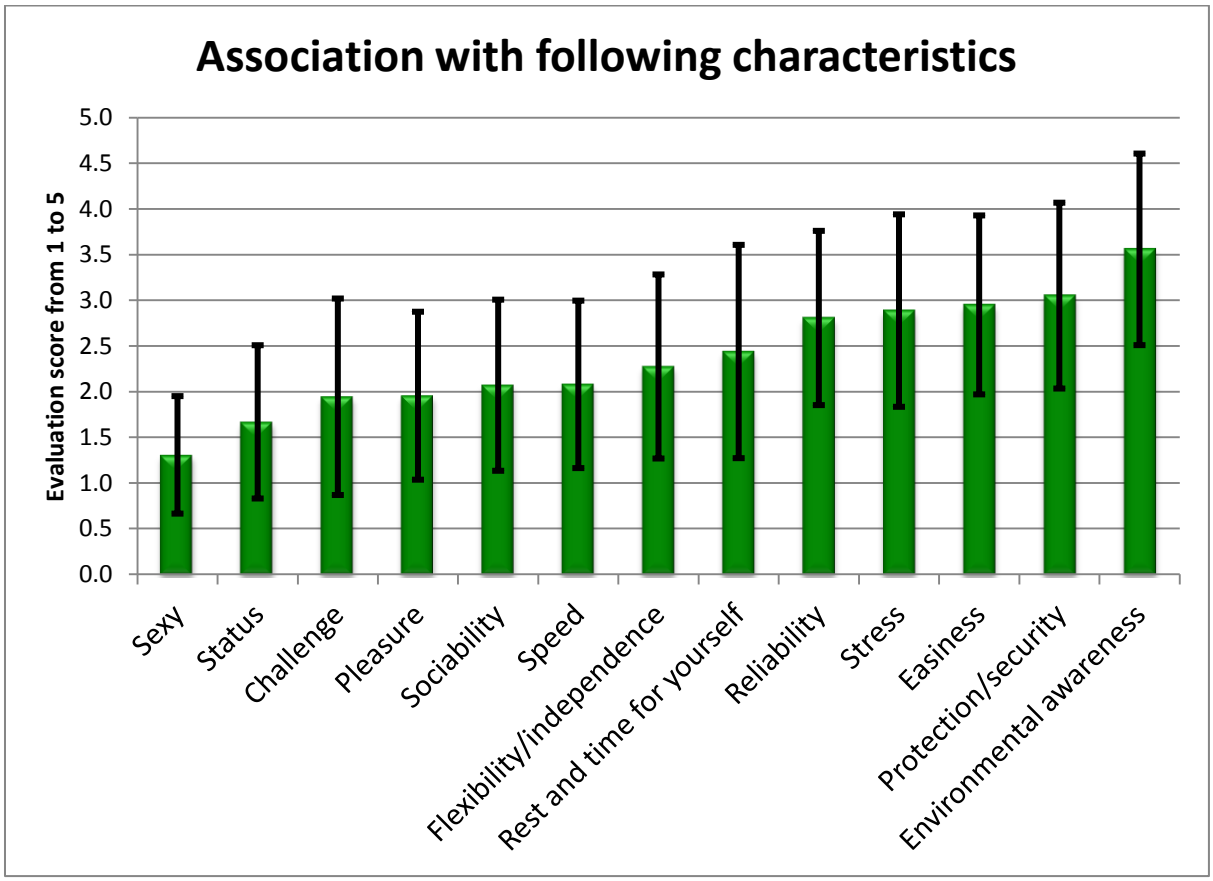

Figure 27 Analysis: associated characteristics (n=531)

The amount of respondents that never use the bus were sent to the question: why do you never use the bus? The number of completed answers is n=62. The most important reason is the **limited freedom of movement** (24%). Also the **poor connections** (18%), **the distance from home to the destination** (15%) and **the pleasure of driving a car** (13%) were reasons to never take the bus. 13% of the non-users indicated that they are using the bike or they are retired and don't have the need to travel. The other reasons (unreliable, uncontrollable, unsafe, uncertainty of a seat, disruptive behaviour of other passengers and expensive) were not ticked through the non-bus users (Figure 28).

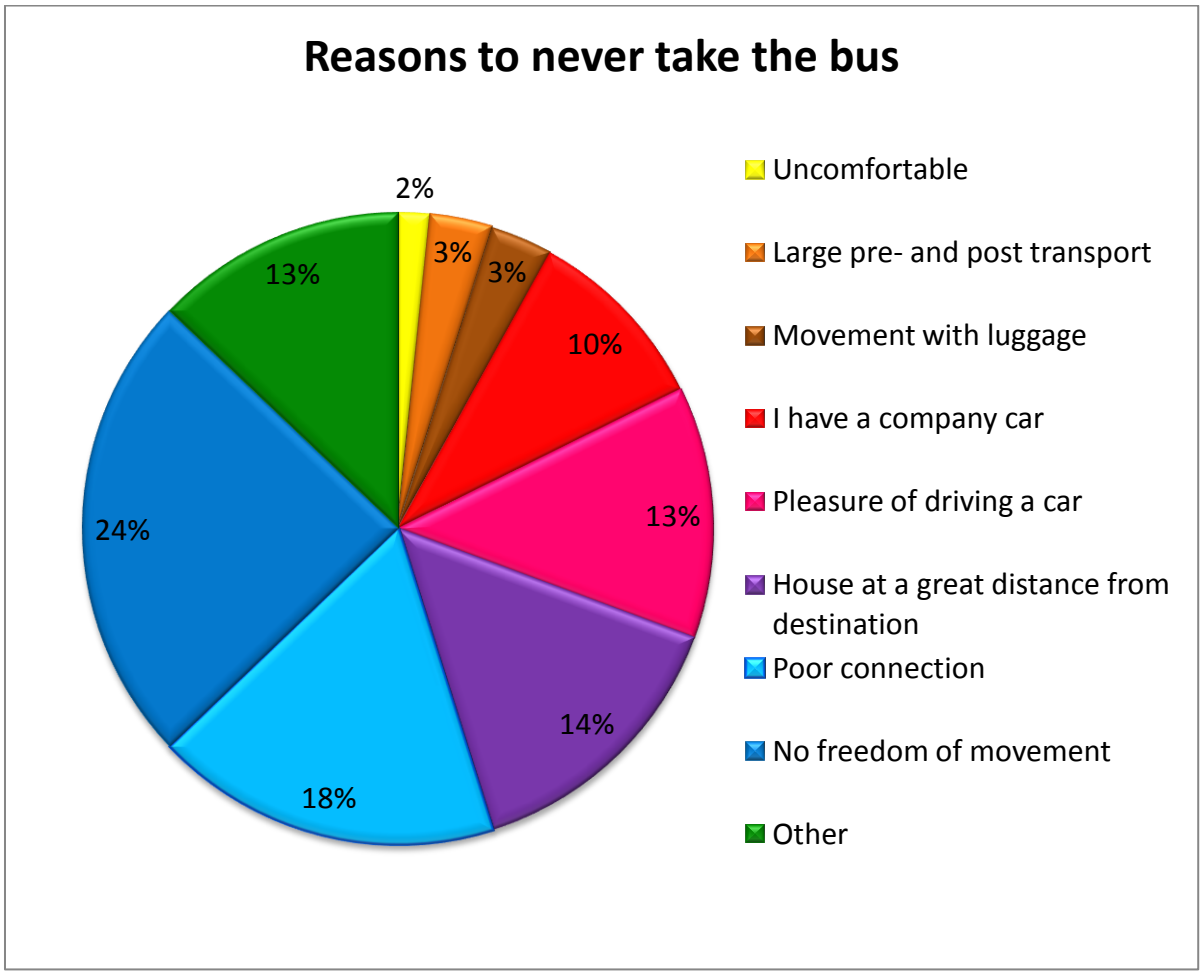

Figure 28 Analysis: reason to never take the bus (n=62)

Detailed information about the descriptive statistics is available in Annex 10 - Values of the analyses.

7.3. Model analysis

Before starting with the analysis of the choice sets, the data from the choice tasks were translated and redesigned. This data are the input for the program NLogit 5. Two models are estimated by the program; one MNL model with six different construct variables and one MNL model with thirty different attribute variables [55]. The estimations are based on 7104 observations.

7.3.1. Construct model

The construct model is a model with six constructs. The construct model on the left hand side is labelled with the variable 'choice': this is the dependent variable y and can be '0' (= not chosen) or '1' (=chosen). The right hand side or the independent variables x involves the scores of the six constructs. To start the analysis, the value of each alternative has to be encoded. Every construct gets a value of '-1', '0' or '1'. Six iterations were done to calculate the most optimal values. The model has a log likelihood of -1963.51 and a constant only log likelihood of -2403.99. The overall fit of the model R^2 is calculated to 0.18, which is below 0.20 indicating a weak model. A weak model means that the model is still better than no model at all. The parameters of the model ensure that a better distribution is achieved then a proportional distribution (Table 9).

Model fit and goodness-of-fit measures	Value of constructs
Log likelihood	-1962.5141
Constants only log likelihood	-2402.9868
R^2	0.1833

Table 9 Model 1 constructs model - goodness-of-fit measures

All the constructs are significant and have a positive ß coefficient, meaning that there is a positive impact force on the bus choice. A positive coefficient of a construct will raise the possibility that a bus type provided with this construct will rather be chosen than a bus type without the construct. The construct with the highest influence is the construct 'the bus as a comfortable seating place' (ß=0.78), followed by the construct 'the bus as accessible vehicle' (ß=0.23). The construct with the lowest impact is the construct 'the bus as eating and drinking place' (ß=0.11). The constructs 'the bus as working office (0.1689)', 'the bus as sensitive attractive vehicle (0.1560)' and 'the bus as entertainment place (0.1151)' all have similar values (Table 10).

		Variables	Coefficient ß	Prob. [Z|>z]	Sign.
Construct	1	The bus as accessible vehicle	0.2348	0.0000	***
	2	The bus as sensitive attractive vehicle	0.1560	0.0011	***
	3	The bus comfortable seating place	0.7754	0.0000	***
	4	The bus as eating and drinking place	0.1097	0.0004	***
	5	The bus as working office	0.1689	0.0000	***
	6	The bus as entertainment place	0.1151	0.0007	***

Table 10 Model 1 constructs model - parameters (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

The presented values are in line with the hypotheses: **seating comfort** is mentioned as one of the highest constructs which indicates that passengers care about comfortable seating facilities including the amount of seat available, seat position, seat comfort and seat options. Also with a big influence is the construct **accessibility and information provision**. These two values were highlighted also in previous research as critical factors in the decision to choose between a bus ride and a car journey. The constructs 'the bus as working office', 'the bus as entertainment place' and 'the bus as sensitive attractive vehicle' are new proposals for city and regional buses. Although some characteristics are visible in long distance buses, the respondent has to visualize these facilities inside a short distance bus. The low value of the construct 'the bus as eating and drinking place' may be due to the policy that today no food or drinks are allowed on the public bus in Flanders.

7.3.2. Attributes model

The attribute model includes the dependent variable y 'choice' on the left hand side which can be 0 or 1. On the right hand side the independent variable x offers thirty attributes. Each attribute has two levels. The attributes model was iterated seven times to find the as accuracy as possible values. The log likelihood has a value of -1935.19 and the constants only log function a value of -2402.97. The proportion of variables, the R^2 index was calculated as 0.19, which means that the 19% of the choice behaviour is explained by the independent variables. Although the value of 0.19 is better than R^2 of the constructs model, the value stays below 0.20 what indicates a weak model but still better than a null model (Table 11).

Model fit and goodness-of-fit measures	Values of attributes
Log likelihood function	-1935.1930
Constants only log function	-2402.9868
R^2	0.1947

Table 11 Model 2 attributes - goodness-of-fit measures

Four attributes are not significant indicating that they do not influence the respondents' choice for a specific bus type: 'the window visibility', 'seats on the side', 'a bathroom' and 'an audio system'. The attribute with the highest value is the attribute 'coat rack' (ß=-2.35), followed by the attributes 'television (ß=1.95)', 'trashcan (ß=1.59)', 'steward (ß=1.31)', 'luggage rack (ß=-1.25)' and 'cleanliness (ß=1.03)'. The attributes with the lowest impact are 'seat composition (ß=-0.11)', 'catering options (ß=-0.15)', 'announcement (ß=0.15)', 'light (ß=-0.16)' and 'open bus (ß=-0.18)'.

These levels are encoded with level 1 equal to -1 and level 2 equal to 1. In this way it is possible to notice the influence of each level. For example a standing place of **2 passengers/m²** has a positive influence in relation with a standing place of 4 passengers/m². This is consistent with the hypothesis and the ideas of the bus builders and drivers. The hypothesis for this attribute is the positive influence of one facility so respondents will choose for a specific bus type.

Other attributes that meet with the hypothesis are the preference for

- **a backrest** instead of a vertical seat;
- **a visual announcement** instead of an audio announcement;
- **atmospheric lighting** instead of accent lighting such as reading lamps;
- **a large window** instead of a roof of glass;
- **more standing places** instead of more seating places;
- **an individual seat** instead of a bench;
- **a folding backrest of 180°** instead of a folding foot and elbow rest;
- **a spacious seat** instead of a standard seat;
- **an individual trashcan** instead of one big trashcan;
- **the availability of a drink and eat machine** instead of no dispenser;
- **a mobile cleaning service during breaks** instead of a cleaning service during the journey;
- **an individual folding table** instead of a fixed table;
- **a luggage rack in front or at the back of the bus** instead of a luggage rack above your seat;
- **a cup holder on the side** instead of a cup holder in the table;
- **a television and games through an individual display in a headrest** instead of streaming options for your own electronic;

From the facilities below was thought that they influenced the bus choice more negatively than positive. Attributes that are not in line with the hypothesis:

- **the announcement of available facilities and connectivity options** instead of the announcement of arrival times, delays and waiting times;
- **a bicycle rack inside the bus** instead of in front of at the back of the bus;
- **a general heating and air conditioning** instead of seat heating and individual air condition;
- **a coat rack in front or at the back of the bus** instead of a coat hook near your seat;
- **paid unlimited Wi-Fi** instead of free limited Wi-Fi;
- **a television with movies and series** instead of the news, language course...;
- **a free library** instead of a free daily newspaper;
- **a steward on the bus only with special events** instead of a steward that is always present on the bus.

The parameters of two attributes, the attribute '**air**' and the attribute '**socket**' could not be estimated and were not included in the model. These can be explained by an imbalance between the selected choice tasks and offered choice tasks. Some attributes are correlated with each other and therefore influencing the process. These correlations may be caused by an erratic distribution in completed choice tasks. Although these two attributes do not have any value, the other attributes still give a correct picture of the weighted choices.

Accessible vehicle	Level	ß	Prob.	Sign.
Access	Standing space: 2 passengers/m² Standing space: 4 passengers/m²	0.2520 -0.2520	.0493	**
Standees	Backrest Vertical seat (saddle chair)	0.2146 -0.2146	.0067	***
Announcement	Audio: speakers, microphone Visual: display, countdown	-0.1450 0.1450	.0082	***
Announcement of	Arrival times, delays, waiting time Available facilities, connectivity options	-0.3643 0.3643	.0000	***
Bicycle rack	In front or at the back of the bus Inside the bus	-0.2853 0.2853	.0000	***

Table 12 Model 2 Construct the bus as accessible vehicle (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

Sensitive attractive vehicle	Level	ß	Prob.	Sign.
Light	Atmospheric lighting Accent lighting: footstep, reading lamp	0.1608 -0.1608	.0377	**
Temperature	General heating and air conditioning Seat heating and air conditioning	0.3094 -0.3094	.0000	***
Visibility windows	Window cleaner Sunlight protection	-0.0495 0.0495	.3338	NS
Open bus	Large window Roof of glass	0.1749 -0.1749	.0096	***
Air	Hinged windows on the side Hinged window on the roof	/		

Table 13 Model 2 Construct the bus as sensitive attractive vehicle (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

Comfort seating place	Level	ß	Prob.	Sign.
Seat amount	More seating places More standing places	-0.5184 0.5184	.0000	***
Seat on the side	Looking inside the bus Looking outside the window	-0.0547 0.0547	.4808	NS
Seat composition	Individual seat Bench	0.1104 -0.1104	.0405	**
Seat options	Folding elbow/foot rest Folding backrest 180°	-0.5938 0.5938	.0000	***
Seat comfort	Standard seat Spacious seat	-0.5343 0.5343	.0000	***

Table 14 Model 2 Construct the bus as comfortable seating place (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

Eating and drinking place	Level	ß	Prob.	Sign.
Trashcan	One big trashcan Individual trashcan per seat	-1.5862 1.5862	.0000	***
Cup	Cup holder inside the table Cup holder on the side	0.9918 -0.9918	.0000	***
Catering option	Drink/eat machine available Drink/eat machine not available	0.1445 -0.1445	.0437	**
Bathroom	Toilet Sink	-0.1303 0.1303	.1744	NS
Cleanliness	Mobile cleaning service during journey Mobile cleaning service during breaks	-1.0255 1.0255	.0000	***

Table 15 Model 2 Construct the bus as eating and drinking place (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

Working office	Level	ß	Prob.	Sign.
Table	Fixed table Folding individual table	-0.5795 0.5795	.0000	***
Coat rack	In front or at the back of the bus Coat hook near your seat	2.3454 -2.3454	.0000	***
Luggage rack	In front or at the back of the bus Above the seats	1.2197 -1.2197	.0000	***
Wi-Fi	Free limited Wi-Fi Paid unlimited Wi-Fi	-0.7853 0.7853	.0000	***
Socket	Free limited energy use Paid unlimited energy use	/		

Table 16 Model 2 Construct the bus as working office (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

Entertainment place	Level	ß	Prob.	Sign.
Television	News, advertisement, language course... Movies, series...	-1.9493 1.9493	.0000	***
Television, games	Individual display in headrest Streaming options for own electronic	0.7126 -0.7126	.0000	***
Audio system	General background music Individual system with music, radio...	0.0347 -0.0347	0.5834	NS
Reading material	Daily free newspaper Free library	-0.5120 0.5120	0.0009	***
Steward	Always on the bus On the bus during special events	-1.3112 1.3112	0.0000	***

Table 17 Model 2 Construct the bus as entertainment place (Note: *, **, * ==> Significance at 1%, 5%, 10% level)**

First, was attempted to integrate both models but because the estimations of the parameters did not go as planned, this model has not yet been elaborated. Further research on this model is however desirable.

7.3.3. Willingness to pay

At the end of each choice task the respondents were asked if they would pay more for the chosen bus type. Approximately 36% of the respondents answered that they would still pay 1 euro for the bus ride with the offered bus facilities, 21% would pay 1.25 euro and 23% is willing to pay 1.50 euro. This indicates that 80% of the respondents are willing to pay 1 euro to 1.50 euro for the suggested bus type. A small 20% would pay 1.75 euro or more (Figure 29).

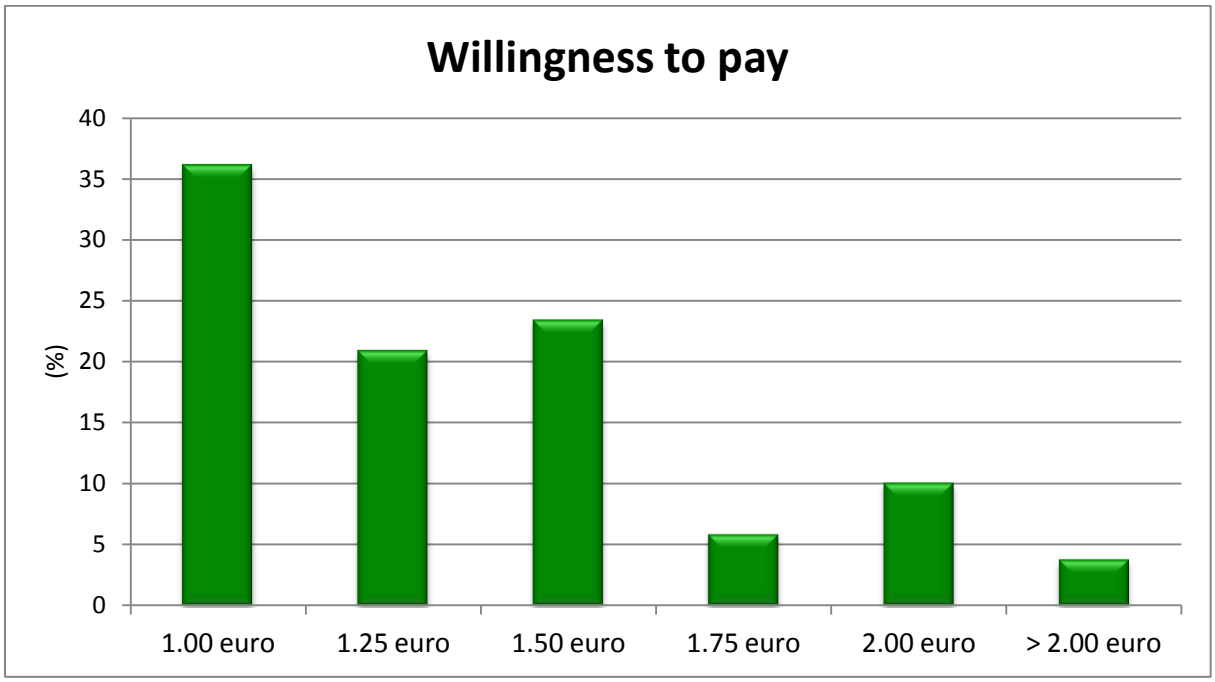

Figure 29 Analysis: willingness to pay (n=592)

7.4. New bus ideas

At the end of the questionnaire the respondents were asked again which facilities they would prefer inside the bus. After the indicated facilities, respondents can have other thoughts and ideas for new facilities. Approximately 167 respondents (or 28%) formulated an answer on this question. The answers that were already mentioned in the questionnaire were eliminated from the table below and only **new suggestions regarding interior facilities** are grouped together and presented in Table 18.

Suggested in the question is the use of a safety belt; this explains the high amount of respondents that answered the usage of a **safety belt** (34%). Followed are suggestions for **fresh air** (11%) and **enough seats and standing capacity** (11%). Also mentioned are an ergonomic backrest, armrest, footrest and headrest (8%), enough legroom (6%) and more handles and holdings (4%).

New ideas	Absolute (N =143)	Relative (%)
Individual headsets	1	0.7
More push buttons	1	0.7
Place to take your dog on the bus	1	0.7
Possibility to smoke on the bus	1	0.7
Provision of an airbag for passengers	1	0.7
Reclining seats	1	0.7
Safety standees	1	0.7
Social discipline of the passengers to slide to the back	1	0.7
Better image of the bus	1	0.7
Comprehensive smart phone application and website	2	1.4
Luggage room under the seats	2	1.4
Seats in the direction of driving	2	1.4
Possibility to take big luggage on the bus	3	2.1
Reducing engine noise	3	2.1
Soft seating cushion	3	2.1
Remedy to motion sickness	4	2.8
Place and safety for buggies	5	3.5
Social safety	5	3.5
More handles	6	4.2
Enough legroom	9	6.3
Ergonomic backrest, armrest, footrest and headrest	11	7.7
Enough seat and standing capacity	15	10.5
Fresh air (e.g. opening of the side windows, ventilation)	15	10.5
Safety belt	49	34.3

Table 18 New suggestions

Some of these suggestions were also listed in the pre-questionnaire but removed because of the limited amount of variables that can be included in the questionnaire.

Chapter 8 - Discussion

8.1. Validation of the results

The research 'Stadsbus van de Toekomst' carried out in 2003 indicated the quality aspects and improvements of the Flemish buses. The results were presented on 'Busworld', the bus exhibition in Kortrijk, Belgium in 2003. The main difference between the research 'Stadsbus van de Toekomst' and this research is **the way of investigation**. Although both surveys are related to the bus usage of the respondents and include several variables, the quality aspects are questioned using another research method. In the research of 'Stadbus van de Toekomst' the respondent had to judge the importance of existing quality aspects and the desirability of new facilities. Each characteristic is evaluated separately and not in function of other service qualities. In this research there is a trade-off between two bus types. The respondent is forced to choose which bus type he would use in a certain situation. 'Stadsbus van de Toekomst' concluded that bus users did not expect futuristic and luxury orientated facilities but preferred useful and feasible improvements. The main output was the importance of the **readability of the destination** on the outside of the bus and a **visual and aural information system** inside the bus. Once on the bus, the respondent is expecting a comfortable journey meaning: **clean and pleasant**. The air quality was indicated as an important quality aspect. Compared with the output of this research 'making the bus look sexy?' can be noticed that the announcement system is not that important as other facilities. The cleanliness on the other hand is also crucial. Fresh air gives an insignificant value but the temperature regulation can be noticed as a value with a certain weight. Both reports are in line with each other.

In the research all coefficients were significant, except from four attribute variables. This shows a good **theoretical validity** [49]. All the construct variables and fifteen of the significant attribute variables had an expected sign. Eight significant attribute variables had a different sign than estimated first.

8.2. Validation of the research

First of all, there is not much existing knowledge on the topic of the interior and quality of a bus. Nor has a lot of (scientific) research been done. More investigations are available about the design of trains and trams. It is a good start for the set-up of the research and a first step for further investigations. But it also signifies that this kind of research is still in its infancy: meaning the argumentation and methods used are seen as an **experimental research**. Through the usage of the **HII method** several difficulties occurred in the design of the questionnaire and the elaboration of the analysis.

- An important question concerns whether each attribute is categorized in the right decision construct. Each of the attributes should have a significant relationship with the decision construct [60].
- The drawback of the use of a SP survey is the effect that the data only describes what an individual claims he/she would do in a given scenario. This does not always correspond to the actual or revealed behaviour and is associated with socially-desirable answers [10].

8.3. Difficulties

During the research some difficulties were encountered. A first remark is **the overload of characteristics and the limited amount of time and research possibilities**. Because of the size of the research not all the characteristics can be taken into account. Boundaries are set and are necessary enable a proper investigation. The selection of the characteristics is based on the literature study and the interviews.

One limitation of the questionnaire might be the **description of new and unknown technologies** that the respondent has never used of seen before. This can cause misunderstandings and misjudgements about systems e.g. the term “standing seat” may cover many ideas [61]. It could be more useful if a picture was added to the questionnaire but this increases the total length and completion time of the survey (Figure 30).

Figure 30 Ryanair’s vertical seat [61]

De Lijn, the Flemish bus operator, introduced different legal provisions based on **legislation** of the Flemish parliament and the European parliament and council. The minimum and maximum regulations are in this report not seen as standards but as a starting point of what is possible. Based on these assumptions and limitations the questionnaire was set up. E.g. the royal Decree of 1976 by Chabert allows no promotion on windows, it is forbidden to eat or drink on the bus, etc. [62] [63]. These legal provisions are influencing the possibilities of bus builders and operators.

Chapter 9 - Conclusion

'What makes the bus sexy enough for people to fall in love with a seat in a public bus instead of using their car?'

Formulating this conclusion starts with the fact that **the standard (public transport) bus is not associated with a 'sexy' vehicle**. Respondents indicated that they do not associate the bus with 'sexy', not even with 'status'. With 'sexy' it is assumed that a more luxury oriented bus interior will get more people on the bus. Usually a standard bus is built with cheap and robust products and regulatory requirements because of financial considerations between bus operators and bus builders. But to compete with the private and comfortable car, another type of bus might be necessary. Some travelers still prefer the car only because driving a car is a more pleasant experience. The service quality perception of a bus has to rise.

After the research results, the following sub questions can be answered. This sub questions give an overview of the travelers' preferences regarding the interior of public buses.

How can we solve the negative characteristics of a bus journey with interior facilities?

The main negative characteristic inside the bus is **overcrowding**. Solving this problem indicates the provision of enough seating and standing capacity e.g. enlarging the standing place. Another downside is the leak of **current information and communication**. Improving the information provision may be done by more and reliable visual and aural announcement systems. These announcements should involve arrival times, delays, waiting times, available facilities and connectivity options. Other bus disadvantages are the disruptive behaviour of the other passengers and the minimum travel comfort. Both characteristics can be associated with the demand for more privacy and comfort.

Which new implementations of a bus concept are found to be good?

Regarding the facilities that are available in the current standard buses, some optimization can be implemented. Facilities with a strong influence on the attractiveness of buses are **a coat rack** in front or at the back of the bus, **a television** with movies or series, an **individual trashcan**, **a steward** on the bus during special events, **a luggage rack** in front or at the back of the bus and **a mobile cleaning service during breaks**. Other implementations such as a cup holder inside the table, paid unlimited Wi-Fi and an individual display in the headrest of the seat are also found to be good implementations.

Which new ideas can be created and introduced to the public transport?

The scenario **'the bus as comfortable seating place'** gained the preference of the respondents. Facilities as an individual seat, a folding backrest and a spacious seat will raise the travel comfort and can be implemented in the bus without any big changes. Also a higher **accessibility and information provision** may indicate a higher usage. Passengers prefer enough standing space to avoid the feeling to be 'canned sardines' and are asking for more and current visual information. **'The bus as working office'** is a new idea and an upcoming trend: individual folding tables and paid unlimited Wi-Fi are two facilities that may lower the 'lost time' and increase the value of a bus ride. Asking the passengers activities in the bus showed that almost 80% is looking around during their bus journey, meaning that enough light and large windows are an advantage.

How much is a traveler willing to pay for new facilities?

Today a bus ticket has a value of 1 euro. Approximately 36% is still willing to pay 1 euro for a bus ride, 21% of the bus users are willing to pay 1.25 euro and 23% would even pay 1.50 euro. The other 20% of the respondents is willing to pay more than 1.75 euro.

Can new facilities/design inside the bus make a difference in the usage?

Interviews with several bus builders showed that bus builders can make everything possible. The ball lies in the passengers and the bus operator's court, referred that one of them has to take action and create a mental shift. Bus operators believe that as long as there is no big demand for better and more futuristic improvements inside the bus, they would not invest or do not have to invest in expensive buses or in 'luxury-oriented' research. Therefore, this type of research is a new way to investigate why a traveler would change his/her travel behaviour. By asking the respondents explicitly to the luxury and comfort facilities inside a bus another bus type may come out, a step further than the superficial negative critics on public transport as reliability.

Bus operators do not have the stimulus yet to make more comfortable buses. In the future, the requirements of the passengers will be higher, the need to put travelers on the bus to reduce traffic will be necessary and the amount of travelling people will rise. The travelers' preferences indicated that more comfort in the bus should be necessary to compete with the car. Although small interior changes are required, for now, today's bus operators should **bring the sexy aspect to the outside of the bus**: referred to the reliability, punctuality, frequency, poor connections, limited freedom of movement; reasons why passengers do not take the bus in the first place.

Chapter 10 - Recommendations

Many opportunities exist for further research. The analyses done in this research are a small part of the calculations that can be carried out with the created database. But for now it is important that bus builders and bus operators can use the gained information to improve their bus services and facilities.

10.1. Bus operators and bus builders recommendations

Based on the current research, some recommendations for bus operators and bus builders can be listed.

- From the total amount of respondents 24% bus users has an average travel time on the bus of 5 to 15 minutes, 27% has an average travel time of 16 to 25 minutes and 14% rides on the bus for 26 to 35 minutes. This indicates that almost **65% of the bus users do not have a travel time more than 35 minutes** and only uses the bus for short distance. A small 22% uses the bus more than 35 minutes. It can be useful to make a difference in the interior of buses for **urban transport** (a ride up to 15 minutes) **and regional transport** (a ride from 16 to 35 minutes). Both types of buses need another interior and design to complete the wishes of their travelers. The provided facilities and asked price should be adapted to this specific travel time.

- The questionnaire illustrated that most passengers are **looking around (80%) or observing other passengers (64%)**. An equal percentage of 64% is using his/her mobile phone while travelling on the bus. Although only 31% indicates that he/she gets bored, useful time activities are not often selected. For example only 17% is reading a book, 15% is reading a newspaper and 9% is studying. Even less than 4% is using a laptop or is working. The reason why people do not spend their travel time more useful might be caused by multiple reasons: restricted travel time, limited space, motion sickness, no Wi-Fi availability... These reasons were not asked in the questionnaire but could have been helpful for further analyses.

- About 54% of the respondents complained about **overcrowding buses**, together with a 52% that would like improvements regarding **current information and communication**. These are both characteristics of the bus which bus operators and bus builders should improve and can be done by some small changes, e.g. more audio announcement in the bus.

- Followed characteristics were not associated with the bus, meaning that their values are below the average. Characteristics as **sexy, status, challenge, pleasure, sociability, speed, flexibility, independence and rest and time for yourself** are seen by the bus users as limited involved with the bus. Some characteristics should be related stronger to the bus image to make a mental shift and increase the bus usage.

- Slowly introducing the mentioned facilities will raise the frequency of potential bus users and ensures the preservation of the current bus users. Preferred facilities are
    - more standing places and a backrest for standees;
    - visual announcements of available facilities and connectivity options;
    - atmospheric lighting and large windows;
    - an individual and spacious seats with folding backrests;
    - an individual trashcan, individual folding table and a cup holder on the side;
    - the availability of a drink and eat machine;
    - a mobile cleaning service during breaks;
    - a luggage rack and coat rack in front or at the back of the bus;
    - an individual display in the headrest of the seat in front;
    - a television with movies and series;
    - a bicycle rack inside the bus;
    - a general heating and air conditioning system;
    - paid unlimited Wi-Fi;
    - a free library;
    - a steward on the bus with special events.

The gained information is useful for bus operators and bus builders but the biggest questions is if the referred facilities are **practical and economical feasible**? Respondents indicated that they are only willing to pay a little more for these facilities: going from 0.25 to 0.50 euro. Bus builders and bus operators should find a way to implement these facilities in an efficient way. This question may be a follow on the current thesis.

10.2. Research recommendations

The use of the **HII method** lured several reactions from the respondents because of the **more complicated way of interrogation**. The most common reaction is the fact that the respondent is forced between two options and does not have the freedom to choose which attributes he/she really prefers. Especially older people mention that they did not completed the survey for this reason. Furthermore the formulation of the questions may not lead to misinterpretations. Although it is mentioned that all the facilities were available in urban and regional buses, there were still respondents that evaluated the questions for long distance buses. Further research applications with the HII method should have a clear and simple design. A positive aspect from the use of the HII method is the **large amount of variables** that can be investigated. Although, these amount of questioned variables should be limited to avoid a large completion time and users' boredom. For example, 63% of all the people that started the questionnaire also completed the survey. The other 37% has not fully completed the questions. One reason might be the size and the completion time of the questionnaire. A smaller questionnaire might increase the amount of respondents.

The imbalance between the selected choice tasks and offered choice tasks caused some problems with the formulation of the attribute model. The **correlation** of two variables in the attribute model resulted that those attributes were not included in the model and did not received any value. The correlations occurred because the HII method works with sub designs, while the use of an overall design this problem would have prevented. With an overall design is meant a design over the attributes and constructs. The models were reviewed several times and the variables were revised on an erratic distribution. No review indicated an error.

Richter and Keuchel recommend in their research 'Modelling mode choice in passengers transport with HII' that the use of a **nested logit (NL)** model allows a partial relaxation of the IIA assumption and a more appropriate model for this kind of researches. By the use of MNL models, **independence of irrelevant alternative (IIA)** may occur. An IIA stated that the ratio of the probabilities of two alternatives should not be affected by the presence or absence of a thirst alternative. The consistency of alternatives could occur, although in this report we have unlabeled alternatives [47].

10.3. Further research

With the database of this research, **more deeply analyses** can be done. Interactions can be investigated and other model types could be explored. The databank offers more information than presented in this study. For example the results of the choice sets can be linked to the travel frequency or average travel time of the respondents. The database is useful for further investigations.

Also **other constructs, attributes and levels** could be used in further analyses. The attributes used in this report were carefully decomposed and they are weighed up against each other. But the detailed list of all the attributes that are collected can trigger more meticulous and spacious investigations. In the future, the content of each facility may be substantiated with **an illustration** so the meaning will be clear and objective to all the respondents.

With the design and structure presented in the report also information of characteristics of **'at the bus stop'** and **'getting in and off the bus'** can be investigated on the same way the interior characteristics are examined.

To go deeper into the outcome alternative options, like a **'lab session'** could be explored. In this type of focus group discussion, a smaller research group can be asked to conduct some practical tasks. Similar topics of the questionnaire can be cited and it is important to know 'WHY' travelers choose a specific option. By undergoing a face-to-face interaction the attitude and position of the traveler on public transport can be observed and the knowledge and opinion of the (non-)users can be asked for. The researcher has to notice all the different actions that are done and the motivation of some actions. Conducting a lab session or co-creation workshop gives another impression of a real bus because of the 3D dimensions and the focus group discussion. People can give their own opinion, evaluate a given example or brainstorm over a new vision. Bringing people together and organise brainstorming sessions, anticipation and cooperation can all generate new ideas and innovative concepts [12]. The reason why the lab session has to be hold after the questionnaire is because the questionnaire is still too wide to focus on one or more specific parts of the bus journey that can change the quality of the bus experience survey. Until now it's not clear yet with appearance qualities can make a different in choosing for a bus journey instead of a car trip.

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Appendices

Annex 1 - Basic mobility

Targets basic mobility in Flanders				
	Weekdays (6-9h/16-18h)	**Weekdays (9-16h/18-21h)**	**Weekends (8-23h)**	**Max. distance to bus stop**
Metropolitan	5 trips/h	4 trips/h	3 trips/h	500m
Urban	4 trips/h	3 trips/h	2 trips/h	500m
Small urban	3 trips/h	2 trips/h	1 trips/h	650m
Rural	2 trips/h	1 trips/h	0.5 trips/h	750m

Table 19 Basic mobility in Flanders [13]

Annex 2 - Travel time

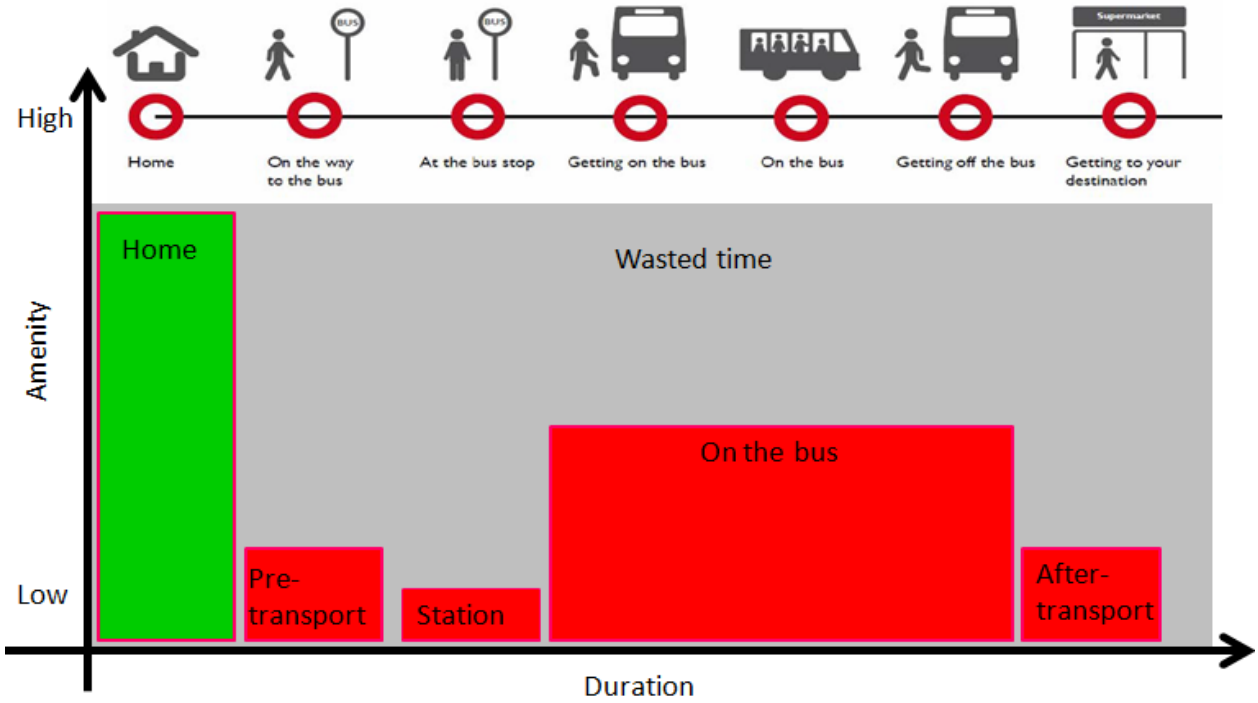

Figure 31 Value of time [23]

Annex 3 - Bus city systems

The **'Lion's City GL articulated bus'** is a project of the International Association of Public Transport (UITP) and MAN Truck & Bus introduced in Lion, France. This new bus needs to increase the flow of passengers at a high volume and improve the conveyance of the passengers. With these ideas in mind, they started to construct a new kind of bus [64].

- **A new door concept:** each door has a width of 1.25m and is fully glazed. The doors are optimized with an electrical drive that allows shorter closing and opening times and leads to faster entry and exit of the passengers. Also a retractable ramp and a kneeling function are still integrated. The construction of 5 instead of 4 doors will save time.
- **Flexible passenger compartment:** in the bus the passenger flow is in conflict with the high passenger flexibility and comfort. This bus will have a standing room of 118 passengers, because 7 folding seats are available. Passengers can only use the folding seats if the capacity of the bus is sufficient. An optical signal (controlled by the driver) on the seats shows whether the passengers can use the seat or not (Figure 32).

Figure 32 Optical signal on the seats [36]

- **Comprehensive safety features:** good colourful hold, light barriers in the inward swinging opening doors, eye-catching.

The **light rail system** in Rouen is a great success. The network consist of two light rail lines, 26 bus routes, 5 shared taxi circuits and 24 bus routes. In 1997 the city carried out a study to investigate the differences between the light rail system and the buses (on a scale of 1 to 20). The following data were observed (Table 20):

Satisfaction	Light rail	Bus
Overall satisfaction; with regard to comfort	15.4	12.8 to 14.6
• Smooth, pleasant ride	16.6	12.7 to 14.6
• Comfortable seat	14.7	12.4 to 14.7
Overall satisfaction; simple and practical travelling	17.4	14.9 to 15.8
• The service is fast and I can be sure of arriving on time	17.4	14.9 to 15.8
• Schedules are respected, I can rely on them	17.4	14.9 to 15.4
• No need to wait long before a vehicle arrives	16.5	13.4 to 15.2
Overall satisfaction with regard to servicing and cleanliness	17.2	13.6 to 15.2
Overall satisfaction with regard to information	16.2	14.3 to 15.5

Table 20 Satisfaction rate between the light rail and the bus, Rouen [65]

A new network in Rouen is in development under the name '**East-west transport in Rouen' (TEOR)** and is a bus rapid transit system operating in the city. The CIVIS bus features 100% accessibility courtesy of its integral **low floor, four doors on each side of the vehicle, a drive system using electric wheel motors that are fed electricity by a clean diesel engine, a futuristic design and an optical guidance system at stations** [65]. The vehicles have also a GPS on board which allows traffic signals to **give the buses priority at intersections**. The buses are giving a full accessibility to the passengers: there is detection system, RFID detection on the outside of the bus that controls the station and regulates the floor height and the gap flap opening process by the arrival to the station; **precision docking at bus stations** (Figure 33). The gap filler opens automatically during doors' opening time. It bumps the platform with reduced effort and fills the horizontal gap. This increases the safety feeling when embarking and alighting the bus [66] [34].

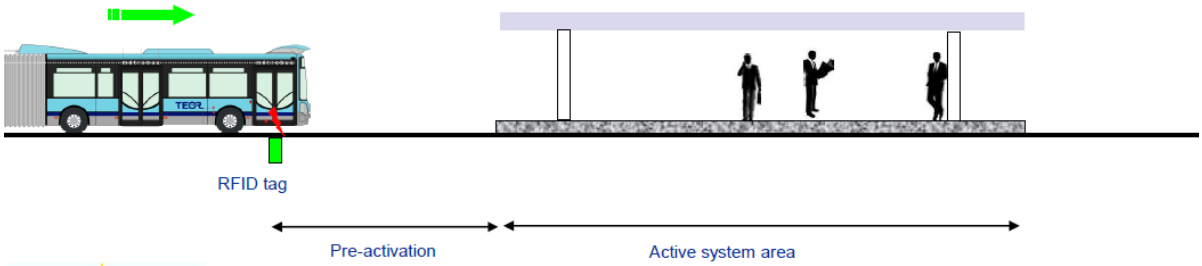

Figure 33 RFID Tag TEOR bus [34]

The **ExquiCity of Van Hool** is a Bus Rapid Transit vehicle. It combines the flexibility of a bus with the efficiency of a light rail (Figure 34). The ExquiCity is promoted as the elegance and efficiency in public transport itself: reliable, luxurious comfort, elegant design and a safe travel leading to a relaxing experience for the passenger. The focus was on the **design and ergonomic interior e.g. spacious entrances, low floor, wide corridors, modern lighting...** [67] [68].

Figure 34 Exqui City Van Hool [67] [68]

Enthoven associates, a design consultant, developed **'Le Passeur'** for the transport company Veolia. Le Passeur was created in 2011 and is now implemented as a shuttles service at the Mont-Sint-Michel in France. This type of bus was necessary to transport visitors from the parking lot to the touristic area. The bus is made with **aluminium and wood:** materials that reflect a respectful and sustainable design (Figure 35) [69].

Figure 35 Le Passeur Veolia [60]

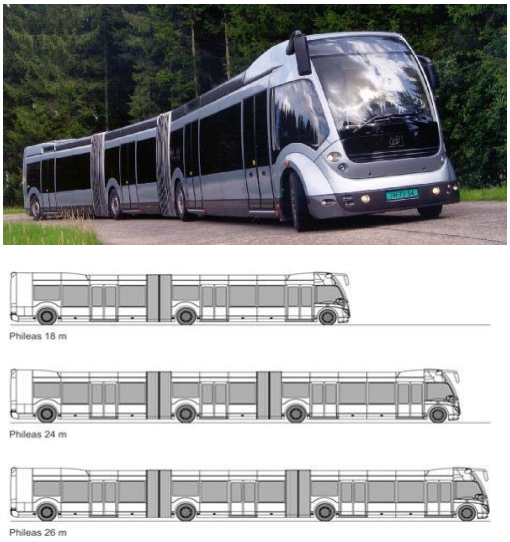

Figure 36 Phileas bus [67] [71]

The **Phileas bus** is a Bus Rapid Transit service that is available in the region of Eindhoven in the Netherlands and uses separated bus lanes. In the lanes magnet guidance is built in, allowing the buses to drive automatically, although there is always a driver present (**lane assistance technology**). The bus image and design makes it look like a tram but the infrastructure is cheaper, has less maintenance costs and rails in the ground are not needed. The Phileas offers the same quality as a tram system. The investment cost is 50% lower. The bus has **a completely flat floor**, **one open design through the whole bus and doors are positioned on both sides** which lowers the infrastructural implementation costs and makes it possible to change the front of the vehicle (Figure 36) [66] [70].

Figure 37 Routemaster, London [69]

In 2012 a new **tourist bus** was introduced in the streets of London. The bus has a hybrid engine whereby the buses eject 40% less emission and are 40% more fuel efficient. Furthermore the bus has a spectacular design that was based on the already existing double deck buses: there are **2 staircases and 3 doors and the bus has a capacity of 87 passengers.** This type of buses was exclusively designed for London (Figure 37) [71].

In Norway, there is a **transport service for disabled passengers**. People in a wheelchair can enter the bus with **an elevator from the platform to the double deck bus** and enter the bus easily. There is enough space for more than one wheelchair to park. The wheelchairs can be strapped **to the floor by a metal strip**: this system makes it possible to place the chair anywhere on the bus and not just at some specific places also allows people to drive facing forward. The bus is provided with **an accessible toilet** on the second floor. The passengers have an open view and it is possible for other users to sit next to the wheelchair users. Trains in Norway are also designed so disabled persons can enter the train without extra help: the **doors are wide and on ground level and the aisles are sufficiently wide to pass**. In the train is **a toilet and a drink- and food machine**.

Curitiba is a city, situated in the south of Brazil with approximately 2 million inhabitants. The public transport system consists entirely of buses, divided in several different types of buses. Lanes used exclusively by buses are available, so the usual congestion can be avoided. The **well-organized public bus system** improves the quality of life in the city and lowers the unemployment rate. The buses are running frequently and reliably and the stations are convenient, well designed, comfortable and attractive. This system is offered to a low price and more than 70% of the residents of Curitiba are using the buses every day. The buses have **wide doors and ramps** that extend out to the station platform when the doors open. With this same-level bus boarding, all the passengers can enter and alight the bus quickly, including wheelchairs and the pre-payment results in a dwell time of no more that 15 to 19 sec. at a stop (Figure 38) [72].

Figure 38 Accessible bus network in Curitiba, Brazil

Annex 4 - Bus concepts

High quality transport

The interliner' was an express bus formula in the form of high quality public transport. The bus operated in several municipalities in the Netherlands in cooperation with the train company. The interliner can be seen as a supralocal transport service between the national railways and the local bus service. The bus was allowed to use the emergency lane because an important requirement was that the bus needs to be 20% faster than the original network. Because of decentralization, liberalization and privatization of the public transport companies, the interliner is no longer profitable and no longer meets the requirements. The service of an interliner was **fast, comfortable and created a business-like environment: spacious seats, screens with real time travel information and air-conditioning** [73].

The '**Superbus',** designed by the Delft University of Technology, is a high speed coach that offers speed and luxury and gets you from door to door. This concept is an alternative for today's personal mobility and sustainable mobility. There is no fixed schedule and transport is on demand. The Superbus runs at a **speed of 250 km/h** using separated lanes next to the highways. It is 15m long and provides seating for **23 passengers**. To improve comfort and allow individuality, it has **8 doors per side**. The bus is designed to provide a sensational travel experience. The high level of comfort and the sensational experience will be realized by the **high speed, ergonomic interior design and personal multimedia equipment** (Figure 39) [74].

Figure 39 Design Superbus [75]

Accessibility

Figure 40 Accessible City Bus [72]

The **ACBus 'Accessible City Bus'** is designed by Ceren Bagatar. Because of the design, the target groups of the bus are people with a disability. There is room for at least two wheelchairs and buggies, there are **bright contrasts for ease of identification** for impaired passengers and there are **several handles**. The bus has a **low floor, an open design** (Figure 40) [75].

The new generation of buses from the MIVB is also focusing on accessibility: **low entry, wide doors, low floor over the entire length of the bus and large windows.** On the outside of the buses, a **destination signification** shows the line number in colour, which increases the legibility of the information. Inside the bus are **line diagrams and dynamic information visible on LCD panels**. The new busses are all equipped with camera surveillance. A separated cabin with safety glass protects the driver against aggression and vandalism [76].

Visibility

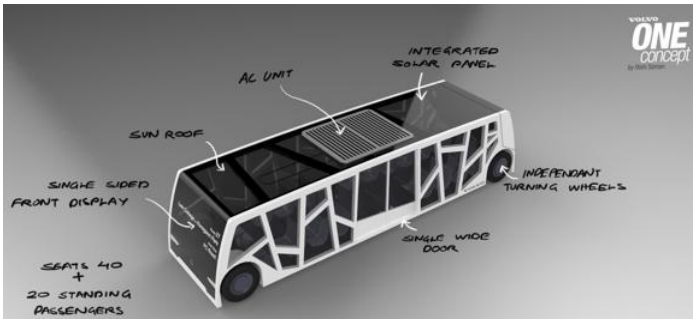

Figure 41 Volvo One Concept [74]

Previous research indicated that passengers prefer an **open bus with natural and sun light**. Volvo created a virtual idea named **'Volvo One Concept'** where the bus has an open view and different **windows on the sides and on the roof** (Figure 41) [77].

Using the slogan 'A bus can be sexy' Rafal Pilat & Michal Bonikowski designed '**the Cityline'**. The Cityline characteristics are its futuristic look and smooth silhouette lines. The windshield is wide and seamlessly merges with the roof. It offers ideal visibility for the driver. The new **'MB Tourismo demobus'** in Nijkerk, the Netherlands has **a roof window of glass** allowing more sunlight inside the bus [77].

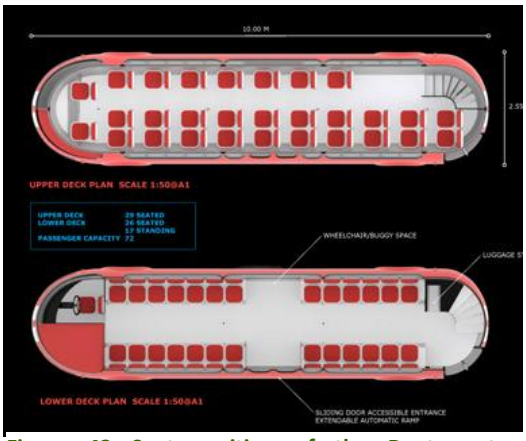

Figure 42 Seat position of the Routemaster, London [76]

The interior design of the **Routemaster London** reflects the way passengers are using the available space. The **lower deck has increased standing and circulation space** to allow better use of the space when the bus is busy. The seats on the lower deck are arranged in **inward facing benches**. The upper deck features passenger's seats in the direction of driving. The conventional double seat layout leads to poor use of space - passengers preferring to take an empty double seat rather than sit next to another passenger (Figure 42) [78].

Similar is the **Volvo prototype bus**, designed by Philipp Divitschek. The result of the new bus design is a high visibility for passengers and a flexible interior. Bus operators can arrange the interior themselves so they can optimize the passengers' comfort according to the amount of travelers in the bus or the time of the day. Furthermore the new bus tried to improve the safety of the vehicle in case of an accident. A vehicle should be adequately equipped for the rescue of passengers by the fire fighters' department (Figure 43) [34].

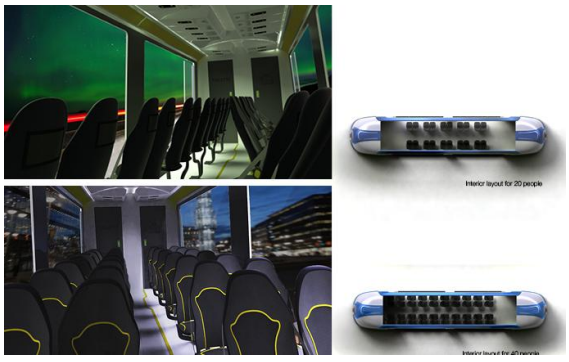

Figure 43 Seat position of the Volvo bus [40]

Seating

Figure 44 Modular concept bus Keolis [60]

In 2011 the private Flemish transport company Keolis had the ambition to increase passenger comfort. **The modular bus** had to give a better solution to the problems of diverse usage and the expectations of the client. The new bus concept exist of modules sitting and standing spaces, larger seats, luggage modules, lighting that changes during the day, spaces differentiated by colour… . Special attention was given to **the welcoming role of the driver** (Figure 44) [69] [79].

Bruno Suraski, a designer from Buenos Aires, Argentina, came up with a conceptual interior of a bus. The **roof and walls** are in **transparent glass** and **seats are oriented towards the sides** so passengers can have a good view on the road. Hanging chairs or backrests for standees are also provided (Figure 45) [80].

Figure 45 Conceptual bus of Bruno Suraski [80]

Designers continue to rethink facilities and develop ideas for standees, according to '**flying standing up'** from Ryanair. These vertical seats, called '**the saddle seat'** can also be integrated in buses which will result in more passengers and cost savings (Figure 46) [61] [81]**.**

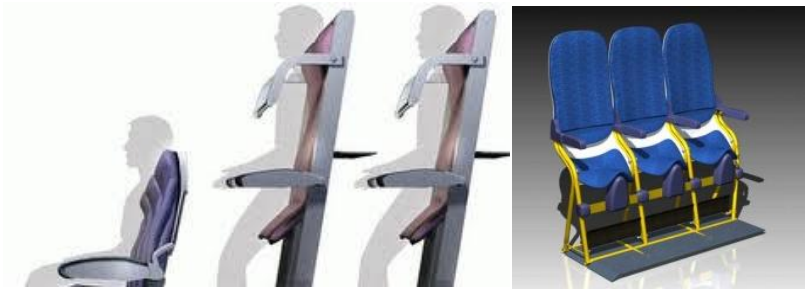

Figure 46 Vertical seats [61] [81]

In the **royal VIP bus of Van Hool** 42 seats are available, spread over the upper deck and the lower floor. Seats are covered with white leather and can turn 360°. Buses can also be arranged as driving offices or class rooms; equipped with tables, working chairs, computers, sockets and Wi-Fi. Microsoft provided a free bus transportation to work for some of its employees in China (Figure 47) [82] [83] [84] [85].

Figure 47 Passengers seats in Van Hool Royal VIP TD 824 Mercedes [87]

Figure 48 The VDL Bova Magiq 'Greek Limo Bus'[83]

The **VDL Bova Magiq 'Greek Limo Bus'** was developed for a Greek company. The bus is equipped with 29 passengers' seat, 4 23" LCD panels, a surround audio system and in built connectors for radio, CD, IPod, internet, telephone and individual 9" monitor in the chairs. Furthermore the bus is provided with meeting facilities, swivel chairs, a fax, a scanner, a printer and presentation facilities. Finally also a full kitchen is available (Figure 48) [84].

Folding seats can give a higher capacity during peak loads and more seats during off peak loads. Different applications and approaches are on the market providing the right seating area. A new technology, called the **'sliding seat technology'** is able to provide the bus with an extra 24% available seats. During peak hours, a bus can have 21 seats and a maximum standing space, but when there are less people, the bus can use the additional seats and will have a capacity of 26 seats and a minimum standing space (Figure 49) [34].

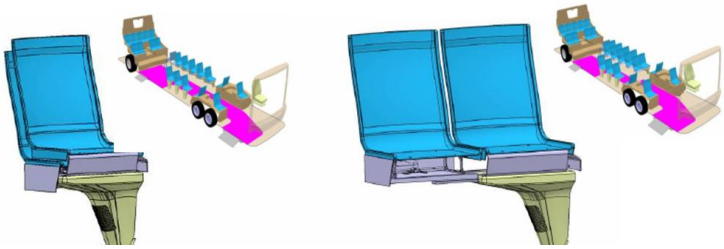

Figure 49 Sliding seat technology [40]

Another possibility to change seats and adapt them to the number of passengers are the **changeable seats**, used e.g. in a train in Argentina between Resistencia and Puerto Tirol. The train is equipped with the usual seats, two on one side of the train and one seat on the other side. The backs of the seats can be switched to the front from one side to the other so a group of 4 persons can sit in a square, facing each other or if one person would like to ride facing forward, he can change the seat if no other space is available (Figure 50).

Figure 50 Changeable seats on the train

The "**Office Bus**" is a public transportation that allows brisk commutation while sustaining the environment. The hi-tech vehicle lets the commuters take advantage of the journey time. The Office Bus combining the advantages of public transport with the flexibility of a personal commutation provides adequate space for both individual as well as group tasks. The seats are provided with **cup holders, fold-out tables in several directions and a small luggage rack** (Figure 51) [86].

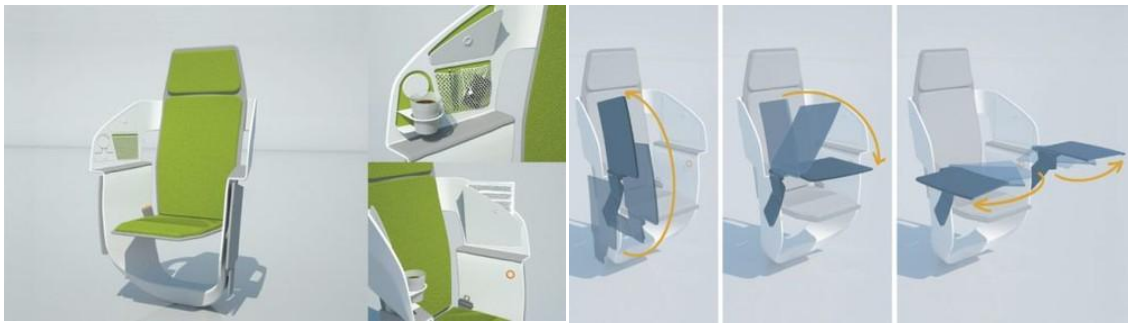

Figure 51 The Office bus [86]

The **Nightliner** in Europe provides bunk **beds (180°)** in the bus and can transport 8 to 18 passengers. The facilities in the bus can vary from a **television and a toilet to a play station, DVD players, Wi-Fi access, a coffee machine....** This system is increasingly used by travel companies. They use the mobile hotels as an attraction to take tourists to locations where no hotel is available or for long distance overnights (Figure 52) [87].

Figure 52 Nightliner [85]

Figure 53 Sleeper bus, Argentina [87]

More familiar are the **sleeper buses that are used for long distance journeys** in Latin America, especially in Argentina. Taking the sleeper bus is more common than taking a plane. Several bus companies are serving a particular area or region, with different stops. The number of passengers depends on the type of bus and the quality. On the bus there is always a driver and one or more stewards or waiters may also be present. The price of a ticket is in proportion to the quality. The waiters can serve hot and cold beverages and regular or more refined food. **Seats can be reclined from 120° to 180°** (shaped into a bed), can be provided with a **foot- and elbow rest**, can be equipped with **a pillow and a blanket** and are covered with **fabrics or with leather**. In the bus one general movie could be shown. A general movie will be shown and dinner and breakfast can be served. In more luxurious buses curtains are provided between the seats and specific movies may be requested and can be viewed on personal screens in front of the seat (Figure 53) [88] [89].

Privacy

The idea of a **Royal Class-Sleep bus** comes from the comfort developments for airplane passengers. British Airways created the Club World-bed. The bed can turn completely horizontal and provides the appropriate privacy through the use of a separation screen. The **Thomson Solutions Cozy Suite** also allows each passenger a private space whilst still allowing for comfortable conversation. It also offers a **reclining seat, individual armrests and a head-rest** for snoozing. This seat configuration allows for 15% extra passenger capacities in airplanes (Figure 54) [90].

Figure 54 Royal Class Sleepbus / Thomson Solutions Cozy Suite [90]

Although this are example of the airplane sector, Japan tries to turn a bus travel into what looks like first-class air travel, with extreme luxury seat modules that they call 'cocoons'. **'The Willer Express'**, which runs from Osaka to Tokyo, only seats twelve people [91]. But each of those people gets their own personal relaxation pod, complete with a seat that reclines **140 degrees, a personal entertainment system, free Wi-Fi, dedicated power outlets and high partitions to separate you from your other passengers.** In some night buses are curtains provided between two seats so passengers can enjoy their privacy while travelling and sleeping (Figure 55 / Figure 56) [84] [92]**.**

Figure 55 The Willer express [89]

Figure 56 Curtains between two seats

Ashok Leyland is a public bus builder for (among other) luxury busses and the design of interiors for a luxury atmosphere. One example is the interior of the **Luxura Magical India bus**. The bus can seat nine people and is equipped with two **LCD televisions, Wi-Fi, a stereo, a tablet for each traveler, reading lights, power sockets, a kitchen with a coffee machine and microwave, a bathroom and even an on-board spa area for two individuals with trained therapists** (Figure 57) [93]**.**

Figure 57 Luxura Magical India bus [87]

Taking this one step further is **the CUBIE car by Haitao QI**, featured as a low-paced moving public or private space in the street. The CUBIE's aim is to help people making maximum use of the time e.g. holding a meeting or getting work done using a laptop. Several **storage places** are below the seats and the mini bus is **re-organisable: seats and tables** can be moved from their location depending on the travelers' activities (Figure 58) [94].

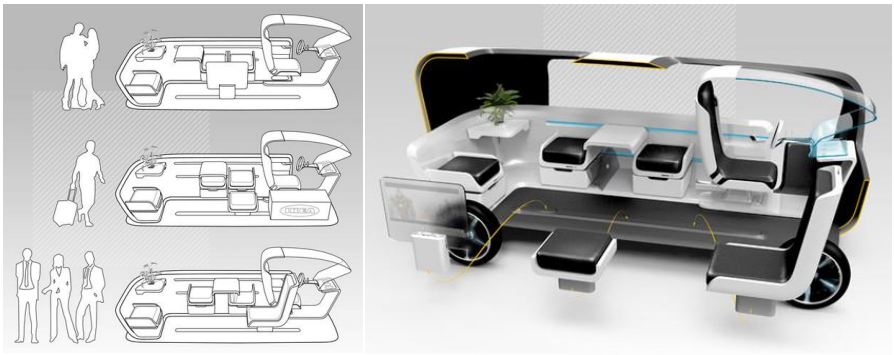

Figure 58 The Cubie Car [94]

Information

'The Willie bus' by designer Tad Orlowski intends to "**transform city landscapes**". This mobile billboard bus consists of a perimeter of large LCD panels. The LCD panels can show advertisements on the road or passengers information at the bus stop. For example it's an option to show a map with the route of the bus on a huge scale. Also other information such as the weather, the latest news, emergency messages, tourist or travel information can be displayed. The panels of the bus are transparent so the bus passengers can still look through the windows (Figure 59) [95] [96].

Figure 59 The Willie bus [77]

Figure 61 Dynamic traveler information, Seoul, South Korea [95]

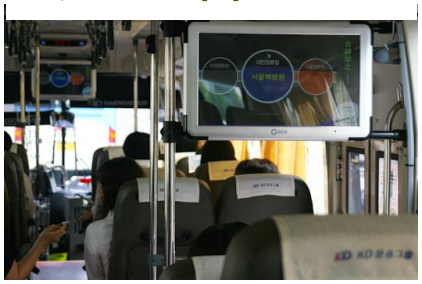

Figure 60 Dynamic traveler information, New Zealand [94]

Information panels have been installed in most buses in the Seoul and Gyeonggi-do area. As a stop approaches, the **name of the stop is shown, as well as the previous and next locations**. During the ride, ads and **cartoons are playing**. The right side also features some **news and weather information** (Figure 61). The **real time information** at bus stops in New Zealand has also been a success. Since the installation of RTI and the available website, traffic has increased by 13.5% and bus stop information page views have increased by just over 60% over a year. After the first reviews, public transport planners have suggested that the display screens should be pole-mounted which will improve the legibility of the screens in bright sunlight (Figure 60) [97] [98].

Entertainment

On many train stations and several bus stations, sandwich shops and on university campuses in Belgium a **free newspaper** is distributed, named **'Metro'**. This initiative started in 2000 and there are both Flemish and French language editions [99].

In Estonia, **Wi-Fi** can be found on moving public vehicles such as the bus and train. Estonia was one of the first countries to introduce internet access on buses. Providing **a hotspot for internet on the bus** increases customer satisfaction: passengers are allowed to use Wi-Fi, are able to bring portable computers, PDA's and mobile phones to get access to entertainment and information. The Wi-Fi can also give **actual travel information about transfer times and connections**. Research by the Dutch transport company questioned more than 100 young people about their ideal bus. A lot of them said that a Wi-Fi connection was one of the aspects that could improve the attractiveness of the bus (Figure 62) [100] [101].

Figure 62 Wi-Fi on the train and on the bus [45]

In the United States, more than 2000 busses are equipped with '**Transit televisions'**. Different TV-series alternate and can be watched during a trip to and from the respective destinations. For example the series "Los Americans" will appear in a **3-minute episode** looped to augment workday **local and national news, entertainment, weather updates and local advertisements**. Transit Television seems to be making the ride more enjoyable: it keeps customers happy, it costs nothing to install or maintain and it even brings in a little money. With the advent of new media such as the Internet and handheld devices, advertisers have had an increasingly difficult time reaching audiences, particularly young ones [102]. Also **language courses** can be showcased on bus television. A novel program in Vilnius, Lithuania aims to make productive use of the period spent in a bus. The program tries to inject some **education into the commute**. An EU mandate said that every European should know at least two languages. Passengers are subjected to a two-minute language lesson during which phrases are repeated over the trolleybus intercom in Lithuanian, Polish, and English. The phrases are also written on signs posted within the trolleybus so that passengers can learn some of the grammar as well (Figure 63) [103] [104] [105].


Figure 63 Transit televisions [102]

Service

Figure 64 Lijn 100, Woensel [7]

The **project 'Lijn 100'** in cooperation with the development company MUZUS and the transport company INNO-V, worked with older people to get them used to take the public bus. Most of the time the elderly find it difficult and unattractive to take the bus. The companies developed a bus route, called Lijn 100, which drove around Woensel, a city in the Netherlands. The project focussed on the **social characteristics of a bus journey**. On the bus **a steward** is always present: he helps the passengers get in and out the bus, makes the bus a safe place so people feel secure on the bus. He is recognizable, can answer questions and give information and creates entertainment: there is someone to talk to. The bus is equipped with **an electric ramp** so wheelchairs or people with a buggy can enter the bus easily. The bus drives **every hour** between 09.00 and 17.00 and has **fixed stops**, highly visible and well known. For example the bus does not stop at the station because it is then overcrowded and a busy environment is created. In the bus there is room for **two wheelchairs**, so disabled people can travel together. Older people took the bus for several reasons: the target group felt more flexible than with a call bus, just for relaxation or for being alone. Passengers were very enthusiastic and evaluated the bus positively but financially the bus is a "leaking tap". Also it is not clear if the bus provides added value to trips from A to B: people may only take the bus so they are not alone or to avoid being bored. In spite of all this, the project provided more information about **what older people want in the bus: they don't care about speed and frequency but focus more on reliability, time to board and embark the vehicle, the assistance and social aspects that were offered** (Figure 64) [11].

B-Clean is the **mobile cleaning service** from the Flemish train company NMBS. The cleaning service is responsible to keep the trains tidy and clean. B-Clean started in 2007 and is a big success. Before 2007 all the trains had a clean-up at the end of the day. Nowadays **trashcans will be emptied also during the day, toilets are cleaned and garbage is picked up**. Every day almost 500 trains are having a maintenance [106].

Designer Sergio Alonso created the concept **Bus Toilet design**. The toilet was designed after studying female postures. The sleek and clean toilet design with a sliding door feature should be incorporated on all public transport buses. Although a unisex toilet, it attaches a lot of importance to the needs and comfort of female users (Figure 65) [107].

Figure 65 Toilet on the bus [107]

Figure 66 Bike rack [104] [105]

Taking a bike with you on a trip is a more common phenomenon. Popular are the folding bikes that can be folded up really small but normal bikes are more comfortable. On many buses in Switzerland, Germany and the United States it is possible to load your bicycle on the bus. The system used differs from bus to bus and depends on the company: a **bike rack** can be situated in front or on the back of the bus. The bike racks can be expanded when passengers arrives with a bike, otherwise the rack will take up more space than needed and can be dangerous. To fasten the bike, a simple system is used so no time is lost and still maximum security for the bike is ensured. On every bus and on the website of the bus company, a manual is available showing how to up- and unload your bike. The passenger is responsible for loading the bike: the driver is not allowed to help. To make sure that a bus arrives equipped with a bike rack or that there is still room for his bike, passengers can call the bus company and make **a reservation**. The possibility to take your bike on the bus **increases the use of public transport** and **enhances healthy active travel options**. Travelers can organize their journey in a different way and for example take the bus in the morning to go to work and then cycle back home (Figure 66) [108] [109].

Several trains in South Korea are equipped with **vending machines**. A train crew also pushes a **food trolley** along the aisle. Similar concepts are available in Japan, for example the Fuji-Kyuko-line has a drinking machine on board (Figure 67) [110].

Figure 67 Vending machine on board of train, South Korea and Japan [110]

Annex 5 - List of variables of appearance qualities

Decoration	Facilities	Passengers seats	Access	Information	Safety	Service
Carpet	**Bicycle rack**	**Amount**	**Aisle**	**Announcement of**	**Safety**	**Service**
-carpet in bus station -carpet in front of the door -carpet in the whole bus	-bicycle rack in front/at the back of the bus -bicycle rack inside the bus	-22 seating places + 42 standing places = 64 passengers	-width 85cm (min.) height 2.20m (min.) -width 90cm, height 2.20m (min.)	-arrival times -available facilities -connectivity options -delays -information of the terminal -next services -waiting time	-camera surveillance -driving (speed...) -personal security on the bus -seatbelt -belt for wheelchair users -belt for baby carriages	-driver in a closed cabin -driver's contact -entertainer on the bus -greeting/welcome from the driver -ideas – complaint box -mobile cleaning service during breaks -mobile cleaning service during the journey -stewards on the bus -stewards on the bus during special events
Curtains	**Television**	**Cover**	**Holding**	**Audio**		
-curtains between two seats -curtains on the windows in the whole bus	-advertisement -language class -movie -news -soap	-leather -plastic mounted -removable cover -soft cover: anti-allergic and fire protection	-handle on the top of the back of the seat -height holdings -holding opportunities	-loudspeakers outside the bus -microphone -talking sign -timetable		
Light	**Facility services**	**Position**	**Access facilities**	**Visual**		
-accent lighting -atmospheric lighting -board for footsteps -door knobs that glow in the dark -illuminated door frame -illumination above the door	-catering options -coat hook -coffee maker -cup holder -drink dispenser -eat machine -fixed table -folding table -luggage rack in front of the bus -trashcan	-facing each other -in the direction of the driver -to the inside of the bus -to the outside of the bus -individual seat -more folding chairs -more seating	-automatic kneeling function -bridge plate / gap filler -folding steps for boarding -larger buses -lift inside the bus -lift to get in the bus -pushbuttons	-countdown till next stop -coloured line films -current time -destination on all sides of the bus -display -LCD panels outside the bus -map of the place around		

-individual lighting for advertisement -multicolour lighting -natural lighting -reading lamp above seating places -reflecting strips on steps -street lighting	-luggage racks above the seats -plug-in function: socket -toilet -trash can -umbrella holder -WI-FI	places -more standing places -on a platform (reachable with steps) -rotating seat -seats in a circle (35 to 50 persons) -sideway -sliding seat	-ramps (manual / electrical) -slope inside the bus -time to get to your seat -time to board on and off bus (min. 6sec.)	-name of the next bus stop -poster with itinerary and all stops -route map		
Material	**Reading material**	**Standees**	**Detection**			
-bright contrast -type of material	-free newspaper - newspaper sale -library	-backrest for standees -saddle chair	-(trapped) passenger detection system			
Temperature	**Sound system**	**Comfort**	**Infrastructure**			
-thermal curtain -thermometer -general air conditioning -general heating system -individual air conditioning -seat heating system -wall heating system -individual fan	-background music -headphone with traveler information -headphone with music, radio...	-comfortable, ergonomic seat (seat wide (44cm), seat deep (35cm-40cm), seat height (40cm-50cm, min. 35cm) -folding backrest (from 120° to 180°) -folding seat (higher capacity during peak) -individual folding elbow rest -individual folding footrest	-from ground floor inside the bus: max.10cm -from platform inside the bus: max.16cm-20cm -height gap (max. 2cm-5cm) -low floor throughout the bus -passengers flow -personal space -standing space: 2 passengers/m² -standing space: 4 passengers/m²			
Smell	**Multimedia equipment**					
-smell in the bus of ... (e.g. flowers)	-games -information					

Window						
-sun protection -contrast marking on doors -external visibility -hinged windows on the roof -hinged windows on the side -large window from floor to top -privacy glass -roof of glass -window cleaner - automatic dark tones for sunlight	system -personal TV	-individual folding head rest -leg space (65cm-68cm till 70cm-75cm for seats in the direction of the driver; 130cm (each seat min.60cm-70cm) for seats facing each other) -seat occupancy system: availability of seats	-steps height in the bus (max. 18cm high, min. 24 cm deep, maxi. stair angle 15°) -steps inside the bus -wide of the door (minimum 90cm)			

Table 21 List of appearance variables

Annex 6 - Interviews

Busworld Academy

Busworld took place in the exposition hall in Kortrijk, Belgium from the 18th till the 23th of October 2013. It was the 22 time that the annual exhibition found place, a unique opportunity to meet different bus builders and manufactories. Busworld foundation started in 1971 with the first exhibition. The idea was to build a market where the individual, the passenger and the macro level of bus manufactory reach each other. During the years the amount of visitors and exhibitors increased steeply. During the exhibition days, more than 300.000 visitors discovered what's new in the world of buses and coaches. Around 390 exhibitors are attending Busworld and are showing their newest products and type of buses.

I attended the workshop Busworld Academy on the 18th of October and was surprised by the rich and good organisation of the workshops. The seminary started with a welcome word of the president of Busworld foundation Redgy Deschacht, followed by the mayor of Kortrijk Vincent van Quickenborne and the president of Busworld Academy Stefan Meersseman. The different bus builders believe that the bus is the safest way of travelling; according to statistics this is true. But getting people on the bus is another challenge. The market needs to decide what they want, so buses can give what they need. Until now the bus had to be comfortable, flexible, quick and related to the price. The different stakeholders of Busworld try to achieve what is possible. It will be a mix of economical, social, technical and design characteristics that will eventually create a good bus.

Busbuilder VipDesign

VipDesign bestaat 15 jaar en ontwerpt, creëert en innoveert de meest luxueuze interieurs voor voertuigen. VipDesign maakt luxe minibussen en zorgt voor de bekleding van stoelen. VipDesign doet ook de lederen bekleding van de zitplaatsen van de bussen van Van Hool. Een interview volgt met medewerker Yassin Abattoui (30-01-2014).

Wat is jullie doelpubliek?

Iedereen is bij ons welkom. Dit kan gaan van klanten zoals dokters en advocaten tot mensen met een beperking die nood hebben aan een aangepaste bus.

Hoeveel passagiers kunnen plaats nemen in een aangepaste bus?

Dit kan gaan van 2 personen tot maximum 8 personen in een grotere model. Hierbij kan ook nog een chauffeur plaatsnemen en een reiziger op de passagiersstoel.

Wat zijn de wensen van de klanten? Waar is er veel vraag naar?

Men begint altijd met een basispakket maar alles is mogelijk. Extra opties kunnen worden toegevoegd. De bus wordt gemaakt op maat van de klant.

Zijn hier er speciale redenen voor deze wensen? Vb. welke activiteiten voort men uit tijdens de rit, zijn deze vb. business gerelateerd?

De bussen worden voornamelijk gepromoot als 'het rijdende kantoor': met het nodige comfort, luxe en privacy om tijdens een verplaatsing (of een file) te kunnen blijven werken vb. door uitklapbare tafels. Ook ligzetels voor slaapmogelijkheden zijn optioneel. Momenteel kunnen de zetels 160° kantelen door middel van de rugleuning en de kuitensteun. Ook 180° zou een optie kunnen zijn.

Figure 68 VipDesign seat options [109]

Wat zijn vernieuwingen binnenin de bus van de laatste jaren?

Er is veel elektronica bijgekomen. Domotica zit in een stijgende fase. Alle elektronica kan worden bestuurd via een laptop of een smartphone. In de bus is een 4G hotspot aanwezig. Ook zetelverwarming is een kenmerk van de laatste jaren.

Wat vinden de klanten zelf belangrijk? Vb. kleur, materiaal, tastbaarheid, vormgeving, structuur...?

Via led verlichting kan de sfeer in de bus worden aangepast. Ook extra leesspots zijn aanwezig. Verder zijn de zetels in leer (naar wens van de klant) en ligt er een vloerkleed op de grond. Alles is tot in detail afgewerkt; dat is ons uitgangsbord.

Hebben jullie zelf een idee waar de toekomst naartoe zal gaan?

Er gaat nog meer elektronica bijkomen; alles gaat computergestuurd worden; verlichting, verwarming, de koffiemachine... noem maar op. Maar er is een keerzijde; deze luxe bussen hebben een sterk luxueus imago en worden door veel reizigers als 'snob'-voertuigen bezien. Het imago van deze bussen strookt steeds minder en minder met het Vlaamse vervoersidee. Vlaanderen promoot namelijk groene voertuigen en het openbaar vervoer waardoor de luxe status om zich te vervoeren verder zal verdwijnen. Dit in tegenstelling tot in andere landen. Het filiaal van VipDesign in Turkije heeft steeds meer en meer succes. Daar komt regelmatig voor dat een dokter een luxe minibus heeft om zijn werk en verplaatsingen te combineren. Ook in de Arabische wereld, bv. Dubai zijn er meerdere busbouwers van dit soort.

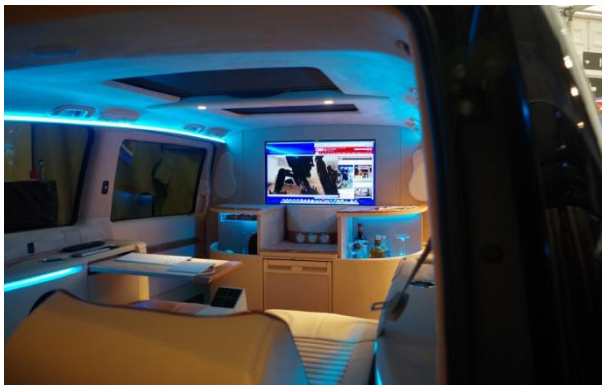

Figure 69 VipDesign Domotica [109]

Doen jullie zelf de gehele inrichting?

Nee, we besteden een deel uit namelijk de leerbekleding van de stoelen waarbij we samenwerken met een Duitse leder fabrikant en de elektronica die hier in België wordt voorzien. De afwerking wordt door ons gedaan.

Vinden de klanten het belangrijk hoe de buitenkant eruit ziet?

De aankoop van de wagen is een standaard gebeuren waar de consument weinig inspraak in heeft (er zijn een aantal vaste modellen). Maar hierin kan de consument ook inspraak in hebben; vb. de kleur van de wagen en of de wagen gepantserd moet worden.

Is er de laatste jaren een evolutie? Vb. meer vraag naar aangepaste modellen?

Geen sterke stijging. Het bedrijf zoekt nu ook uit wat de mogelijkheden zijn voor de inrichting van boten, privéjets of treinen. Op deze gebieden kunnen we nog klanten winnen en is groeipotentieel.

Doen jullie zelf onderzoek naar wat de klant wil?
Nog niet, voornamelijk omdat alles mogelijk is. De klant kan tot in details vragen wat hij graag wilt. Maar er wordt sinds het laatste jaar meer aandacht besteed aan een goed klantenbeheer en netwerking.

Is er aandacht aan veiligheid en bescherming?
Steeds meer; de wagen zelf is een standaard product maar ook hier zien we dat er meer aandacht wordt besteed aan veiligheid, voornamelijk in combinatie met ITS. Deze veiligheid proberen we nog steeds te garanderen in de aangepaste versies. Dit moet ook wettelijk in orde zijn.

Zijn er veel wettelijke voorzieningen waar jullie je aan moeten houden?
Ja, het is een heel strikte wetgeving in België, een echt staatsgebeuren vb. de autokeuring is hier een onderdeel van. Dit is in andere (Arabische) landen niet het geval; daar beslist de autofabrikant of het voertuig veilig is; in ons ander filiaal hebben we hier meer vrijheid in.

Interview Bert Dorleman

Bert Dorleman werkt al enkele jaren als lijnbuschauffeur bij vervoersbedrijf A. De Voeght & Co uit Kampenhout. Het vervoersbedrijf beschikt over 21 bussen (standaard en gelede bussen) die worden ingezet op bestaande lijnen in het Leuvense voor stad- en streekvervoer van De Lijn (11-02-2014).

Op welke momenten zijn de bussen druk bezet?
Op de schooluren (rond 8u en rond 16u) en op zaterdag (zeker in Leuven door winkelende mensen). In de ochtend is het altijd iets drukker doordat er zowel schoolgaande kinderen als werkende mensen de bus nemen. In de namiddag is deze piek meer verspreid.

Rijden de mensen liever met de richting mee?
Ja over het algemeen gaan de mensen met de rijrichting meezitten. Zijwaartse stoelen zijn minder in trek. Maar bijvoorbeeld als men met 4 reist, gaan met altijd aan een plaats van 4 zitten waarbij er twee in tegenovergestelde richting rijden.

Zouden flexibele stoelen een oplossing zijn (verschuifbare rustleuning)? Flexibele configuratie is zeker een mogelijkheid zolang het veilig is en niet kan wordt afgebroken. Alles wat losstaat of makkelijk breekbaar is, blijft nooit lang heel.

Welke wensen heb je zelf al buschauffeur qua inrichting? Comfortabelere stoel? Meer contact met de passagiers?
Qua chauffeurscomfort is alles oké: ergonomische stoel, voldoende ruimte... . Er is alleen geen voldoende doorstroming tot achterin de bus waardoor het voorste gedeelte altijd druk bezet is.

Wat zijn de wensen van de passagiers zelf? Waar is er veel vraag naar? Of waar wordt er veel over geklaagd?

Er is een hele slechte communicatie naar de passagiers toe. Reizigers weten niet weten waar naar toe en dit is erger als er werken zijn of vertragingen opkomen. Reizigers klagen ook over de hogere tarieven. En bij de oude bussen staat er bij de achteruitgang een ijzeren buis in het midden van de twee deuren waardoor de bus minder toegankelijk is voor buggy's.

Zijn er vernieuwingen qua design in de bus de laatste jaren?

Bij de nieuwe bussen zijn er bagagerekken voorzien die ook meer wordt gebruikt. Het gebruik van deze rekken ligt bij de bussen naar en van de luchthaven hoger.

Worden er veel vragen gesteld vb. over waar haltes zich bevinden?

De frequente reizigers stellen geen vragen meer en weten hun weg en waar ze moeten afstappen. Maar niet-regelmatige gebruikers stellen wel vragen: de meest gestelde vragen gaan over de halte en weg. Vandaar dat informatie zowel auditief als visueel een essentieel gegeven is. Dynamische informatie zou de haltes, reistijden en vertragingen moeten kunnen weergeven. Een stap verder zou de weergave zijn van overstapmogelijkheden en de vertrektijden van andere verbindingen. De grootste problemen doen zich voor bij vertragingen en onvoorziene wendingen. Er is een mogelijkheid dat de dispatching rechtstreeks informatie kan doorgeven naar de reizigers via de audiosystemen (dat zelf de chauffeur niet tussenbeide moet komen). Maar dit wordt bijna nooit gebruikt (een mogelijke reden kan zijn de slechte kwaliteit van de audiosystemen). Informatie naar de passagiers toe is een van de meest belangrijkste items.

Zou een assistent of entertainer een oplossing zijn? Vb. proefproject in Nederland: vooral veel ouderen die hierdoor meer de bus nemen.

De voorziening van assistentiepersoneel is zeker een goed idee. In specifieke situaties bijvoorbeeld als door vb. een ongeval, de bus een andere route moet nemen en hierdoor enkele haltes moet overslaan er toch iemand de wachtende reizigers aan de onbediende haltes kan waarschuwen. Assistentie wordt nu enkel ingevoerd bij evenementen (vb. Rock Werchter) maar als dit financieel toelaatbaar is zou dit een meerwaarde bieden voor de dagelijkse busreizigers.

Is er de laatste jaren een evolutie? Vb. meer vraag naar aangepaste modellen? Worden er andere bus modellen gebouwd/aangekocht?

Wij beschikken nu over 21 bussen. De gemiddelde leeftijd van een bus is 7 jaar en de wettelijke maximum leeftijd is 15 jaar. Van de 21 bussen zijn er 5 bussen niet-laagvloers. De rest van de bussen is rolstoeltoegankelijk en die behoren tot de nieuwe generatie bussen. Soms kan het achterste gedeelte nog oplopend zijn maar hierdoor blijven de beide ingangen laagvloers. Het meest ideale is dat de bussen voor het stadsvervoer 3 deuren hebben met een geheel lage vloer.

Is er een camera aanwezig in de bus? Zo ja hoeveel en waar?
Er zijn 3 bussen uitgerust met een camera. Hierdoor is heel het interieur zichtbaar. Het gebruik van camera's is interessant als er iets mis moest gaan maar of het echt een preventief effect heeft blijft een vraagteken. Naar agressie en veiligheidsgevoel toe kan het zeker helpen. Maar achteraf blijft er evenveel afval achter als in een bus zonder camera.

Denk je dat mensen meer de bus zouden gebruiken als er meer luxe is?
Een bepaald publiek gaat zeker meer de bus gebruiken. Voornamelijk keuzereizigers zie ik overschakelen naar de bus. Zij verkiezen namelijk de auto boven de bus voor de kwaliteit en het comfort dat de wagen biedt. Als dit comfort ook in de bus waarneembaar is, is de kans reëel dat de autogebruikers overschakelen naar de bus.
Het zou ook helpen als de bus properder is. Nu worden de bussen één keer per maand volledig gekuist. Tevens wordt er elke avond met een borstel door de bus gegaan en echte vuile plekken worden ook met water schoongemaakt. Bijvoorbeeld het voorzien van een vuilnisemmer zou voorkomen dat reizigers de grond gebruiken als afvalbak.

Wat vind je zelf van het interieur? Vb. kleur, materiaal, vormgeving, structuur...?
De combinatie van geel en grijze kleuren geeft een heel functioneel gevoel en niet direct een comfortabele en vertrouwelijke context. Dit is het geval bij alle bussen van De Lijn. De MIVB heeft een veel beter design en nog steeds met heel simpele materialen. Ook de VDL city beschikt over luxueuze stoelen en een glazen dakluik waardoor er meer licht in de bus komt en het geheel aangenamer maakt. Een ander mooi voorbeeld is de Mercedes-Benz Citaro: met een soort van houten vloer en vertrouwelijke kleurentinten (Figure 70).

Figure 70 Mercedes-Benz Citaro [111]

Wat denk je van meer voorzieningen (o.a. leeslamp, fietsenrekken, tafeltjes ...) in de bus?
Bij deze voorzieningen moet er een onderscheid gemaakt worden tussen stadvervoer en streekvervoer. Dit is vandaag de dag ook niet het geval. Alle bussen worden ingezet op beide lijnen waardoor er geen duidelijk onderscheid is en men kansen voor een betere busvoorziening misloopt. Zo zouden deze voorzieningen een groter effect hebben op streekbussen waar de reiziger gemiddeld 20 à 30 minuten op de bus zit; in plaats van een stadsbus die men gebruikt voor 5 minuten. Er zou een duidelijke productonderscheiding moeten zijn, vergelijkbaar met een lange afstandstrein en een lokale trein.

Vb. Fietsenrekken op de bus zou een goed idee zijn voor streekbussen. Als iemand een fiets op de bus neemt voor een rit van 5 minuten is dit waarschijnlijk uit luiigheid omdat deze reiziger niet wilt fietsen, dan uit noodzaak. Momenteel mag men de fiets niet meenemen op de bus. In de nieuwe bussen is dit wel voorzien maar nog steeds verboden. Het meenemen van de fiets zou ook enkel mogelijk zijn op rustige momenten omdat de fiets plaats moet nemen bij de klapstoelen. **In een voorbeeld van Zurich in Zwitserland zijn er vooraan en achteraan de bus fietsrekken voorzien, zou dit een optie zijn?** Ja, dit is een betere oplossing maar dan zou de reiziger zelf de fiets op en af het rek moeten halen. Als dit de verantwoordelijkheid van de chauffeur is dan neemt dit opnieuw veel tijd in beslag en wat gebeurt er dan bij een accident of bij schade?

Het meenemen van een televisie zou gecombineerd moeten worden met RTPI. Op de televisie zou ook informatie over de rit en de omgeving zichtbaar moeten zijn. Zo weet de reiziger automatisch waar hij zich bevindt. Op een televisie zou ook reclame kunnen wordt geprojecteerd door lokale handelaars vb. Dit kan de reiskosten voor de reiziger drukken. Maar het spelen van een televisie zou niet storend mogen zijn voor de rest van de reizigers. Vandaar dat een individueel multimediasysteem een andere mogelijkheid is. Hierbij kan ieder individu zijn ding doen en dit sluit ook meer aan bij de individualisering van de samenleving. Mensen zijn steeds meer gericht op hun privacy. Andere voorzieningen zoals tafeltjes en Wi-Fi zijn een goed idee voor streekbussen en langere verplaatsingen.

Heb je zelf een idee waar de toekomst naartoe zal gaan? Vb. toilet in de bus? Aan de halte? Invoeren van ligzetels?
Op lange termijn gaat er meer apart en hoogwaardiger vervoer nodig zijn. Reizigers zijn ook bereid hier meer voor te betalen. Ik denk dat BRT ook een goede oplossing zou vormen. BRT geeft een hoogwaardiger gevoel en zorgt voor een meer vaste en betrouwbare verbinding. Of dit haalbaar is, is een andere vraag. Omdat het openbaar vervoer hier nog steeds gebonden is aan de overheid zijn de uitwerkingskansen beperkt. In een privé context zou er meer realiseerbaar zijn.

Doen jullie zelf onderzoek naar wat de klant wil? Vb. aangepaste bussen?
Nee, wij doen zuiver de exploitatie. We kopen de bussen aan maar ik denk dat de fabrikant hier ook meer invloed kan op uitoefenen. Nu beslist de operator welke bus ze gaan aanbieden maar misschien dat operatoren wel geïnspireerd kunnen worden door fabrikanten. Dit wijzigt de rol van fabrikanten en geeft hen ook meer kansen om andere bus modellen op de markt te brengen. Als een fabrikant zelf onderzoek zou uitvoeren naar de reizigers zijn wensen, kan dit een positief gegeven zijn voor de operators.

Is er de laatste jaren een evolutie van meer Intelligent Transportation Systems (ITS) in de bus?

Het ReTiBo-project zou een doorbraak moeten geven. Het ReTiBo (REgistratie- en TIcketsysteem met BOordcomputer) project heeft als doel het aanbod van De Lijn beter af te stemmen op de wensen van de reizigers. Het uiteindelijke product zou één chipkaart zijn voor alle vervoersmaatschappijen in België. Het project ReTiBo zal de bussen voorzien van boordcomputers en de nodige technologie voor reizigersregistratie. De boorcomputers kunnen de reizigers meer en directere informatie geven over reistijden, omleidingen en files. Verder zouden verkeerslichten beïnvloed kunnen worden zodat bussen voorrang krijgen op de rest van het verkeer. De volledige realisatie zou rond moeten zijn tegen 2015. Reizigers zouden ook meer tevreden zijn moest er 1 pasje zijn voor alle openbaar vervoers modi. Nu moet men nog met verschillende abonnementen rekening houden. Een goed voorbeeld is MOBIB: een contactloze kaart waarbij verschillende vervoersbewijzen kunnen worden opgeladen. Tegen 2016 zouden alle bussen en reizigers met dit system vertrouwd moeten zijn [112] [113] [114].

Zijn er veel wettelijke voorzieningen waar jullie je aan moeten houden?

Ja, zo zijn er bijvoorbeeld de procedures als een rolstoelgebruiker de bus neemt. Allereerst moet een reiziger met een beperking 24u op voorhand de bus reserveren. Zo kan er geschoven worden met de bussen zodat er op die lijn een aangepaste bus voorzien wordt. De helling moet manueel worden uitgehaald: daarvoor moeten we de kassa uitladen en afsluiten voor we uit de bus kunnen stappen en de helling voorzien. Als buschauffeur zou je niet mogen helpen bij het instappen van een rolstoelgebruiker maar dit is soms ook niet mogelijk en een helpende hand is noodzakelijk. Natuurlijk moest er dan iets gebeuren, dan is de buschauffeur aansprakelijk.

Verder zou er bijvoorbeeld ook geen radio mogen opstaan. Niet voor de chauffeur en niet in de bus; dit ook omwille van Sabam problemen.

Interview Van Hool

Van Hool is een Belgische onafhankelijke constructeur van autocars, bussen en industriële voertuigen. Het familiebedrijf werd in 1947 opgericht en is gevestigd in Koningshooikt-Lier in België. Het merendeel van de geproduceerde voertuigen is bestemd voor Europa en Noord-Amerika. Van Hool bouwt jaarlijks ongeveer 1.600 bussen en autocars en zo'n 4.000 industriële voertuigen waarvan 80% wereldwijd wordt geëxporteerd. Van Hool biedt een compleet gamma bussen aan voor openbaar vervoer, gaande van een 9m lange midibus tot een 25 m lange dubbelgelede lagevloersbus. Een interview volgt met Public Relations manager Dirk Snauwert en manager Sales Public Services ir. Geert van Hecke (18-02-2014).

Doen jullie zelf onderzoek naar wat de klanten/vervoersbedrijven willen?

Nee, hierbij moeten we je teleurstellen: er wordt geen wetenschappelijk onderzoek gedaan. Van Hool is een familiebedrijf en de 3de en 4de generatie is runt momenteel het bedrijf. Er stromen kleine busjes door hun bloed en de hele generatie Van Hool heeft al jarenlange ervaring in het vak. Nieuwe ontwikkelingen en ideeën worden via buikgevoel gecreëerd. Verder zijn het de wensen en verwachtingen van de klanten zelf. Voor Van Hool is veel mogelijk maar het zijn de kosten die bij een project komen kijken die een invloed uitoefenen op het finale product.

We wisselen wel ervaringen uit met anderen en gaan naar verschillende beurzen. Bij het promoten en tentoonstellen van een bus luisteren we naar de reactie van onze gasten. Als er bijvoorbeeld een nieuwe bus wordt voorgesteld met een afgesloten chauffeursplaats en we horen van 40 van de 50 chauffeurs die komen kijken dat dit een goede oplossing is, weten we dat ons product zal aanslaan. Er gaan ook mensen van de design afdeling naar stoffenbeurzen of materiaalbeurzen en hier worden wel verslagen van gemaakt van welke stoffen of materialen als goed en degelijk werden bevonden en mogelijk zijn om te integreren in een bus.

Figure 71 Trambus Mettis, Metz [67]

Een mooi voorbeeld is de trambus Mettis in Metz in Frankrijk. Metz was op zoek naar een vervoersmiddel voor een bredere regio om het openbaar vervoer te verbeteren. De stad keek in eerste instantie naar een tram omdat het voertuig een hoog niveau van snelheid en frequentie moest aankunnen en bovenal het nodige comfort moest bieden. Verder waren voertuigen nodig met een hoge capaciteit. Een uitgewerkt technisch en financieel voorstel maakte echter duidelijk dat het invoeren van een tram een te hoge kostprijs met zich mee zou brengen. Daarom is Van Hool op zoek gegaan naar een ander type vervoersmiddel en ontstond het concept van de ExquiCity. De trambussen in Metz zijn 24m lang en hybride gestuurd om het geluid te reduceren. Metz bestelde 27 trambussen (Figure 71).

Hoe kwamen jullie bij het idee van ExquiCity en het ontwerp van de trambus?
Het idee is gegroeid 2011 en het eerste grote project was Metz. Het is een nieuwe vorm van Bus Rapid Transit. De trambus is een kruising van een trolley en een hybride bus. Ondertussen hebben we met de ExquiCity ook succes in Barcelona, Parma, Luxemburg en Malmö. De grootste aanwinst was de bestelling van 33 trambussen voor Genève. Met zo'n bestelling, dan is het groot feest.

Twee modellen zijn vandaag op de markt: de gelede ExquiCity 18m en de dubbelgelede bus ExquiCity 24m (Figure 72). Aandrijvingen zijn mogelijk door een hybride trolleyaandrijving, een hybrideaandrijving of een brandstofcelaandrijving. De bussen rijden voornamelijk op een eigen bedding. In sommige steden zijn er ook Bus Rapid Transit banen voorzien.

Figure 72 ExquiCity 18 and ExquiCity 24 [67]

Is het invoeren van een ExquiCity volgens jullie haalbaar in Vlaanderen?
Het invoeren van de trambus is zeker mogelijk. De trambus rijdt niet op vaste sporen en kan hierdoor makkelijk worden geïmplementeerd in het verkeer. Er hangt alleen een grote kostprijs aan vast: investeren in een trambus is niet goedkoop.

Alles hangt af van de wensen van de klant?
Ja, wij hebben hierin wel een adviserende functie maar de klant beslist. Bijvoorbeeld wij kunnen aanraden om een gestreepte of geruite zetelovertrek te kiezen en donkere tinten zodat een vlek minder zichtbaar is. Maar als de klant graag een effen en lichte kleur wil dan zal dit uiteindelijk in de bus komen. Dit was het voorbeeld in Metz, men wilde graag lichte kleuren.

Wat vinden de klanten zelf belangrijk? Vb. is er meer vraag naar kunststof zitplaatsen?
Plastieken of in kunststof gegoten stoelen zijn opties. Nu bijvoorbeeld de vraag naar leren zetelhoezen komt niet vaak meer voor. De wensen van de klant verschillen ook per land. In Italië is de vraag naar kunststof gegoten stoelen groter: het is er warmer, men zweet makkelijker en dan zijn stoffen zetelhoezen minder aantrekkelijk.

Vinden de klanten het belangrijk hoe de buitenkant eruit ziet?

Steeds meer en meer, dit is een evolutie van de laatste jaren. Terugvallend op het voorbeeld in Metz: de stad Metz wilde een speciale voor- en achterkant van de bus, afwijkend van de modellen die wij aanbieden. De stad zou zelf de mallen financieren om de voorzijde en achterzijde van de bus in te laten drogen. Dit is perfect mogelijk. De bussen zijn nu zichtbaar op bijna alle reclame- en promotiefilmpjes van de stad. De Mettis is deels een uithangbord geworden van de stad (Figure 73).

Figure 73 Promotion City Metz [67]

Wat zijn vernieuwingen binnenin de bus van de laatste jaren?

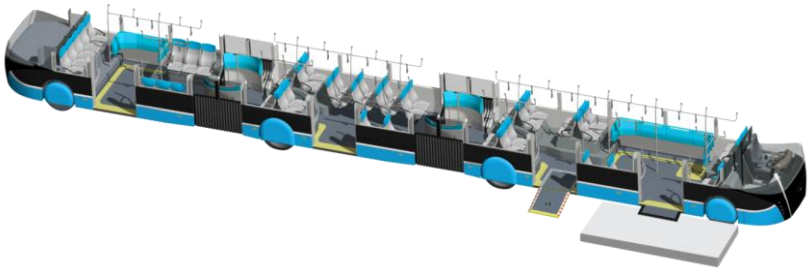

Figure 74 Interior ExquiCity 24 [67]

Onze klanten zijn milieubewuster geworden. Er is meer vraag naar milieuvriendelijke voertuigen: hybride trolleybus, hybride dieselelektrische bus, hybride fuel cell bus of een elektrische bus (Figure 74).

Doen jullie zelf de gehele inrichting of besteden jullie sommige diensten uit (vb. stoelbekleding)?

Ja, wij doen alles zelf: we hebben een uitgeruste werkplaats en de hele bus wordt door ons gemaakt. Natuurlijk maken we de stoffen niet zelf: stoffen en bijvoorbeeld glas kopen we aan maar deze worden door ons in de bus geplaatst.

Zijn in de nieuwe modellen van camera's en andere voorzieningen (o.a. ligstoelen, verstelbare rugleuningen, tafeltjes, televisie...) voorzien?

Camera's en dergelijke is allemaal optioneel. De keuze ligt bij de klant of deze al dan niet worden voorzien in de bus. Het plaatsen van ligstoelen en dergelijke is zeker mogelijk, we beschikken over de juiste technologie en ervaring.

Wij denken dat ook het storend gedrag van andere reizigers een groot effect kan hebben op de evaluatie van de busreis. Passagiers die in contact komen met luide muziek of vervelende schoolkinderen. Voorzieningen ontwikkelen die meer privacy bieden kunnen meer keuzereizigers naar de bus lokken.

Een goed voorbeeld is de supermarkt Lidl in Polen. Lidl baat zelf stads- en streekbussen uit om zo in te spelen op de wensen van hun klanten. De winkelketen probeert op deze manier het vervoer van mensen met boodschappen te vergemakkelijken. In de bus wordt er verder reclame gemaakt voor Lidl en producten die in aanbieding staan.

Denkt u dat mensen meer de bus zouden gebruiken als er meer luxe is?
De definitie van luxe is natuurlijk heel persoonlijk en de vraag blijft 'wat definiëren reizigers als luxe en comfort'? Het is in onze maatschappij vooral belangrijk om het bussysteem als een geheel te zien. Als de bus binnenin heel comfortabel is maar de verplaatsing naar de bushalte en de informatievoorziening zijn niet goed geregeld, dan zal het effect van een luxe bus gering zijn. Het draait allemaal om een geïntegreerde visie. Een voorbeeld is opnieuw Metz: alle halteplaatsen zijn 22cm hoog waardoor de uitklapplaat voor rolstoelgebruikers automatisch is afgestemd op 22cm. Dit verhoogt de toegankelijkheid van het op en afstappen van de bus. Dit is bijvoorbeeld in België niet haalbaar.

Wat denken jullie over de manuele helling voor rolstoelgebruikers bij de bussen in Vlaanderen?
Dit is het perfecte voorbeeld. De Lijn mist in dit opzicht een grote visie die ze in andere landen wel hebben. Technisch zijn automatische hellingen perfect implementeerbaar in een bus. De Latijns-Amerikaanse steden zijn hier ver op vooruit, kijk maar naar het openbaar vervoer in Bogota.

Is er de laatste jaren een evolutie van meer Intelligent Transportation Systems (ITS) in de bus?
De bussen staan in contact met de centrale maar onderlinge verbinding tussen bussen is niet aanwezig. We denken ook dat dit niet noodzakelijk is. Verbindingen tussen bussen en de infrastructuur is wel een optie: kijk maar naar het automatisch groen worden van verkeerslichten bij een naderende bus. Maar het is de keuze van de politici en regering om deze systemen in te voeren. In Genève is er bijvoorbeeld een groene golf, waarbij voertuigen niet zouden moeten stoppen voor een verkeerslicht als men zich aan de snelheid houdt. Als er echter een bus uit een zijstraat op de groene golf komt krijgt deze voorrang en wordt de groene golf voor de andere voertuigen verbroken.

Zijn er veel wettelijke voorzieningen waar jullie je aan moeten houden?
Ja, de minimum afmetingen van een bus zijn welgekend, hier kunnen we niet buiten. Verder worden er bustesten uitgevoerd als we een aanbesteding indienen bij een stad. Verschillende busmaatschappijen tekenen in voor dezelfde aanbesteding waardoor de stad testen uitvoert om te zien welke bus het beste scoort. Wie op het einde van de testen de hoogste/laagste score heeft, krijgt de aanbesteding. Deze testen gaan bijvoorbeeld over het geluid: er wordt gemeten hoeveel decibels er ontstaan als de bus 30km/u, 50km/u of 70km/u rijdt.

Annex 7 - Random distribution of attributes and constructs

Figure 75 visualizes in which order the main constructs are separated from the other sub constructs.

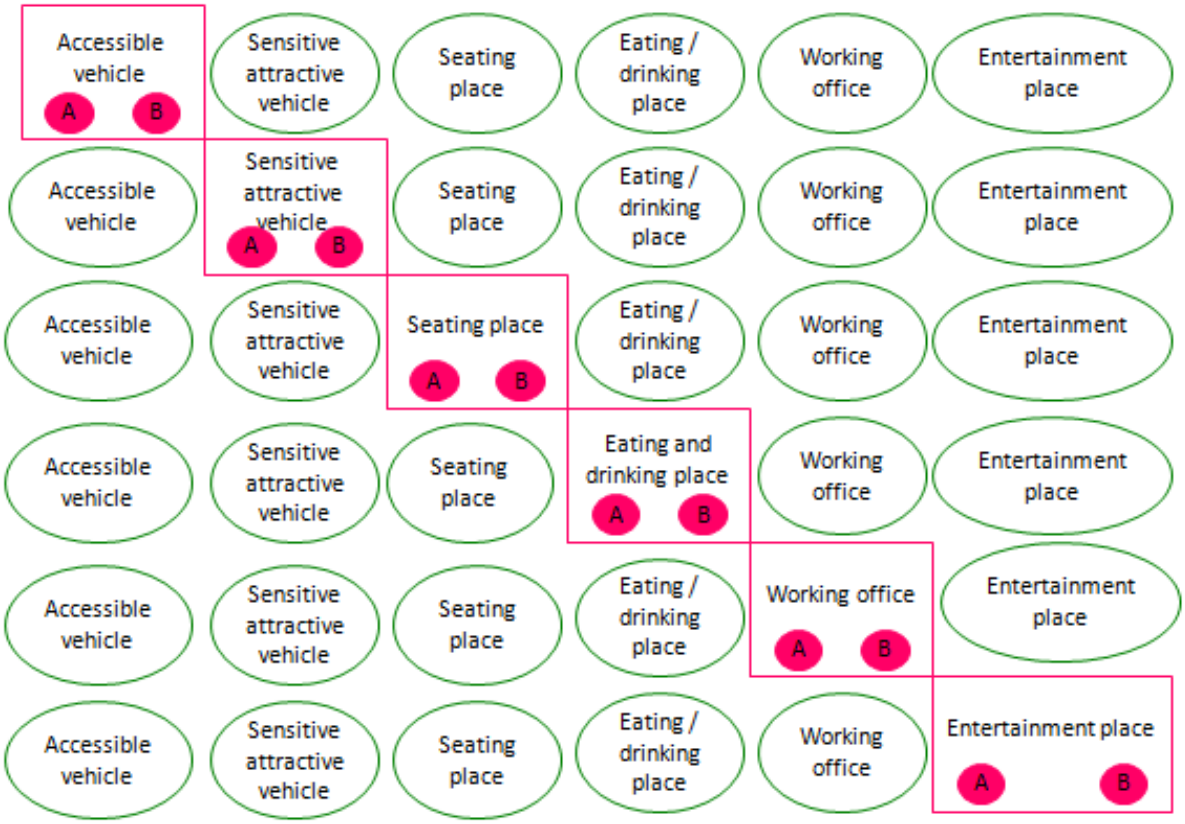

Figure 75 Design choice sets

The tables below show which randomisation has been used for the attributes, constructs and choice tasks in the questionnaire (Table 22, Table 23 and Table 24).

Set	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5
1	Level2	Level2	Level2	Level1	Level2
1	Level2	Level1	Level1	Level2	Level1
2	Level2	Level2	Level1	Level2	Level2
2	Level2	Level1	Level2	Level2	Level2
3	Level1	Level2	Level2	Level2	Level1
3	Level2	Level2	Level1	Level1	Level1
4	Level1	Level1	Level1	Level1	Level1
4	Level1	Level1	Level1	Level2	Level2
5	Level1	Level2	Level1	Level1	Level2
5	Level1	Level2	Level2	Level2	Level1
6	Level2	Level1	Level2	Level1	Level1
6	Level1	Level1	Level2	Level1	Level2

Table 22 Random distribution of attributes

Set	Construct 1	Construct 2	Construct 3	Construct 4	Construct 5	CARD	Random
1	+	+	-	-	-	11	0.003268
1	+	+	-	+	-	4	0.040879
2	-	-	-	-	+	6	0.080092
2	-	-	+	+	-	9	0.190600
3	-	+	+	-	-	2	0.221597
3	-	+	+	+	+	7	0.298362
4	-	-	-	-	-	10	0.346856
4	+	+	+	-	+	5	0.572847
5	+	-	+	+	-	1	0.623198
5	+	-	-	+	+	8	0.662932
6	+	-	+	-	+	3	0.805560
6	-	+	-	+	+	12	0.943616

Table 23 Random distribution of constructs

Set	task 1	task 2	task 3	task 4	task 5	task 6
1	1	2	1	4	4	2
1	1	2	1	4	4	2
2	2	5	4	2	5	1
2	2	5	4	2	5	1
3	3	4	3	3	1	3
3	3	4	3	3	1	3
4	4	3	6	5	2	5
4	4	3	6	5	2	5
5	5	1	5	6	3	4
5	5	1	5	6	3	4
6	6	6	2	1	6	6
6	6	6	2	1	6	6

Table 24 Random distribution of the choice tasks

Annex 8 - Pilot survey

A first pilot survey was held with the participation of a dozen pilot respondents: the following remarks came up during and after conducting the questionnaire. Based on the outcome of these remarks several changes were made to the layout and the question design of the survey.

- **The formulation of the questions and the answer options** had to be clear and not subjective impressionable. E.g. the answer categories for some questions had to be changed because a mix of 'frequency' (never – always) and 'intensity' (low extent – strongly extent) answers categories appeared. Now everything is changed to an answer category of 'intensity'.

- All **rating categories** were reduced to 5 answer options because the difference between 'very strong' and 'strong' was not clear enough. Before that, 7 options were available ranging from 'very strongly favourable' to 'very strongly unfavourable'.

- The **rating scale with the question: to pay more for the ticked bus type** changed after the confusion with regard to the standard price of a bus type. The standard price of 1 euro for a bus journey for one/two zone(s) is mentioned and seen as the lowest possible price option.

- The **layout of the choice sets** changed because some respondents were overwhelmed by the large amount of text and the bright colours. The background colours used in the table unintentionally also influenced the choice of bus type.

- The **person characteristics questions** were moved to the end of the questionnaire.

- Each choice task had to be equipped with **a legend.** At first, the legend was only provided at the first question.

Annex 9 - Questionnaire

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KNOWLEDGE IN ACTION

How to make the bus look sexy?

Inleiding

Beste deelnemer,

Welkom bij deze enquête. De enquête is ontworpen in het kader van mijn thesis **'How to make the bus look sexy?'** voor het afronden van de master opleiding Mobiliteitswetenschappen aan de Universiteit Hasselt. Het doel van de enquête is om inzicht te krijgen in de wensen van busreizigers omtrent **luxe en comfort voorzieningen** in **stads- en streekbussen** in Vlaanderen.

De enquête bestaat uit drie delen: 1) verplaatsingskenmerken, 2) luxe en comfort voorzieningen en 3) persoonskenmerken. Het invullen van de enquête neemt ongeveer 15 minuten in beslag. Uw antwoorden worden anoniem verwerkt en niet aan derden beschikbaar gesteld.

Veel succes,
Emilie Couwenberg
Student Mobiliteitswetenschappen, Universiteit Hasselt

Start

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How to make the bus look sexy?

Deel 1 - Verplaatsingskenmerken

Hoe vaak reist u met de bus?

- 4 dagen in de week of meer
- 1-3 dagen in de week
- 1-3 dagen in de maand
- 6-11 dagen in een jaar
- 1-3 dagen in een jaar
- Minder dan 1 dag in een jaar
- Nooit

Hoe lang zit u gemiddeld op de bus?

- <5 minuten
- 5 - 15 minuten
- 16 - 25 minuten
- 26 - 35 minuten
- >35 minuten
- Ik neem nooit de bus

Vorige Volgende

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How to make the bus look sexy?

Deel 1 - Verplaatsingskenmerken

Voor welke hoofdreden neemt u nooit de bus?

- Ik heb een bedrijfswagen
- Geen vrijheid
- Groot voor- en/of natransport
- Onbetrouwbaar
- Oncomfortabel
- Onveilig
- Onzekerheid over een zitplaats
- Plezier van autorijden
- Slechte verbinding
- Storend gedrag van mede passagiers
- Te duur
- Verplaatsing met veel bagage
- Woonst op grote afstand van bestemming
- Andere

namelijk:

Vorige **Volgende**

Ook als u nooit de bus neemt, blijft het voor ons heel interessant om u mening te horen van volgende gestelde vragen. Daarom vragen wij u ook de rest van de enquête door te nemen en na te gaan of u meer de bus zou gebruiken met volgende voorzieningen aanwezig in de bus.

Deel 1 - Verplaatsingskenmerken

Welke activiteiten doet u op de bus? **(Meerdere antwoorden zijn mogelijk)**

- Berichten versturen met gsm
- Drinken
- Een boek lezen
- Een computerspel spelen
- Een krant lezen
- Een kruiswoordraadsel / sudoku invullen
- Eten
- Gebruik maken van laptop
- Naar de radio / muziek luisteren
- Me vervelen
- Mensen observeren
- Praten met andere passagiers
- Rond kijken
- Slapen
- Studeren
- Telefoneren
- Werken
- Andere

namelijk:

Vorige **Volgende**

How to make the bus look sexy?

Deel 1 - Gevoelskenmerken

In welke mate associeert u de bus met volgende kenmerken?
(op een schaal van 1. in beperkte mate tot 5. in sterke mate)

	1 beperkte mate	2	3	4	5 sterke mate
Betrouwbaarheid	○	○	○	○	○
Bescherming / veiligheid	○	○	○	○	○
Flexibiliteit / onafhankelijkheid	○	○	○	○	○
Gemakkelijkheid	○	○	○	○	○
Gezelligheid	○	○	○	○	○
Milieubewustheid	○	○	○	○	○
Plezier	○	○	○	○	○
Rust en tijd voor jezelf	○	○	○	○	○
Stress	○	○	○	○	○
Sexy	○	○	○	○	○
Status	○	○	○	○	○
Snelheid	○	○	○	○	○
Uitdaging	○	○	○	○	○

Vorige **Volgende**

How to make the bus look sexy?

Deel 1 - Verplaatsingskenmerken

Wat zou u willen verbeteren/veranderen binnenin de bus? (Meerdere antwoorden zijn mogelijk)

- ☐ Actuele informatie en communicatie
- ☐ Gedrag van de chauffeur
- ☐ Kwaliteit van de diensten
- ☐ Overbezetting
- ☐ Prijs-kwaliteit verhouding
- ☐ Properheid van de bus
- ☐ Reiscomfort
- ☐ Sociale veiligheid
- ☐ Storend gedrag van mede passagiers
- ☐ Toegankelijkheid
- ☐ Veiligheid
- ☐ Verlichting
- ☐ Werkruimte
- ☐ Zitplaatsen
- ☐ Andere

namelijk:

Vorige **Volgende**

How to make the bus look sexy?

Deel 2 - Inleiding

In deel 2 van de enquête wordt u mening rond het comfort van bussen onderzocht met behulp van enkele vragen en voorgestelde bus types. Het gaat hierbij telkens over voorzieningen **in de bus**. De voorzieningen kunnen worden onderverdeeld in **6 categorieën**. De bus wordt voorgesteld als...

1. **...toegankelijk vervoermiddel**: ruimte, staanplaats, aankondigingen, fietsenrek...
2. **...zintuiglijk aangenaam vervoermiddel**: licht, temperatuur, zichtbaarheid, luchtstroom...
3. **...comfortabele zitplaats**: aantal plaatsen, stoel compositie, - opties, - comfort...
4. **...eet- en drinkplaats**: bekerhouder, catering opties, properheid, vuilnisbak...
5. **...werkplaats**: tafel, vestiaire, Wi-Fi, bagage rek, stopcontact...
6. **...ontspanningsplaats**: televisie, audiosysteem, leesmateriaal, steward...

Op de volgende pagina vindt u een voorbeeld van de vraagstelling. **Deze eerste vraag nemen we stap per stap met u door.** Neem de tijd om deze oefenvraag eerst grondig door te nemen. Er is geen 'goed' of 'slecht' antwoord. Kies wat het beste bij u past, zelfs als het niet 100% correct is voor u.

Vorige **Volgende**

How to make the bus look sexy?

Deel 2 - Oefenvraag

1) Hoe zou u de voorzieningen in de voorgestelde bus types A en B beoordelen? U moet de **combinatie van de gegeven kenmerken** per bus type evalueren.
(op een schaal van **zeer gunstig** tot **zeer ongunstig**)

De bus als... *werkplaats*	Bus type A	Bus type B
Tafel	*Individueel openklapbare tafel*	*Vaste tafel*
Vestaire	*Vooraan of achteraan de bus*	*Jashouder naast stoel*
Bagage rek	*Vooraan of achteraan de bus*	*Boven elke stoel*
Wi-Fi	*Betalend ongelimiteerd Wi-Fi*	*Gratis gelimiteerd Wi-Fi*
Stopcontact	*Gratis gelimiteerd energiegebruik*	*Betalend ongelimiteerd energiegebruik*
1. Welke beoordeling geeft u aan elk bus type?		

2) Gegeven bovenstaande omschrijving voor de bus als werkplaats **en onderstaande waarden (-/+) voor de categorieën**; welk bus type zou u kiezen voor een comfortabele busreis?
(waarbij **"+" = goed/voldoende aanwezig** en **"-"= slecht/onvoldoende aanwezig**)

Stopcontact	*Gratis gelimiteerd energiegebruik*	*Betalend ongelimiteerd energiegebruik*
1. Welke beoordeling geeft u aan elk bus type?		

2) Gegeven bovenstaande omschrijving voor de bus als werkplaats **en onderstaande waarden (-/+) voor de categorieën**; welk bus type zou u kiezen voor een comfortabele busreis?
(waarbij **"+" = goed/voldoende aanwezig** en **"-"= slecht/onvoldoende aanwezig**)

De bus als...	Bus type A	Bus type B
Toegankelijk vervoersmiddel	+	-
Zintuiglijk aangenaam vervoermiddel	+	-
Comfortabele zitplaats	-	+
Eet- en drink plaats	+	+
Ontspanningsplaats	-	-
2. Welk bus type zou u kiezen?		

3) Hoeveel bent u bereid maximum te betalen voor een bus met deze voorzieningen? Wetend dat de **standaard prijs** per busrit voor een **korte afstand** in Vlaanderen **1.00 euro** bedraagt.

3. Hoeveel bent u bereid max. te betalen voor het gebruik van het aangekruiste bus type?	

Vorige **Volgende**

De volgende **6 vragen** zijn van gelijke soort als de oefenvraag.

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De bus als... *toegankelijk vervoermiddel*	Bus type A	Bus type B
Ruimte staanplaats	*2 passagiers/m²*	*2 passagiers/m²*
Staanplaatsen	*Rugleuning*	*Rugleuning*
Aankondiging met	*Geluid: luidsprekers, microfoon...*	*Geluid: luidsprekers, microfoon...*
Aankondiging van	*Aankomst- en wachttijd, vertragingen*	*Voorzieningen, aansluitingen*
Fietsenrek	*Vooraan of achteraan de bus*	*Binnenin de bus*
1. Welke beoordeling geeft u aan elk bus type?		
De bus als ...	**Bus type A**	**Bus type B**
Zintuiglijk aangenaam vervoermiddel	-	+
Comfortabele zitplaats	-	+
Eet- en drink plaats	-	+
Werkplaats	-	-
Ontspanningsplaats	-	+
2. Welk bus type zou u kiezen?		
3. Hoeveel bent u bereid max. te betalen voor het gebruik van het aangekruiste bus type?		

Waarbij **"+" = goed/voldoende aanwezig** en **"-"= slecht/onvoldoende aanwezig**

Vorige **Volgende**

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The following five similar tables not represented here but equal to the previous table.

How to make the bus look sexy?

Deel 3 - Persoonlijke kenmerken

Tot slot worden nog enkele persoonlijke vragen gesteld om een duidelijk beeld te krijgen van de samenstelling van de onderzoeksgroep.

Wat is u geslacht?

- ○ Man
- ○ Vrouw

Wat is u geboortejaar?

Wat is u postcode?

Postcode

Beschikt u over een auto- of motorrijbewijs?

- ○ Ja
- ○ Nee

Vorige | **Volgende**

How to make the bus look sexy?

Deel 3 - Persoonlijke kenmerken

Wat is u hoogst behaalde diploma of getuigschrift?

- ○ Geen
- ○ Lager onderwijs
- ○ Lager middelbaar onderwijs
- ○ Hoger middelbaar onderwijs
- ○ Hoger niet-universitair onderwijs
- ○ Universitair onderwijs
- ○ Andere

namelijk:

Heeft u een beperking?

- ☐ Geen beperking
- ☐ Auditief
- ☐ Fysiek
- ☐ Visueel

Vorige | **Volgende**

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How to make the bus look sexy?

Zijn er voorzieningen in de bus die niet werden aangehaald in de enquête en die u van groot belang vindt voor een comfortabele busrit? Vb. een veiligheidsgordel.

Vorige | **Volgende**

Berg Enquête System © 2007 Design Systems

How to make the bus look sexy?

Heeft u nog vragen of opmerkingen met betrekking tot deze enquête?

Vorige | **Volgende**

Berg Enquête System © 2007 Design Systems

How to make the bus look sexy?

U bent hartelijk bedankt voor het invullen van de enquête. Voor een goed onderzoek zijn er echter veel deelnemers nodig. Door volgende link, http://vragen1.ddss.nl/q/Bus, naar vrienden en familie te sturen, wordt de enquête verder verspreid.

Alvast bedankt voor u tijd. U mag het venster sluiten.

Met vriendelijke groeten
Emilie Couwenberg
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Annex 10 - Values of the analyses

Frequency of travel	Frequency (n=592)	Percent (%)
4 days a week or more	106	17.9
1-3 days a week	108	18.2
1-3 days in the month	79	13.3
6-11 days in a year	103	17.4
1-3 days in a year	102	17.2
Less than one day in a year	32	5.4
Never	62	10.5

Average travel time	Frequency (n=592)	Percent (%)
<5 minutes	5	0.8
5-15 minutes	144	24.3
16-25 minutes	157	26.5
26-35 minutes	83	14.0
> 35 minutes	132	22.3
I never take the bus	71	12.0

Activities	Frequency (n=531)	Percent (%)
Working	17	3.2
Using a laptop	20	3.8
Competing a crossword / Sudoku	31	5.8
Playing a computer game	35	6.6
Studying	46	8.7
Making calls	52	9.8
Eating	60	11.3
Reading a newspaper	81	15.3
Drinking	82	15.4
Reading a book	90	16.9
Sleeping	91	17.1
Talking with other passengers	101	19.0
Get bored	162	30.5
Listing to the radio / music	226	42.6
Sending messages with mobile phone	337	63.5
Observe people	339	63.8
Looking around	425	80.0
Other	15	2.8

Bus characteristics (n=531)	1	2	3	4	5	Mean	Std. dev.
Reliability	49	144	209	118	11	2.81	0.954
Protection/security	37	121	179	165	29	3.05	1.017
Flexibility/independence	140	173	156	55	7	2.28	1.008
Easiness	42	125	198	149	17	2.95	0.980
Sociability	171	192	130	35	3	2.07	0.937
Environmental awareness	22	67	127	222	93	3.56	1.049
Pleasure	198	192	111	26	4	1.96	0.919
Rest and time for yourself	139	156	119	97	20	2.44	1.168
Stress	54	137	182	130	28	2.89	1.054
Sexy	407	93	26	1	4	1.31	0.643
Status	288	143	89	9	2	1.67	0.839
Speed	163	199	135	31	3	2.08	0.917
Challenge	250	124	101	48	8	1.95	1.076

Improvements	Frequency (n=531)	Percent (%)
Lighting	28	4.7
Workspace	50	8.4
Safety	67	11.3
Social security	79	13.3
Accessibility	82	13.9
Behaviour of a bus driver	119	20.1
Price – quality balance	121	20.4
Cleanliness of the bus	143	24.2
Quality of services	151	25.5
Seats	181	30.6
Travel comfort	212	35.8
Disruptive behaviour of other passengers	231	39.0
Current information and communication	309	52.2
Overcrowding	318	53.7
Other	31	5.2

Reasons to never take the bus	Frequency (n = 62)	Percent (%)
Unreliable	0	0
Uncontrollable	0	0
Unsafe	0	0
Uncertainty of a seat	0	0
Disruptive behaviour of other passengers	0	0
Too expensive	0	0
Uncomfortable	1	1.6
Large pre- and post transport	2	3.2
Movement with luggage	2	3.2
I have a company car	6	9.7
Pleasure of driving a car	8	12.9
House at a great distance from destination	9	14.5
Poor connection	11	17.7
No freedom of movement	15	24.2
Other	8	12.9

Money	Average total amount of respondents over all the choice tasks	Frequency (n=592)	Percent (%)
1.00 euro	1283	213.83	36.12
1.25 euro	742	123.67	20.89
1.50 euro	831	138.50	23.39
1.75 euro	206	34.33	5.80
2.00 euro	357	59.50	10.05
> 2.00 euro	133	22.17	3.74

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Travelers' preferences regarding the interior of public buses - Making the bus look sexy

Richting: **master in de mobiliteitswetenschappen-mobiliteitsmanagement**
Jaar: **2014**

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Voor akkoord,

Couwenberg, Emilie

Datum: **1/06/2014**