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Exploring new possibilities for user-centred e-ticketing

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Exploring new possibilities for user-centred e-ticketing

Analysis report, March 2013
OV-chipkaart Graduation Lab

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Challenge the future

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Contents

List of Abbreviations

AVM	Add-Value Machine
CBO	Central Back Office
CH	Clearing House
CICO	Check-in, Check-out
CPS	Central Processing Server
DPS	Depot Processing Server
EOD	Equipment Operating Data
NAL	National Action List
OVC	OV-chipkaart
POST	Point of Sales Terminal
PS	Permanent Structure
PTO	Public Transport Operator
PUD	Pick-Up Device
PVU	Personal Validation Unit
RSB	Routing, Signing & Branding
SDOA	Specification Document Open Architecture
SPS	Station Processing Server
TLS	Trans Link Systems
TVM	Ticket Vending Machine
VAL	Validation machine
VCF	Validator Concentration Feature
Wp2000	Wet personenvervoer 2000 ('Public Transport Act of 2000')
XPS	X Processing Server

List of Definitions

User/traveller. This research is concerned with the end-user or traveller. In most cases the term 'user' refers to a person performing actions with a card not related to travelling, for example: purchasing or bill payment. We will explicitly describe any other (professional) users if the report refers to them.

He/she. We use the masculine third person pronouns indiscriminately throughout the report and can be replaced by the opposite sex: 'he' can be 'she' as well.

Concession. A region wherein one operator has the time-limited monopoly on providing a certain transport service. Granted by an OV-authority and usually acquired through a public tendering process.

Subscription or season ticket. A ticket that is bought in advance of travelling and pays for (part of) future journeys taking place in a particular timeframe. Often used by frequent travellers to enjoy discounts.

OV-chipkaart system. The usage of the term system is reference to the collection of computer systems and hardware elements that are required to make travelling with the OV-chipkaart possible.

Travel product loading. Travel products are electronic (season) tickets one can register on a card. One can buy travel products online, at machines or service desks, and your purchase is only valid if you load them onto your card. One card can currently contain a maximum of 12 travel products.

Credit balance (auto) top-up. Travellers can purchase credit to store on their card, allowing them to pay for tickets. This can be done at machines or an OV-chipkaart can be linked to a bank account and automatically top-up if the balance drops below a pre-determined threshold.

Summary

The OV-chipkaart graduation lab of the TU Delft focuses on developing integral solutions for improving the usability of electronic ticketing for public transport in the Netherlands. The project is divided into two main phases. The analysis phase, in which the three students work together to analyse the OV-chipkaart system, and the design phase, in which three design solutions are developed. This report presentes the findings of the analysis phase.

The analysis is based on existing reports and qualitative research. We focussed on identifying usability problems, since the main aim of this graduation lab is to further improve the system. In order to improve it, technological and business considerations are taken into account, however the main focus lies on the human interaction with the OV-chipkaart system.

This project is supported by the Permanente Structuur (in formation), the provinces (IPO), city regions (SkVV), Rotterdam public transport operator (RET), Dutch railways (NS) and travellers association Rover.

Chapter 1: Introduction
The first chapter describes the scope and the relevance of the project. The aim of this report is to determine the (unused) OV-chipkaart possibilities and problems. The main focus is the perspective of travellers, but in order to come to a good overall user-centred product or service it is important to take into account the business and technology side as well. The Delft University of Technology has the expertise to design, test and improve complex systems such as the OV-chipkaart. Since this project aims at improving the usability of the OV-chipkaart this analysis is conducted qualitatively. According to Kvale (1983) qualitative research goes beyond a surface understanding of people and their interactions with products and services

Chapter 2: Literature review
Chapter two describes several theoretical concepts to understand users and their actions. Five concepts and theories on innovation and technology acceptance have been reviewed and form a basis for further research. These theories describe the importance of usability and perceived ease of use for users in adopting innovations.

The Action Model (Rasmussen, 1983) describes and explains the different ways people extract and understand information from a system. The model indicates that people will always try to lower the cognitive load required to operate systems by developing rules and skills.

The Diffusion of Innovation Model (Rogers, 1962) segments members of a social system into five categories based on their innovativeness, which follows a normal distribution: innovators (interested in new ideas regardless of geography), early adopters (localites who serve as role model), early majority (deliberate willingness in adopting innovations), late majority (adopts because of economic necessity or peer pressure), and laggards (resistance to innovations). The Innovation decision process (Rogers, 1962) makes clear that the usability of a product is one of the important factors in persuading a potential user to adopt an innovation.

The technology acceptance model (Davis, 1989) describes the various factors influencing the adoption of technology by users. Some of these are based on the capabilities and context of the user, and some depend on the technology one tries to implement. Improving any of the determinants will lead to a better use behaviour, but depending on the situation, some determinants have more impact than others.

And finally the understanding of technology-based-self-service as described by Meuter (2000) and Reinders (2008) helps companies to target different groups of customers, by stressing the advantages for each group. Eventhough technology based self services contain a lot of benefits for both companies and customers, companies have to be aware that they always have to provide an alternative solution to their customers and should not rely on technology-based self-services only.

Chapter 3: Analysis of the Dutch system

An understanding of the broader context, the history of the OV-chipkaart and the interests of the stakeholders involved, led to insights on the Dutch system in general. Desk research and expert interviews were used to outline the business, technology and user side of the system how it is now and how it got implemented.

During the 1990s, different operators started to develop a new electronic ticket with the (financial) support of the government. In 2001, the NS (national rail), GVB (Amsterdam), RET (Rotterdam), HTM (The Hague), and Connexxion (regional bus) formed the Trans Link Systems (TLS) joint venture in order to setup a national electronic ticketing system. On November 3, 2011 the new, national electronic ticketing system, the 'OV-chipkaart' took over from the 'Strippenkaart'. The OV-chipkaart is operated, used and influenced by a variety of stakeholders, which has great impact on the way usability problems get solved.

Chapter 4: OV-chipkaart usage

The insights gathered about the Dutch system led us to our own field research. Observations, interviews, questionnaire booklets and OV Loket complaints were used to understand the usage of the current situation. The findings are visualised in a customer journey map.

From the field research, it could be concluded that some of the travellers we have observed encounter usability problems with the OV-chipkaart that may prevent some users from accomplishing their task effectively, efficiently and with satisfaction. This possibly results in less satisfied travellers as possible and may decrease trust some people have in the OV-chipkaart and travelling with public transport. Three main problem areas could be identified.

The first research area occurs in the purchase and pre-travel phase, in which some participants in our study were not guided and supported well enough in order to enter the system easily and with satisfaction.

The second research area manifests itself at the point of check-in. Due to missing, inconsistent or confusing information, some participants were not able to identify whether they made a mistake. The system is not functioning according to their expectations and they are not able to solve their problem independently. This left some of our participants with an uncertain feeling about their further actions.

The third research area occurs at point of check-out or transfer. Some participants faced insecurity and the risk of a financial disadvantage. Some of the participants of our study were not completely aware of the operator they are coming from and/or going to and which validator belongs to which operator.

Chapter 5: International Examples

After the Dutch usage was mapped, two successful international e-ticketing systems were studied. An overview of the systems from London and Hong Kong is given, followed by the usage of the Oyster and Octopus cards. User observations, user and stakeholder interviews and personal travel experiences form the basis of the research. Both card systems are compared to the Dutch system based on the customer journey map. Based on the findings of these international examples, three possible focus areas are formulated in order to improve the Dutch situation.

Firstly, we conclude that the Dutch system requires alertness of the particpants that were either new or infrequent users of the system, especially when it comes to checking-in and checking-out, whereas both international systems support the traveller more actively in this action.

Secondly, we conclude that the Dutch system does not always support the traveller in his journey as much as it could. Even though the systems of London and Hong Kong do not work seamlessly in all aspects, the traveller is almost always in the position to ask the service personnel for help. This does not solve the underlying problem, but it actively supports the traveller by taking care of his problem immediately.

And thirdly, we conclude that the purchase of an OV-chipkaart is a more demanding task in the Netherlands than it is in London or Hong Kong. Mostly complicated by the fact that there are more transport operators and season tickets in the Netherlands.

Chapter 6: Conclusions

In the current situation, the service travellers receive does not always meet the level of service they would like or expect to receive. The current situation is characterized by a higher degree of uncertainty for certain users than is necessary. In addition, some travellers make errors without being aware of it, because of insufficient information and support.

A better situation for travellers would be one that does not require alertness too much. Travellers need a system that enables them to take care of their own situation and that reduces their internal insecurity. The findings of the studies lead to a final customer journey map showing the expectations of travellers and the preferred situation.

We identified three gaps based on research in the Netherlands, Hong Kong and London. These gaps show the discrepancy between user expectations and user experience.

Firstly, purchasing the OV-chipkaart is relatively cumbersome in the Netherlands; not all users feel seduced by the possibilities the OV-chipkaart offers. Not wanting to own and use an OV-chipkaart in combination with sometimes weak guidance and support, makes the system adoption more difficult than it has to be. Design brief one, therefore, focuses on how to improve the adoption by simplifying the system entrance and by increasing the value of the OV-chipkaart for the user.

Secondly, users are not always able to solve their problem at the touchpoint where they encounter an error. The system can provide inconsistent or confusing information. Users are directed to Internet or have to find their way to staff at service desks or call centres. Self-service does not always enable users to take care of their own situation. An improvement on supporting travellers in using the OV-chipkaart during their journey is therefore required (design brief two).

Thirdly, users of the Dutch system only have access to information concerning their OV-chipkaart at points of interaction with the system (validator, ticket vending machine, etc) or some time after the transaction took place via their online account. Check-in and -out, and expense

information is not easily available during travelling and this causes some people to feel insecure. Design brief three plans to address this lack of card transaction information during travelling.

Outlook

In the upcoming design phase, the students will not try to tackle all identified usability problems. Each student will focus on a specific theme, which corresponds with the individual competences best. The three solutions will contribute to the integrated design solution in order to improve the travellers satisfaction.

The themes are:

- 'Improving system adoption of the OV-chipkaart'

- 'Support travellers during their journey'

- 'Making the invisible visible'

1   Introduction

The TU Delft OV-chipkaart graduation lab focuses on developing integral future solutions for user-centred electronic ticketing (e-ticketing) used by public transport in the Netherlands. During nine months, three Master of Science students from the faculty of Industrial Design Engineering identify which usability problems travellers encounter and develop solutions to solve these problems. This report does not provide a balanced overview of positive and negative aspects of the OV-chipkaart system, but focusses on the problems related to usability. In the first four months, from September to the end of December, the students analysed the Dutch context, studied users and international examples and combined these insights in order to formulate three individual design briefs. This report summarises this first phase (see Figure 1). The solutions generated within the graduation lab will look three, five and ten years into the future and take into account the existing infrastructure, positions of the different stakeholders and the benefits for the traveller.

Important stakeholder groups are: public transport operators, governments, and consumer organisations. However, not all OV-chipkaart parties were able or willing to support this research effort and we have tried to understand their role with the help of experts.

This project is supported by the Permanente Structuur, the provinces (IPO), metropolitian areas (SkVV), Rotterdam public transport operator (RET), Dutch railways (NS) and travellers' association Rover.
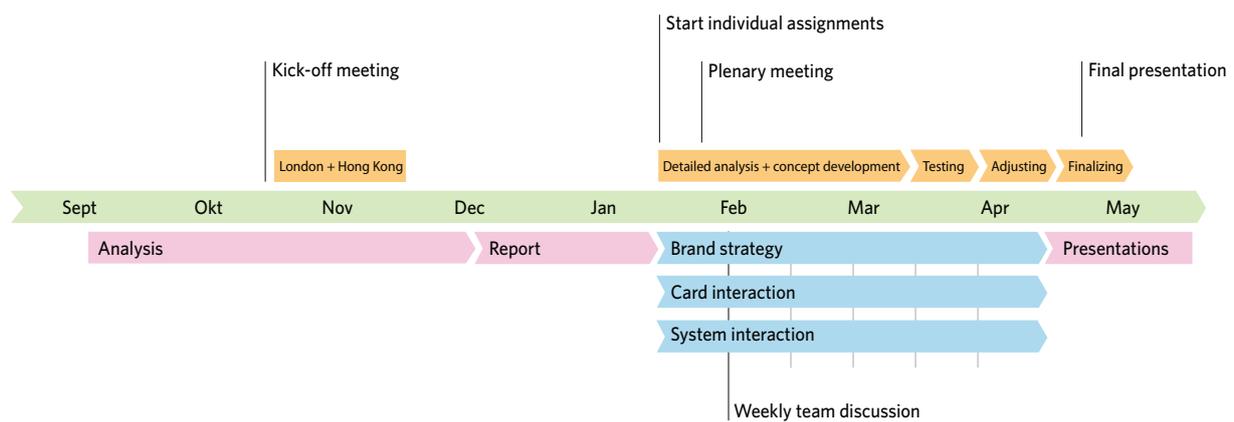

Figure 1: Timeline of the entire project.

Relevance

Public transport fulfills an important role in the Netherlands. The Dutch Government values the effect public transport has on area accessibility, impact on liveability, participation of citizens in society, and the support for economic activity (CPB & KiM, 2009). Electronic ticketing influences many aspects of public transport usage and has an effect on the decision making process of prospective customers. It is therefore important to make e-ticketing as easy and pleasant to use as possible.

The Delft University of Technology has the expertise to design, test and improve complex systems such as the OV-chipkaart. As a public university it also has the responsibility to apply this expertise to a system of this importance to Dutch society, which it does in various forms, such as this graduation lab.

Problem statement

We observe that some travellers have problems with understanding how to use the OV-chipkaart, with overseeing the consequences of their actions and at times lack the knowledge of the requirements for obtaining an affordable valid ticket. This can increase insecurity for some travellers and cause stress, discouraging public transport usage by some people.

Vision & Mission

We envision an OV-chipkaart system that is easy to understand, helps the traveller with their journey, and sets the worldwide standard for ease-of-use public transport ticketing.

The mission of our project is to improve the OV-chipkaart e-ticketing system to such a degree that Dutch people when travelling abroad will share proud positive stories about it.

1.1 Method

1.1.1 Aim

The aim of this report is to determine the (unused) OV-chipkaart possibilities, and problems. The main focus is the perspective of travellers and the identification of elements that could be improved for them. In order to come to a good overall user-centred product or service, it is important to take into acount the business and technology side as well. The three factors are of great influence on product, service and product-service development. As Figure 2 illustrates, the three circles overlap with each other and form one sweet spot where business considerations, user needs and wants, and technological requirements are equally taken into account. Human-centred design, as described by IDEO (2009), starts with investigating what is desirable for the users, and thereafter investigating what is technically feasible and viable for the organization involved.
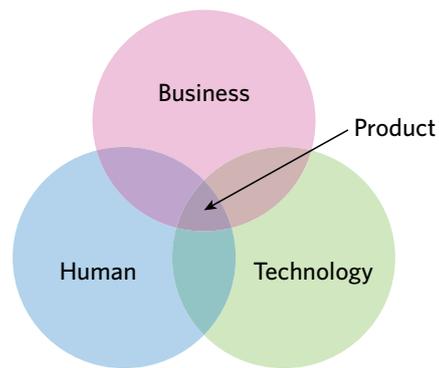
Figure 2: Technology, Business and Human, as visualised by IDEO (2009)

1.1.2 Research questions

The questions cover the three areas mentioned before: user, business and technology.

Questions related to the users of the OV-chipkaart; the travellers:

- What are relevant properties of travellers?

- What is the traveller group segmentation?

- How do travellers experience the OV-chipkaart, what causes this?

- What touchpoints do travellers encounter?

The organisational and business side:

- Who are the stakeholders and what are their interests?

- What were, and are, the roles of the stakeholders during development, implementation and management of the system?

Technology:

- How does the OV-chipkaart system work?

- How does the OV-chipkaart compare to other e-ticketing systems?

- How does the technology influence usage?

- What are the technical opportunities and restrictions?

1.1.3 Methods

In order to answer these questions we interviewed experts, visited testing facilities, conducted field research, interviewed users and studied literature.

Qualitative Research

The conducted analysis is based on qualitative research. Instead of collecting a lot of data and to create statistics, this research aims at collecting rich insights and understanding the thoughts, expectations, attitudes and processes of people. These insights are obtained by talking to people, observing them in their natural behaviour, conducting semi-structured interviews, and by interpreting textual material (Malterud, 2001). Qualitative research aims at partial understanding of a certain phenomena and developing more questions while conducting the research (Kvale, 1983). Following this approach, the researcher gains deeper understanding of the latent knowledge and understands what people know, feel and dream (Sleeswijk Visser, 2005). Whereas quantitative research aims at obtaining as many descriptions as possible in order to gain data, qualitative research aims at collecting rich data about the studied interaction (Kvale, 1983).

Possible problems with qualititative research may include interview bias, leading questions, wrong analysis of the data and skewed interpretation meaning. However, qualitative research goes beyond a surface understanding of people and their interactions with products and services (Kvale, 1983).

Literature argues, that a deep understanding of the people who will ultimately use the product (or service) is required in order to design a product that serves their needs, satisfies their expectations and provides them with a pleasant experience (Jeffries and Miller, 1998 as cited in Kanis, 1999 & Sleeswijk Visser, 2009). Furthermore, literature suggests that quantitative data provides useful information such as performance, time and total number of errors (John, 1998 as cited in Kanis, 1999) but is not supporting designers in creating usability-focused design (Kanis, 1999).

Since this project aims at improving the usability of the OV-chipkaart, this analysis is conducted qualitatively.

2   Literature review

The goal of this report is to provide an analysis of problems people could experience, and how people understand and use the OV-chipkaart. We distinguish several aspects that determine the understanding and use: how the product is distributed, why people accept the product, how people understand the product, and how people experience the product. Relevant literature on these topics describes innovation diffusion, technology acceptance, mental models and self-service. These theories are explained and summarised in this chapter.

2.1   Usability, Interaction, Experience

To capture the relationship a user has with a product, three terms are regularly used: usability, interaction and experience. While there are many slightly different interpretations of these terms, this project will use the International Organization for Standardization's (ISO) definitions.

> *Usability*: The extent to which a product can be used by specified users to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use (ISO, 2008a)

This definition makes clear that a product will not have the same level of usability for all users and in all situations. Usability is thus always discussed in relation with the context of usage and the user. The work of Constantine & Lockwood (as cited in DePaul University, 1999) adds two other factors that influence usability: learnability and retainability.

> *Interaction*: Bi-directional information exchange between users and equipment (ISO, 2008b)

User input and machine response together form an interaction. Information exchange may also be in the form of physical actions and sensory feedback.

> *Experience*: A person's perceptions and responses that result from the use or anticipated use of a product, system or service (ISO, 2010)

The perception and response are formed before, during and after use.

2.2   Mental Models

People try to understand products and predict interactions by developing "small-scale models" (Craig, 1943) of them. This helps people understand particular domains (Gentner & Stevens, 1983, p. 1) and mentally rehearse actions before executing them (DePaul University, 1999). These mental models are often based on pieces of evidence and people sometimes confuse correlation with causation, or make other deductive errors (Norman, 2002, p. 38). By applying and evaluating these mental models, people are able to refine and adapt them, bringing their model closer to reality (Norman, 2002, p. 38; DePaul University, 1999). Important is that while there might be only one way something is possible, different people will have a different understanding of how that something works.

Rasmussen (1983) describes an action model that explains the different ways people extract and understand information from a system (see Figure 3, as used by Kim, 2012). People can perform simple interactions by applying skills they have. If the situation requires a higher cognitive level of action, when a person cannot apply a skill, the person has to identify the problem and context and solve it with rules and mental models learned through experience in other situations or provided by instructions. This allows for product operation without knowing the underlying principles. If the rule-based approach also fails, the person has to reason based on principles, which requires more effort. Rasmussen indicates that people will always try to lower the cognitive load required to operate systems by developing rules and skills. People do not need to have a full understanding of how something works to effectively use it (Norman, 2002).

Interpretation	Evaluation	Knowledge
Identification	Procedure	Rule
Observation	Execution	Skill
Input		Output
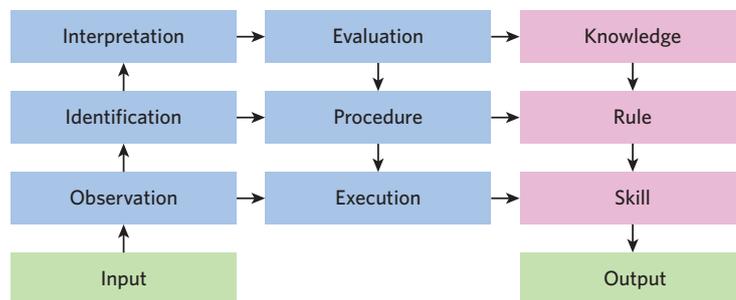
Figure 3: Action model (Rasmussen, 1983)

Concluding, the theory behind mental models explains why people will quickly (and sometimes wrongly) assume how things work and act based on that believe. The action model shows how people will try to find the lowest possible cognitive level of action. It predicts that products and services will need to have as many skill-based actions as possible, to increase user acceptance.

2.3   Diffusion of Innovations

Diffusion of Innovations is a theory popularised by Everett Rogers (1962) about how, why and at what rate innovations spread through cultures. Rogers identified four elements that influence diffusion: innovation, communication channels, time, and social system. As Rogers wrote: "Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" (1995, p. 5). Here, innovation is an idea, practice or object. Communication channels are the way information about innovation spreads between people. Time is the duration innovation needs to spread. And the social system determines how innovations are diffused, who diffuses innovations and the norms that are applied to innovations.

According to Rogers (1995, p. 161), the adaption of new ideas happens through the innovation-decision process (Figure 4). One first acquires knowledge about a new idea, then forms an attitude towards that idea and is persuaded, the person then decides to adopt or reject said innovation, implements this new idea, and confirms this decision. This five-step process is how people deal with the uncertainty of deciding what to do with a new idea.
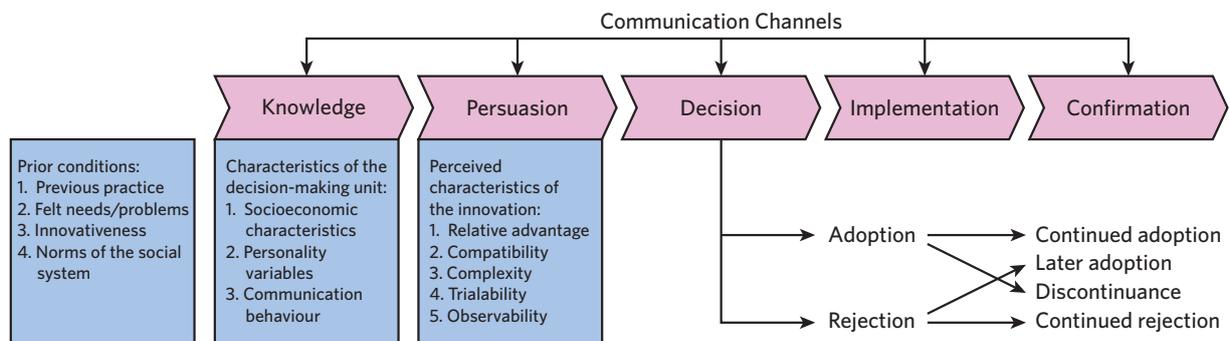
Figure 4: Innovation-decision process (Rogers, 1962)

The innovation-decision process is optional, collective or made by an authority. Optional innovation-decisions can be made independently by an individual, collective decisions are made by consensus, and authorities often have the power to make a decision for other people (Rogers, 2003, p. 28). Innovation decisions taken by authorities generally have the highest rate of adoption, but members may circumvent them during implementation (Rogers, 2003, p. 29).

The relative speed with which innovations are adopted differs wildly, from days to centuries. Generally, the adoption "is measured as the number of individuals who adopt a new idea in a specified period" (Rogers, 2003, p. 206). The reason the adoption rate differs between innovations can be explained based on perceived attributes of an innovation (Rogers, 2003) or the characteristics of adopter categories (Rogers, 2003, p. 204).

Innovations have five attributes: relative advantage over existing ideas; compatibility with values, needs and experiences; complexity hinders adoption; easy trialability let's people experiment on a limited basis; and observability of the results of the innovation (Rogers, 2003, p. 15).

Rogers (1962, p. 150) segments members of a social system into five categories based on their innovativeness, which follows a normal distribution: innovators (interested in new ideas regardless of geography), early adopters (localites who serve as role model), early majority (deliberate willingness in adopting innovations), late majority (adopts because of economic necessity or peer pressure), and laggards (resistance to innovations); see also Figure 5. Additionally, a social system has gatekeepers (institutions or persons controlling information flow) and opinion leaders (people with the ability to influence other people's opinions), and is influenced by change agents (people bringing innovations from other social systems) (Rogers, 1995, p. 335). The key is that these categories of adopters do not adopt an innovation at the same time, have different thresholds for participation, have different levels of influence, and require different means of adoption persuasion (Rogers, 2003).
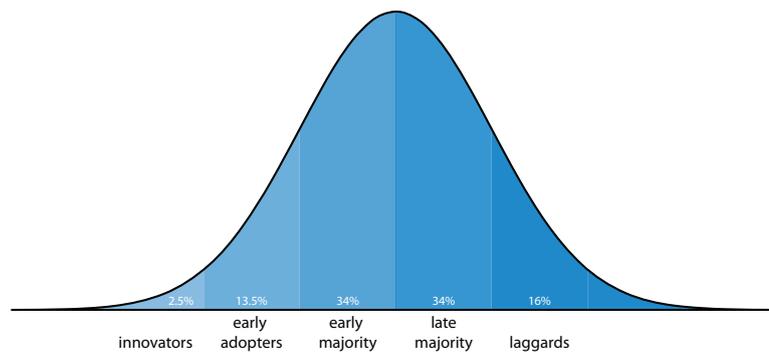
Figure 5: Adopter categories as percentage of the population

Concluding, the Diffusion of Innovations model describes the innovation-decision process and indicates several conditions of innovation acceptance. The prior conditions need to be met, knowledge characteristics need to fit and persuasion parameters need to be positive. Furthermore, it matters who takes the innovation decision. All these determinants together influence the adoption rate.

Quicker adoption is achieved with a decision taken by an authority to implement a innovation that meets previous practice, solves an existing problem, fits the social norms, is affordable, clearly communicated, has an advantage over other solutions, is compatible with existing systems and behaviour, is easy to understand, easily tried and produces observable results.

2.4 Technology Acceptance Model

The Technology Acceptance Model (TAM) describes the various factors influencing the adoption of technology by users (Davis, 1989; Davis et al., 1989). The model is based on the Theory of Reasoned Action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and expanded by Venkatesh (2000), Venkatesh & Davis (2000), and Venkatesh & Bala (2008).

Acceptance of technology has been an active area of research in the last decades, because technology has become a bigger part of people's lives and major implementation and adoption barriers still exist (Venkatesh & Bala, 2008). By understanding the factors behind acceptance, organisations can identify adoption barriers during the design and development phase and accommodate for these during either development or implementation (Venkatesh & Bala, 2008). Especially interesting are the product related determinants (output quality, job relevance, result demonstrability), and the anchors and adjustments which are influenced by design (perceptions of external control, perceived enjoyment, objective usability).

Note: dashed arrows are determinantes influenced by experience with the system
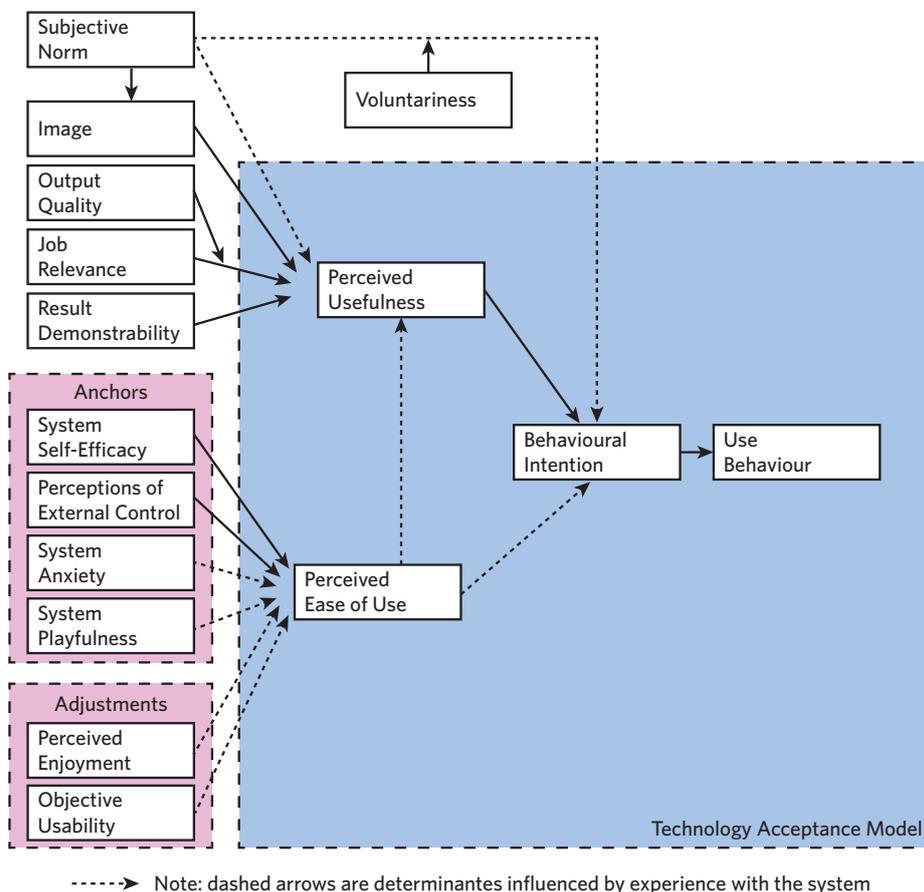
Figure 6: Technology Acceptance Model 3

According to Davis et al. (1989), Usage Behaviour is influenced by Behavioural Intention, which in turn is determined by two beliefs: Perceived Usefulness and Perceived Ease of Use. These two beliefs are anchored and influenced by several determinants, as described in the third revision of the model; visualised in Figure 6 (Venkatesh & Bala, 2008). While these determinants are clearly defined (see Appendix A), a large part of their influence is based on their specific implementation (Lee, et al., 2003). These determinants have been validated in several studies, as discussed in Venkatesh & Davis (2000) and Venkatesh & Bala (2008).

The original Technology Acceptance Model was developed and tested with the adoption of microcomputer technology in businesses in mind, but subsequent revisions and adaptations have generalised the model and it has been adapted to other technology systems. For example, the work of Hong & Tam (2006) applied TAM to personal multipurpose information appliances and Pikkarainen et al. (2004) applied TAM to personal online banking.

Concluding, TAM describes the different determinants that influence use behaviour. Some of these are based on the capabilities and context of the user, and some depend on the technology one tries to implement. Improving any of the determinants will lead to a better use behaviour, but depending on the situation, some determinants have more impact than others.

2.5 Technology-Based Self-Service

Technology-Based Self-Services (TBSS) are increasingly used by companies in order to serve individual customer needs better and to increase their brand value, differentiate from competitors and to save costs. Since a growing number of users nowadays interact with such Self-Service-Technologies (SST) extensive research has been done on the perceived service quality (Curran et al., 2003; Dabholkar, 1996; Meuter et al., 2000; Reinders et al. 2007; Reinders et al. 2008). SST can be applied in multiple ways, such as automated teller machines, package tracking services, or the OV-chipkaart. According to Meuter et al. (2000) these technologies are a critical component of customer-firm interactions and will be increasingly important for long-term business success. The technology replaces the interaction with a company's employee, which makes this new interaction a crucial part of the resulting customer satisfaction. Each interaction that takes place between the company and the customer is a chance for the company to sell itself and to satisfy the customer, no matter whether this interaction is real (between two people) or virtual (human-machine-interaction). According to Bitner et al., Parasuraman proposed in 1996 to extend the Service Marketing Triangle (Figure 7) with a fourth dimension 'Technology' to a Service Marketing Pyramid (Figure 8). Self-service technologies replace the personal interaction by enabling the customer to carry out a certain service without the direct involvement of an employee of the company.

Company

Employees   Customer
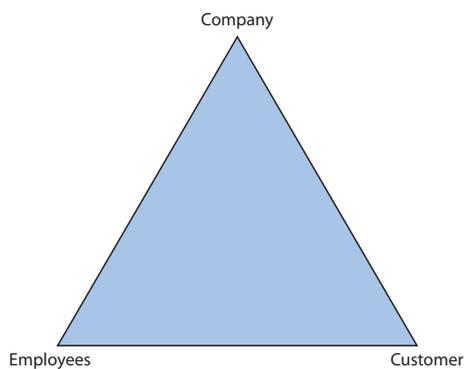
Figure 7: Service Marketing Triangle

Company

Technology

Employees   Customer
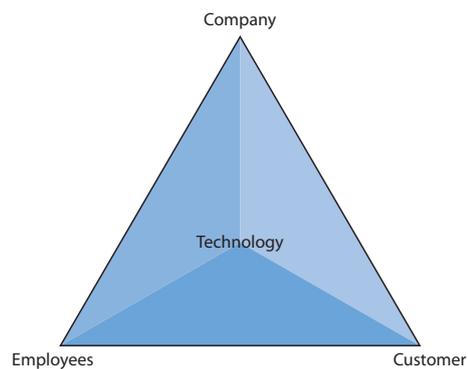
Figure 8: Service Marketing Pyramid

If well-designed, SSTs deliver advantages to the company and its customers as well. Reinders et al. (2007) summarized the advantages for the company and the customer as researched in multiple studies (Curran et al., 2003; Dabholkar, 1996; Meuter et al., (2003). According to them, the main advantages for the company are: the speed of delivering a certain service, preciseness and level of customization, cost savings, competitive advantage, constant quality, and more flexibility in time and space where the service is available. The biggest advantages for the customer are: ease of use, time saving, availability, feeling of independency, more control, and cost savings.

Sometimes customers are forced to use Technology-Based Self-Services, if there is no other option to fall back on other available services. In the case of the OV-chipkaart, this is the case at smaller train stations or bus stations where no service personnel are present or at times when the service desks are closed. Reinders (2008) states that a limited choice of service delivery may result in negative effects and goes on in saying that 'imposing an innovation on consumers results in resistance towards the innovation'. Furthermore literature points out, that previous experiences with TBSS have a positive effect on the attitude towards new technologies and their usage. According to a study by Langeard from 1981, which Meuter et al. (2000) refer to in their article, customers who are more willing to use SST tend to be 'younger, single, better educated and have a lower income'.

In order to use a SST successfully, it is crucial for companies to understand which factors cause dis/satisfaction. The research of Meuter et al. (2000) identifies three factors that trigger satisfaction and four factors, which trigger dissatisfaction. According to them, the most important factor of satisfaction is that customers evaluate the TBSS as 'better than the alternative'. This means, that customers appreciate the availability, the ease of use, the time and money saving factors. These factors correspond with the mentioned findings of Reinders et al. (2007). The most important factor for dissatisfaction is technology failure. This factor includes situations in

which the user is prevented from using the TBSS. Solving the problem, by following a different approach, will incur a cost for the service provider. However, a successful problem recovery in such a situation is satisfying to customers (Meuter et al., 2000 referring to Tax et al., 1998).

In case customers do not have an alternative to the SST and are forced into TBSS their attitude towards the service provider is negative and their evaluation is likely to be affected as well (Reinders et al. 2008). However, according to Chang (2006) their feeling of having no choice of freedom is somehow recovering when they are provided with a recovery option in case of service failure. The study of Reinders et al. (2008) further points out that the evaluation gets more positive, when users of the TBSS in case of service failure are provided with a 'fall-back' option in the form of an employee. Finally, it can be stated that users with more experience of TBSS are generally more positive towards the TBSS. However, they are not towards the service provider.

SSTs are increasingly important to companies and offer a lot of potential. However, the user has to be taken into account when developing such a system. In the case of the OV-chipkaart, one can conclude, that the service also has to offer advantages for the user, such as cost saving, more control and a feeling of independency. Apart from that, a forced situation should be avoided and service personnel should be more available as an 'escape-solution' for users of the system.

Concluding, the TBSS theory predicts that people will enjoy using SST if it offers ease-of-use and saves time and money. SST will help companies to reach different users, offer a better product and at lower costs. Forcing users to adopt to SST might cause dissatisfaction and a negative attitude.

2.6   Conclusion

The theories presented in this chapter help to understand how people decide to use innovations, accept technology, and understand products and services.

All theories have recurring variables a company can control: the design of the product (functionality and how it works), usability of the product, support it offers with the product and (to a limited extend) user knowledge about the product. Parameters one cannot control directly are the personalities, capabilities and socioeconomic characteristics of users.

The theories also point out specific areas of attention. Diffusion of Innovation theory says that an innovation-decision taken by an authority will be accepted at a higher rate, though it predicts that user may try to circumvent the implementation as well. The Technology-Based Self-Service theory warns that forcing users to switch to self-service technologies without offering an alternative, will cause a negative attitude towards the provider. One has to balance the

preferred rate of acceptance with the ability to endure negative user attitudes, possibly solved by bearing the cost of providing extra support (during transition) and in case of service failure.

Finding new possibilities for user-centred electronic ticketing has to take into account the different models explaining technology acceptance and satisfaction.

3

3 Analysis of the Dutch system

The Dutch electronic ticketing system is embedded in complex structures of the public transport sector. These structures are formed by decisions in the past, the interests of the stakeholders and travellers. This chapter gives an overview of the system: its history, stakeholders and the system architecture. Besides these topics, an overview is given of various studies concerning the possibilities and use cases of the OV-chipkaart.

3.1 Method

3.1.1 Aim

To get insights into the OV-chipkaart system as it is now, three areas are looked at: business, technology and users. These three factors are of great influence on product, service and/or product-service development. As Figure 9 illustrates, the three circles overlap with each other and form a sweet spot where business considerations, user needs and wants, and technological requirements are equally taken into account. Human-centred design as described by IDEO (2009) starts with investigating what is desirable for the users, and hereafter is investigating what is technically feasible and viable for the organization involved.

Our aim within this chapter is to investigate these business interests, how they might have changed over time, and how the OV-chipkaart is set-up technically. Since our overall goal is to make the OV-chipkaart easier to use for users, this chapter also aims at investigating what studies have been done already in order to undercover how the usage of the OV-chipkaart can be improved for travellers.
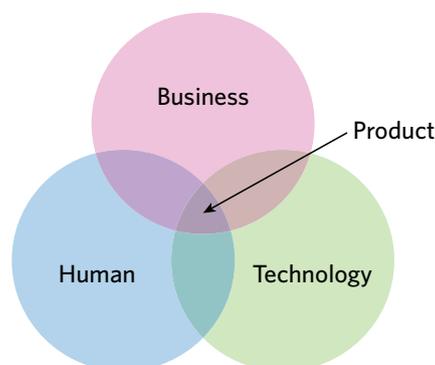
Figure 9: Technology, Business and Human, as visualised by IDEO (2009)

3.1.2 Research questions

- What were the main drivers for the implementation of the OV-chipkaart?

- What are the roles of the parties involved in the OV-chipkaart?

- How was the OV-chipkaart implemented & introduced?

- What is the technical basis of the system?

- What did travellers encounter during the use of the OV-chipkaart in the past years?

- Which studies have been conducted in order to improve the usability?

3.1.3 Methods

In order to gain insights and to create an understanding of the context, stakeholder interviews were done, literature was studied, newspapers, and 'Eindbeeldstudies' were used to complete this first analysis.

In order to get a better understanding of the stakeholder context and the usability of the OV-chipkaart, interviews were done with both stakeholder representatives and users. For all interviews a semi-structured approach was used (Schensul, 1999; Drever, 2003). The interviews were prepared in advance, key questions were formulated in order to guarantee that all topics of interest were covered during the interview. While doing the interview the interviewers were free to ask additional questions to get more in depth information.

During the stakeholder interviews one of the students was the main interviewer, whereas the other two students were taking notes. All students had the possibility to ask further questions at the end of the interview. By following this approach, the interviewed person had one primary person to respond to, which made the interview more natural. A summary of each expert interview can be found in Appendix B.

Literature research provided a basic understanding of the system, the context, and the current state of art on this topic. By reading reports and articles, key players could be identified, further literature was found and the first research questions could be formulated.

Modality	Travellers	Government
Automobile	22	4
Train	8	16
Bus, tram, and metro	11	32
Taxi	22	47

Table 1: Average expenditure per kilometre travelled in euro cents (2007). Included are vehicle procurement, vehicle operation, and investment in and maintenance of infrastructure (CPB & KiM, 2009).

3.2 History of the OV-chipkaart

The development of the OV-chipkaart is linked to the way Dutch public transport and politics works. This part explains the history, governance and e-ticketing.

3.2.1 Dutch public transport

In 2006, the Ministry of Infrastructure commissioned its research institute, *Kennisinstituut voor Mobiliteitsbeleid* (KiM), to document the benefits of public transport. The CPB Netherlands Bureau for Economic Policy Analysis joined this effort and they released their report in 2009. Key findings are summarised in the following paragraph to give an overview of the Dutch public transport situation.

Every day, over 1 million people use public transport in the Netherlands, and public transport makes up 5 percent of all trips and 11 percent of all distance travelled. Half of all distance travelled by train, and two-thirds of all distance travelled by bus, tram and metro, is for commuting to work or school purposes. 40 percent of all commuters travelling more than 10 kilometres to five large cities use public transport. On average, of all distance travelled, about a quarter is done with a student season ticket held by over 600,000 students and payed for by the Ministry of Education.

In the 1970s, many public bus operators were making losses because of the increasing competition with cars and the national government decided to subsidise these operators (Minister of Transport, 1979; KpVV, 2010; and see Table 1 for the average subsidy per modality) in return for price setting authority (Minister of Transport, 1979). Eventually, this led to the national tariff system in the 1980s, which was based on a national zoning scheme and a national ticket called the 'Strippenkaart' (Minister of Transport, 1979). The national tariff and ticket were express wishes of Parliament, in order to make it easier for people to travel around the country without having to purchase unique tickets for separate operators (Minister of Transport, 1979).

Before boarding a vehicle (bus, metro, tram, some trains), travellers would buy a Strippenkaart at an operator kiosk, supermarket, tobacconist, tourist office, or other general point of sale with 2, 3, 8, 15 (see Figure 10) or 45 payment units. When entering the transport vehicle, the passenger would determine the station he or she wanted to go to and accordingly stamp the amount of zones one had to cross plus one extra stamp to cover the base rate.

Figure 10: Strippenkaart

Transport operators and their concessions

January 2013

- Arriva (Deutsche Bahn)
- Connexxion (Transdev/BNG)
- Hermes (Connexxion)
- Qbuzz (deels NS)
- Syntus (Keolis)
- Taxicentrale Renesse
- Veolia
- EBS (Egged Group)
- GVU (Connexxion)
- GVB
- HTM
- HTMbuzz (HTM/Qbuzz)
- RET

**Kennisplatform
Verkeer en Vervoer**
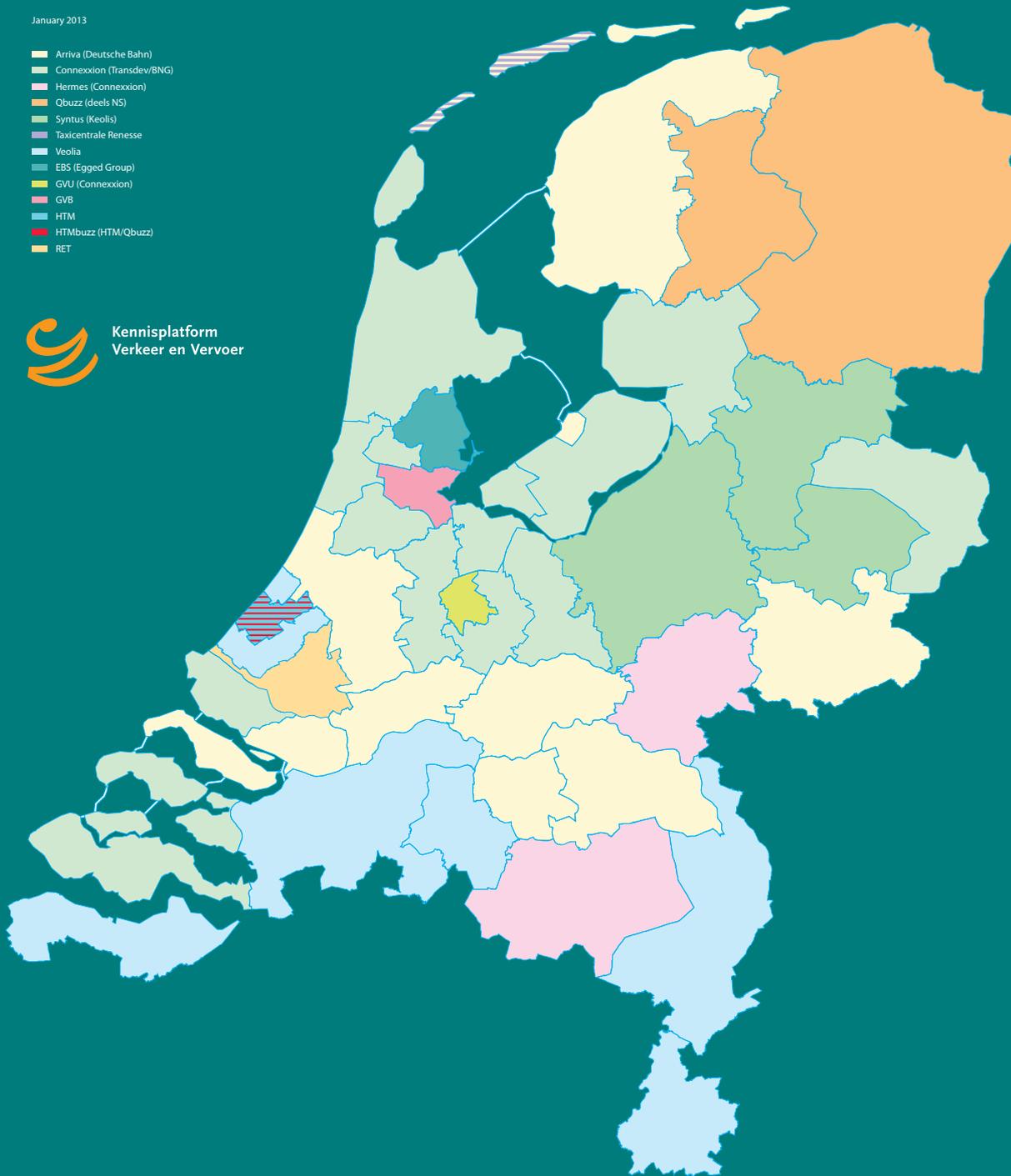
Figure 11: Map of the concessions (except national rail) in the Netherlands per January 1, 2013 (KpVV, 2012)

Revenue from the Strippenkaart was divided by the government over the individual operators based on a sales and usage survey. Nearly all operators were convinced that they were receiving less money than they should, because of flaws in the surveys or other operators trying to influence the survey results.

To mitigate this lack of reliable data, the Ministry of Transport unsuccessfully tried to replace the paper Strippenkaart with a magnetic stripe card in the late 1980s. Passengers would pay by swiping their card when boarding the vehicle and this would provide operators with detailed and up-to-date information about number of travellers and how much revenue they should receive. This magnetic stripe card replacement turned out to be too expensive (over 300 million guilders, or 135 million euro), resulted in unacceptable long boarding times, and the technology was deemed not secure enough. The project was ended after the test period (Leeuwarder Courant, 1989).

3.2.2 Decentralisation of public transport governance

At the beginning of the 1990s two state owned corporations operated national public transport: NS ran trains and VSN operated regional busses. City-owned corporations covered public transport for most of the (larger) cities. During this decade, operator losses kept growing and the government had to increase the subsidies (KpVV, 2010). Parliament decided to liberalise and decentralise the public transport market in order to make it more efficient and effective, and ultimately financially healthy and self-sustaining.

Now, instead of the Ministry of Infrastructure in The Hague having the last word on which regional transport lines are necessary, regional government has the responsibility of ensuring there is reliable public transport. The Public Transport Act of 2000 ('Wet personenvervoer 2000' or Wp2000) requires regional public transport authorities to tender transport concessions, with exception of the national rail network and the concessions of Amsterdam, Rotterdam and The Hague (see Figure 11). Operators can acquire a concession by offering the lowest-price, high qualtiy or a combinatoin of these two.

Each concession is tendered again every 4 to 15 years, dependent on regulatory requirements or regional government plans (European Commission, 2007, p. 6; KpVV, 2011, p. 28). The duration tends to become longer for bus concessions, due to big investments of the transport operators. In case an operator loses a concession, their operating personnel will be taken-over by the company which won the contract. Most operating equipment is owned by each respective company and is generally not taken-over but sold at the second hand market, mainly abroad (Heide, 2009).

The Public Transport Act excludes companies with a market share large than 50 percent from tenders and VSN thus decided to split-up into two companies in 1998 (Trouw, 1998). One part continued under the name 'Connexxion' and the other part was divided again and sold to different (foreign) buyers.

3.2.3 Electronic ticketing

While the magnetic stripe card did not work as a replacement for the paper tickets, operators still wished to replace the national tariff system with something that gave them direct control over fare payment and insight into traveller behaviour. During the 1990s, different operators continued development of new electronic tickets with the (financial) support of the government (see Figure 12). Arriva ran a pilot in 1997 with the 'Tripperpas', a system based on RFID and similar to the OV-chipkaart. Travelllers were satisfied but the national government did not make a decision because the NS was already working on their own plans.

1984 Test with magnetic card

1992 NS pilot with a chip card

1997 Test with 'Tripperpas' by Arriva

2001 TLS is established

2004 First implementation OV-chipkaart at RET

OV-chipkaart

1980   1990   2000   2010   2020

1982 - 2011 'Strippenkaart'

2000 Wp2000 act is signed
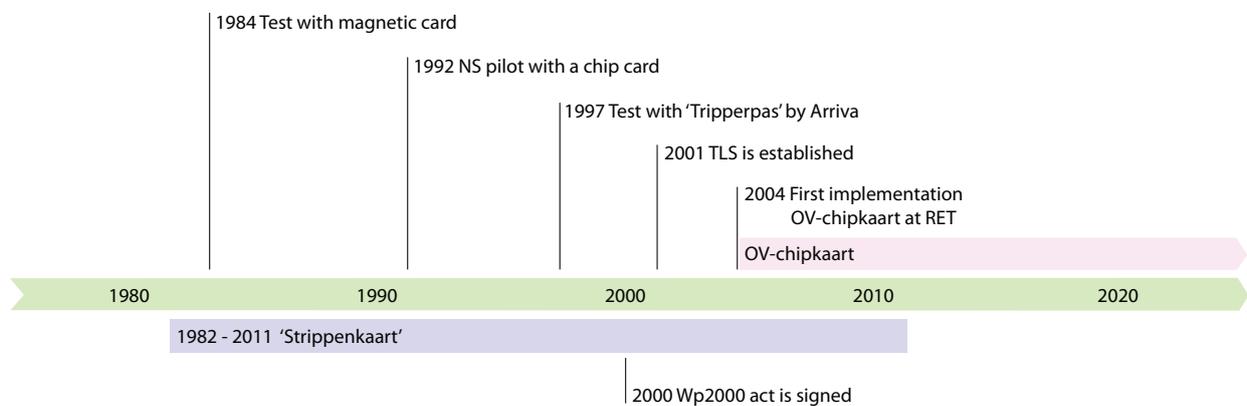
Figure 12: Dutch ticketing in the last 30 years.

After seeing the successful introduction of contactless electronic tickets in Hong Kong, the NS decided in 1999 it was time to look into Radio Frequency Identification (RFID) technology (Zwan, 2011). A smart card system could not only be used as a payment system, but also solve some long-standing issues. The most important problems were the insecurity at stations and trains, and fare evasion. By placing gates at the entrance of stations and giving keys (smart-cards) to travellers, the solution for these two problems was now at hand.

In 2001, the NS (national rail), GVB (Amsterdam), RET (Rotterdam), HTM (The Hague), and Connexxion (regional bus) formed the Trans Link Systems (TLS) joint-venture in order to set-up a national electronic ticketing system. These shareholders together provided 80 percent of all public transport at that time (TLS, n.d.). While the magnetic stripe card was developed by

the national government, this time around the operators were in charge of development. Partly because the government had bad experiences with large information technology projects in the past and partly because the operators had a direct incentive to develop a new system. The national government did set-up 13 functional requirements, determining the minimum scope of the system (CVOC, 2004).

In 2003, the East West Consortium, consisting of Accenture, Vialis and Thales, won the tender to develop this new electronic ticketing system for TLS (n.d.). The most important sub-contractor of East West was MTR, the company that developed the e-ticketing system for Hong Kong (TLS, n.d.). The convincing factor to select East West was that the system in Hong Kong was developed, implemented and managed by the transport operator; the same requirements that were set for the Dutch market. Testing began in Rotterdam with RET at the end of 2004 and interoperable testing commenced between RET and Connexxion in Rotterdam in April 2005. The minister of Infrastructure allowed deployment on June 13, 2006, and promised to retract the national tariff system if all went well (Minister of Transport, 2006). This happened on November 3, 2011. The name of this new, national electronic ticketing system is 'OV-chipkaart'.

3.3   Using the OV-chipkaart

Travellers register their OV-chipkaart each time with the card validation device when entering a vehicle or station to 'check-in'. When disembarking a vehicle, exiting a station or switching operators, the traveller has to register the card again with a validation device to check-out, at which point the system calculates the fare based on the distance travelled. This check-out allows distance-based fares instead of zone-based fares and it generates traveller behaviour data for the operators. Compared to the previous zone-based system, check-in/check-out requires an extra action from travellers and makes fare calculation unpredictable, but it is also considered to be fairer. Zone-based ticketing, on the other hand, was also hard to fully understand for many travellers and considered less fair. With this new electronic check-in/check-out policy, operators are also able to use price differentiation to increase their efficiency. This business data will also help to adjust the travel schedule better for the needs of travellers.

Regional public transport uses linear pricing with a base rate, whereas national trains use price digression with a minimum price (see Figure 13). This means that a traveller will pay a base rate for a trip on regional transport and a fixed price for every kilometre traversed. Travellers will not pay the base rate for any transfer within 35 minutes of a check-out. For national trains, a
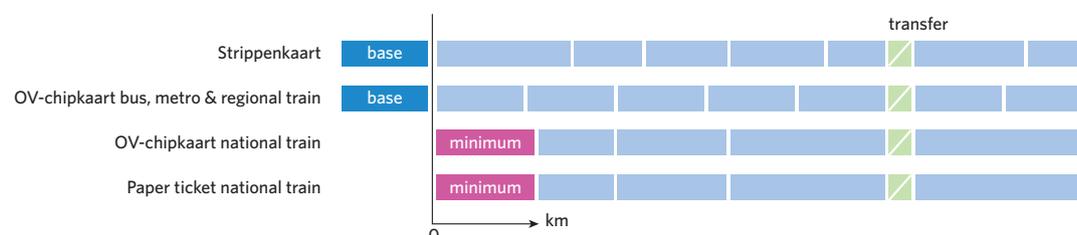
Figure 13: Public transport tariffs; travellers pay per block

traveller pays a minimum price and a smaller kilometre price for every extra kilometre (block) travelled. A minimum price allows a person to check-in at a station without having to pay, if that person decides not to take the train and leave again. Travellers have to pay a base rate again if they transfer from a national train to a regional train. Taxis are currently not part of the OV-chipkaart ecosystem.

Since the fare is calculated at the end of a trip, there is an incentive for travellers to not check-out and thus dodge paying. To prevent this, a deposit is taken from the card at check-in. The excess part of the deposit is returned at check-out if the traveller travelled for a lower fare, or extra money is deducted if the traveller travelled for a higher fare. The deposit differs per operator and modality, but is usually 4 euro for regional buses, trams and metro; 10 euro for regional trains; and 20 euro for national trains. Though the latter it also depends on the season ticket one might use. In the future, this deposit could be determined per service line, if regional governments allow it. Forgetting to check-out will usually result in paying more for a trip than is necessary.

Some systems also use the OV-chipkaart infrastructure for authentication of users. Examples are the OV-fiets, Greenwheels and MyWheels. This provides an easy and seamless payment experience.

The decentralisation and liberalisation resulted in increased competition between public transport operators. The OV-chipkaart makes it possible to have different fares, based on time, usage, location and operator. The consensus is that public transport is cheaper and more efficient now than it would have been without the governance overhaul. A major downside of this competition is the lack of cooperation between operators (Meijdam commission, 2011, p. 31). Companies, particularly, try to sell their season tickets to customers and have almost no incentive to make sure that travellers experience a smooth transition when they transfer from one to another operator. While these companies are heavily invested in their region, travellers have little regard for these artificial boundaries and continue to travel from A to B and if necessary with multiple operators (Meijdam commission, 2011, p. 31). The travellers hit most by the direct consequences of the decentralisation are the ones who cross borders and end up, for example, with two mismatched season tickets.

The OV-chipkaart functions differently than the previously used paper tickets and has different advantages and disadvantages. Table 2 compares the functions of paper tickets and the OV-chipkaart and Table 3 compares the user action differences. The amount of user actions and functionality has increased.

Category	Paper tickets	OV-chipkaart
Usage flexibility	Unable to change destination after ticket purchase/validation	Flexibility to change destination after check-in
Travel advice	Operator personnel is able to offer advice based on the destination on the ticket	Operator personnel is not able to offer advice based on the destination on the ticket
Payment method	Paper ticket only, ability to buy tickets in advance	Need to purchase card and deposit money; add value for travelling, ability to add value for multiple journeys; more expensive single journey bus and tram tickets available
Payment method	Always necessary to bring sufficient money if you need to buy a ticket	Ability to link a card to a bank account for direct deposit
Expense overview	Have to keep track of travel patterns and expenses yourself	OV-chipkaart provides overview of travel patterns and expenses if you have an online account
Expense visibility	Travel expenses are visible on the ticket and the tickets are physical	Travel expenses are visible at points of system interaction and available online after processing time
Business data	Incomplete business data available for revenue division, service optimisation and government subsidy distribution	Detailed business data available for revenue division, service optimisation and government subsidy distribution
Gates	Harder to open station gates with one key throughout the Netherlands	Easier to open station gates with one key throughout the Netherlands
Distribution	More Strippenkaart distribution points with a person to help you (Trouw, 2005)	Fewer OV-chipkaart distribution points, mainly self-service (OV-chipkaart.nl, 2013)
Fares	Harder to change fares and only on a coarse level	Easier to change fares and on a detailed level
Fare structure	Pay per zone for busses, trams and metros	Almost always pay per kilometre for all modalities

Table 2: Function comparison of paper tickets with the OV-chipkaart

Phase	Paper tickets	OV-chipkaart
Purchase	-	Purchase a card
Pre-travel	Purchase train tickets in advance and/ or purchase/carry bus tickets	Carry card, and add value to your card in advance or use automatic top-up
Travel	Determine destination before the journey to purchase ticket	Check-in before the journey
Travel	-	Check-out at the end of the journey
Travel	Season ticket holders have to carry their ticket and sometimes purchase a discount ticket	Season ticket holders have to carry the card and check-in and -out
Post-travel	Use paper tickets for expense report	Use website for expense report
Post-travel	-	Fill-out a refund form for erroneous or missing transactions

Table 3: Differences in user actions between paper tickets and the OV-chipkaart

3.4 Market introduction and public response

News media often reported about the development and introduction of the OV-chipkaart, and many parliamentarians asked the minister questions (Overheid.nl, 2013). One political party, GroenLinks, opened the complaints gathering website OV-chipklacht and consumer organisations received many questions. It was an highly anticipated change.

The OV-chipkaart technology was tested during pilot projects in 2003, 2004 and 2005 in Rotterdam and surrounding areas (Kist commission, 2008, p. 16), and from 2005 on in Amsterdam (Kist commission, 2008, p. 16; Parool, 2004). The system was first installed on the NS train from Rotterdam to Hoek van Holland and later extended to buses in the region and the Rotterdam metro (Meertens & Schmale, 2003). A select group of travellers and employees participated in these tests (Algemeen Dagblad, 2003; Parool, 2005; Heide, 2005). These pilot projects were partly funded by the Minister of Transport (2003, p. 6) and regional authorities (Algemeen Dagblad, 2003). The pilots in Rotterdam showed that the system was not yet able to handle the high load and the hardware was not hooligan-proof (Heide, 2005). Solving these problems took extra time and delayed the implementation (Heide, 2005). Introduction of the OV-chipkaart was delayed from 2006 to 2009 (Haan & Hoove, 2006) and finally to March 2011 (Parool, 2011). The Strippenkaart was eventually phased out in November 2011 (Minister of Infrastructure, 2011).

Pricing between existing tickets and the OV-chipkaart tickets differed for some time (Haan, 2005). NS eventually solved this by removing the discount on return tickets (Treinreiziger.nl, 2010). Using the OV-chipkaart was not decidedly cheaper than the existing tickets during introduction (Mos, 2010).

Quantitative surveys conducted for transport operators (Stadsregio Rotterdam, 2010) and the government (Lubbe & Larsen, 2007; Broek & Radewalt, 2009) indicate many travellers think the OV-chipkaart is an improvement and works well. However, not all surveys published their methodology and conclusions between surveys vary significantly.

3.5 Stakeholders

The OV-chipkaart system is operated, used and influenced by different stakeholders. These can be divided into six main groups: travellers, public transport operators, governments, consumer organisations, technology & service suppliers and TLS (see Figure 14). Additionally, there will be the Permanent Structure in the forseeable future, to handle cross-concession affairs, and there are regulators (CBP, NMa, AFM, DNB). All these groups have shared and unique interests which are briefly summarised here and elaborated in more detail in Appendix C.

Travellers are the most important group, because there would be no need for public transport without them. They use the services of the public transport operators, which have an interest in efficiency of their transport services in order to reduce cost and/or increase profit, or service their region. Regional and national government grant public transport concessions to operators and set requirements. Consumer organisations represent the travellers and inform the governments and operators of problems travellers experience. TLS handles the system to process all transactions and the technology & service suppliers are contracted by TLS and the operators. Regulators oversee whether TLS and the operators stay within the law. The Permanent Structure is a future organisation, tasked with solving inter-concession problems.
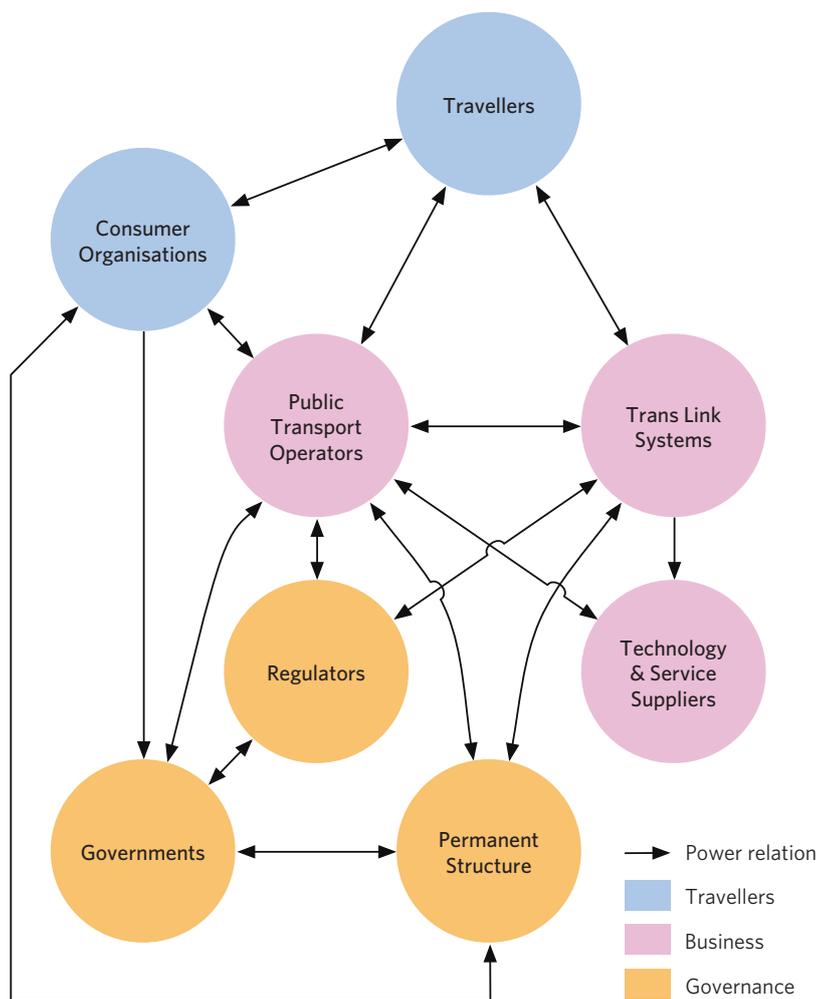
Figure 14: Stakeholder overview indicating the important relations

3.6   Ecosystem

This part discusses the technical architecture of the system, including the different functional levels of the system. These levels correspont to the different types of cards, and Trans Link System in general which are reviewed as well. To generate a complete overview of the whole ecosystem the different touchpoints users might interact with are also briefly described.

3.6.1 Platform technology

Payment and identification are handled by the user registering a contactless chip card when boarding and disembarking a vehicle (bus, tram), or when entering and exiting a station (metro, light rail, train, ferry). The system uses radio-frequency identification (RFID) chips to facilitate communication between the user's card and the validation devices of the public transport operator. For now, taxis do not support fare payment with the OV-chipkaart.

The OV-chipkaart system consists of several data processing parts called levels (TLS, 2003). These levels have different functional tasks corresponding with the physical location of the respective computer systems. Figure 15 gives an overview of these levels.
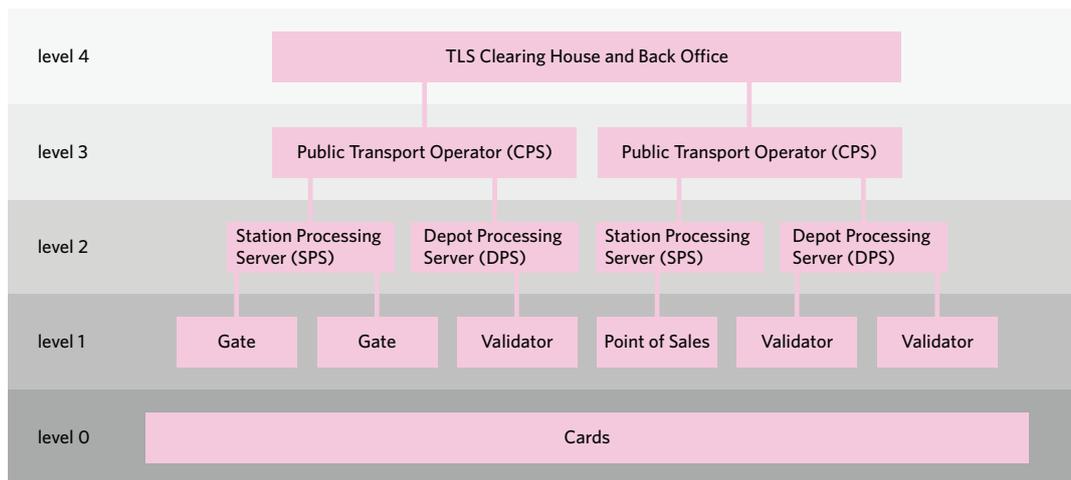
Figure 15: Level diagram of OV-chipkaart computer system

Level 0

The zero level consists of the payment and identification cards issued by the public transport operators (PTOs). Currently, three types of cards are in use: disposable, anonymous, and personal. All cards contain RFID chips to store information about credit balance, season tickets, and recent check-in and check-out actions.

Level 1

The first level consists of station access gates, station or vehicle validators (VAL), mobile validators used by conductors (Personal Validation Unit, PVU), and point of sales terminals (POST) at sales desks. These are the machines that the user encounters. Validators and gates need to contain all necessary information about fare prices, subscription information, network topology, and blocked cards. Gates and validators only see one side of transactions: the traveller either checks-in or checks-out.

Level 2

Information collected by level 1 machines, such as gates, VAL, POST, is send to level 2 equipment. Stations are outfitted with Station Processing Servers (SPS) and receive data from connected level 1 machines every 15 minutes. Moving vehicles with validators on board have a Validator Concentration Feature (VCF) which collects the data and sends it to the Depot Processing Server (DPS) when the vehicle is parked at the depot or a bus station.

Level 3

Every public transport operator has a Central Processing Server (CPS) at level 3 to collect all information from level 2. This CPS stores all transactions made with the OV-chipkaart at one operator and thus contains information about start and end points of a trip, and credit balance changes. The data collected at level 3 is used by transport operators to verify the financial transactions with TLS and to use for business intelligence.

Level 4

The top-level part of the system is called the Central Back Office (CBO), currently operated in the Netherlands by Trans Link Systems. This is where all transactions with all cards are stored and analysed in order to fulfill the Clearing House function. The CBO also keeps a list of all active and blocked cards, and manages auto-credit top-up.

See Appendix D for more detail.

3.6.2 Cards

There are three contactless cards that can be used as valid tickets: disposable, anonymous, and personal:

1. Disposable cards are sold by PTO's and are not registered with the CBO, thus can only be used at the PTO it is sold by.

2. Anonymous cards are sold by PTO's, the CBO, and other organisations like supermarkets and tobacco shops. These anonymous cards are registered for use at the CBO, which means they can be used with any PTO.

3. Personal cards are sold by PTOs and the CBO, and registered at the CBO and can be used with any PTO. The name, date of birth, gender and a picture of the owner is printed on the card. It can be used for season tickets.

Disposable cards currently contain a Mifare Ultralight RFID chip, and anonymous and personal cards use the Mifare Classic 4k RFID chip. After researchers exposed security flaws in both chips, the OV-chipkaart moves to a chip for all anonymous and personal cards.

To allow for changes that affect level 0, and to mitigate problems with forseeable damage, all cards expire after 5 years. The Mifare Classic chip can be rewritten limited times. It is calculated the chip should work for five years without failing. Any modification of this level also requires at least a five year time frame and a migration plan.

3.6.3 Overview of tariff system

The cards contain 'products' which allow the user to pay for an electronic ticket. Products can be a credit balance or season tickets (time limited discounts). To travel with credit balance on bus, tram, metro, regional train, and ferry, the product Easy Trip is preloaded on all cards. To use credit balance for the national trains, one has to load the Rail Easy product on a card. However, when buying an OV-chipkaart from NS directly, both Rail Easy and Easy Trip are already preloaded. This is necessary because the pricing systems of regional and national transport differ from each other. More information about this and the prioritizing of products can be found in Appendix E.

3.6.4 Trans Link Systems

Trans Link Systems (TLS) manages most of the inter-operator financial, operational, and organisational aspects related to the OV-chipkaart system. They act as Central Back Office (CBO; tracks all transactions), Clearing House (CH; redistributes revenue), and System Developer (SD; determines technical standards); simultaneously serving their clients (the operators) and deciding on what the operators can and cannot do. Thereby having a large influence on the business strategy of its customers. Furthermore, all public transport operators are currently obliged by regional transport authorities to use the OV-chipkaart system, without all operators having decisive influence on the costs, effectiveness, and innovation that TLS is delivering (Meijdam commission, 2011, p. 34).

There is also mistrust between operators that are shareholder of TLS and operators that are not (Meijdam commission, 2011, p. 36). Since the Central Back Office and Clearing House have access to the travel transactions of all operators, some of the non-shareholding-operators suspect that the shareholding-operators have access to their business data via TLS (Meijdam

commission, 2011, p. 36). Though TLS's bylaws and contracts prohibit this kind of access by shareholders (Meijdam commission, 2011, p. 36).

To solve these asserted problems, the Meijdam commission (2011) has suggested to separate the different functions of TLS. Their proposal is that TLS can keep the CBO and CH responsibilities for now, but the System Development responsibility will be turned over to a new organisation called the 'Permanente Structuur' (Permanent Structure, PS). The current shareholders of TLS wil be bought out of the remaining operational entity and the PS will negotiate a service level agreement with this new, independent service provider (Kwartiermaker, 2012).

3.6.5 Touchpoints

Travellers come in contact with different parts of the OV-chipkaart system before, during and after a journey by public transport. All these contact points and interactions with the system are defined as touchpoints and can either be physical or non-physical. In this case four main categories can be defined: ticket and OV-chip vending machines; validator machines; distance-based service and sales, and employees (see Figure 16 on page 32). Although employees and ticket machines may act as a point of sales as well, they are treated as a separate group, since they appeal to different types of user groups. Touchpoints will mainly be encountered by the traveler at given moments during the journey. A brief explanation of each touchpoint can be found in Appendix F.

3.7 Usability and use case studies

As described in Paragraph 3.4, the market introduction did not go without problems and the public response on the OV-chipkaart has not been positive continuously. Even though travellers recognize a simplification of their travel process, many are still facing difficulties. Multiple studies have been done to investigate the possibilities for improvement or even new developments.

3.7.1 Studies of the Regieteams OV-chipkaart

In 2009 consumer organisations were concerned about the final implementation of the OV-chipkaart. They formulated a final stage consisting of 78 elements. Eventually this led to 15 studies with one or more elements to investigate the possibilities and impossibilities of the OV-chipkaart and related topics. The studies were executed by various 'regieteams OV-chipkaart'. Transport operators were leading in most studies, the coordination was done by the Ministry of Infrastructure and the Environment.

Although the topics vary amongst the studies, we identified four main groups, which are: usage of the OV-chipkaart, consistency of the system, information and communication, and specific

Touchpoints OV-chipkaart

Machines	On distance services	Employees	Other

TVM   AVM

Ticket vending machines (TVM) are maily used to purchase single journey tickets or to add value, which can be done at an add value machine (AVM) as well.

website

For many travellers websites are the most important channel to get information about the system, the cards and transactions.

driver

Bus drivers and some tram drivers sell disposable tickets (cash only), check season tickets and audit the check-in action of passengers.

signage

Signs are located at multiple places to guide users through the process of checking-in and -out between multiple operators.
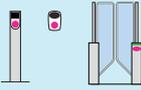
validator

Travellers come in contact with validators at least twice; when checking-in and -out. The validators can have different product forms.

letter

Letters are used as communication tool between transport operators and user to inform about the card and its usage.

conductor

Conductors are checking the travellers for a valid ticket. They do this with a Personal Validation Unit (PVU).

sticker

Stickers at multiple locations. Mainly in vehicles to remind users to check-out or at ticket machines to explain steps.

information and SOS pole

In case of an emercency or when support is needed, located at the platform.

help desk

To retrieve information about the card and error resolving.

sales desk

To purchase a ticket, to get information about connections or to get help.

media

The media regulary reports on the system and effects the public opinion.

pick-up device

Located at multiple places such as stations or convenience shops. Products can be collected here.

service employee

Service employees are contact persons for travellers and help with solving problems.

Figure 16: Touchpoints of the OV-chipkaart system

user groups. Four studies could not be assigned to a group, since their scope is broader. A brief description of the content of each study can be found in Appendix G.

Usage of the OV-chipkaart

Some problems are directly related to certain use cases during a trip by public transport. The improvement of the current situation of the transfer between two train operators (study 052, the possibility for single check-in /check-out (study 053) and automatic top-up for anonymous cards (study 055) are examples.

Consistency and uniformity throughout the system

In various conclusions of the studies the consistency and uniformity of touchpoints and pre-ferred actions by the traveller are discussed. This includes information from different parties to the traveller (study 058) and the usability and uniformity of OV-chipkaart machines (study 057). From a different order are the standardisation of the national distribution of the OV-chipkaart and historical travel information (study 054 and 064).

Information and communication

The OV-chipkaart made it possible for the user to get insights in his travel behaviour. Not all possibilities are exploited yet; future options are around TLS as central location for transaction (study 063). Connected to this topic is study 060, in which options are explored for giving advice to travellers by using previous transactions. When travellers experience any problems they usually go to a service desk of one of the public transport companies. The study 'First time fix' (study 062) focuses on the processes to help the traveller at the service desk the traveller comes for the first time. A second study about communication is about the pick-up points for distributed travel products and explanation about the pick-up process itself. (study 058)

Specific user groups

Problems for people with a 'public transport disability' were mapped and solutions are proposed in study 065. This group of disabled include visual, auditory or physical impaired or mentally deficient. Group travel is not supported by default, but transport operators have their own solu-tions. Study 066 focuses on a pilot executed by RET in which a national solution is investigated.

3.7.2 Studies at the TU Delft

Two courses at the faculty of Industrial Design Engineering of the Delft University of Technol-ogy investigated the interaction with the touchpoints of the NS and problems foreigners en-counter during the use of public transport.

Interaction with touchpoints

In the course 'Usability and User Experience Assessment in Design' students looked at different phases of using the OV-chipkaart. The groups studied the purchase process of subscriptions, acquiring and activating products and error recovery at a validator. The assignment was setup in cooperation with and for the NS, but some issues are valid for other transport operators as well.

Foreigners and visitors

In the course 'Customer Research in New Product Development' students did research on the problems foreign visitors encounter. Visitors who come to the Netherlands experience a lot of comparable problems Dutch residents have. Besides these problems, visitors who are not able to understand the Dutch language and are not familiar with the OV-chipkaart system experience additional problems. Most of these additional problems are related to the ticket machines, where they are facing a new situation.

3.8   Conclusion

The OV-chipkaart completely changed public transport ticketing in the Netherlands. From paper to e-tickets, and from zones to distance-based payment.

It is an advanced solution for the business problem of revenue division and the public security problems public transport had. It also made it possible for travellers to use one card for almost all forms of public transport throughout the Netherlands, though travel products sometimes make this harder.

The design and implementation focused mainly on business aspects and technology development, and was less concerned with user needs. The organisational structure of the OV-chipkaart system results in a slow response to (inter-concession) usability problems.

This resulted in public criticism, a slower acceptance rate and a degraded perceived enjoyment; all factors that negatively influence use behaviour. Several studies have already looked at the individual problems that can be solved in the near future, but none have offered an integrated long-term user-centred vision yet.

4 Studying the OV-chipkaart usage

In chapter 3 the system is described from multiple angles in order to understand the development and implementation of the OV-chipkaart, the technical platform, and the roles, interests and concerns of the stakeholders in past and present. This chapter focuses on the usage of the system and explores how travellers interact with the OV-chipkaart, its touchpoints and mainly the problems (some) participants experienced.

Actionable information for successful (re)designs requires a deep first-hand understanding how people use and experience the OV-chipkaart. This can only be achieved by personally studying people's behaviour and by getting to know their perception of the system. This chapter concentrates on the problems our participants experienced in the Netherlands based on qualitative research: interviews, observations and a qualitative questionnaire. After describing the results per phase of travelling, user group segmentation and stages of experience are discussed. An illustrative customer journey map summarizes the main findings. The chapter concludes with the description of three main focus areas.

4.1 Method

4.1.1 Aim
For the design phase it is important to know why certain events happen and what the consequences are for travellers. The aim of the research in the Netherlands is to discover and understand usability issues and to understand and map current user experiences.

4.1.2 Research questions
- Who are the users and what are their properties?
- How do travellers experience the OV-chipkaart and what causes this?
- When, where, and how do travellers interact with the OV-chipkaart system?
- What are travellers doing at a ticket machine and a validator?
- What do travellers think about the OV-chipkaart?
- Which problems can be identified during a journey?
- What is a useful user segmentation during the remaining steps of the project?

4.1.3 Methods

To investigate what travellers are doing during the use of the OV-chipkaart, observations were performed at different locations: bus, tram, metro and train.

Interviews were used to gain insights into what people think. These took place in the public transport domain, mostly when people interacted with the system or were waiting for a vehicle to arrive.

Questionnaire booklets were used to let participants reflect on their travel behaviour and the OV-chipkaart system when they were at home. By doing this outside of the travel domain the answers are less influenced by the events that happen during the journey. The participants had a week to fill in the booklets.

The results of the interviews, observations and booklets are shown per step in a customer journey map. This map is the basis for the user segmentation and focus areas. The setup for the interviews, observations and booklets can be found in Appendix H. A list of the people interviewed and observed during the analysis can be found in Appendix I.

Interviewing travellers

In total 45 interviews were done with users of the OV-chip-kaart and people travelling by public transportation (see Figure 17). For all interviews a semi-structured approach was used. The interviews were prepared in advance, key questions were formulated in order to guarantee that all topics of interest were covered during the interview. While doing the interview the interviewers were free to ask additional questions to get more in depth information.

Figure 17: Interviewing users

The user interviews were done in a one-to-one setting. Most of those interviews have been recorded on video or tape to save the information. However, in those cases in which it was not possible to record them, the researcher filled in an interview form to store the information. The information gained from the interviews served as a main input for the customer journey maps. Next to this quotes are used to illustrate the findings.

Observations

Observing the natural behaviour of people can reveal important insights. What people say they do can be very different from what they actually do and experience in their lives. The observations (50 in total) were done at all relevant places

Figure 18: Observations

that can be connected to the e-ticket, such as stations, ticket machines (see Figure 18), service desks, gates, validators, in trains, busses or metros.

Questionnaire booklets

The method of questionnaire booklets aims at collecting user insights. The core believe of this method is that every user is an expert of his own situation. This user centred approach provides the user with inspirational design tools to gather more insights on the behaviour (and the what, where, how, when and why) of a specific context. Using booklets aims at getting inspiration and is therefore not meant for validation. A list of the 13 participants can be found in Appendix J, the questionnaire booklet in Appendix K.

OV Loket

The OV Loket is an independent organisation, helping travellers to guide them to the right organisation. They provided us with a list of 600 complaints about the OV-chipkaart concerning various topics. The complaints were collected from the 1st of July 2012 till the 1st of November 2012. These entries give insights in personal stories of travellers interacting with service touchpoints. It has to be noted that the threshold to contact the OV Loket is quite high for travellers, the complains are often complex. Nevertheless, it indicates that people are having issues in solving their problems.

Customer Journey Mapping

A customer journey map is a tool, which describes the different steps users (in this case: travellers) go through (Stickdorn & Schneider, 2010, p.158). Problematic interactions can be identified by means of interviews and observations. The resulting emotions are presented as well.

The customer journey map helps to capture the relevant information that take place at each step. A customer journey map, due to its simplified visualization leaves out certain information, but at the same time serves as a strong tool that helps to align the big amount of information and individual insights into one coherent journey. Taking the customer journey as a basis it becomes possible to spot fields of interest by clustering mentioned pieces of information of the users.

The customer journey map (see Figure 23 on page 57) is divided into four main phases: purchase, pre-travel experience, travel experience and post-travel experience. These four phases are further divided in several steps the user goes through. On the vertical axis the customer journey map is divided in several aspects that are considered as important to the customer journey. These cover goals, expectations and assumptions users have within each step, the touchpoints they encounter and their current experience. To illustrate these experiences, quotes are used to further explain the situation and three curves (stress, support and information) are indicat-

ing the degree to which they are present in each phase. These information serve as an input to formulate the problems and the resulting emotions within each stage.

4.2 User groups

In order to study users, a good understanding of who the users actually are is required. It could be argued that the OV-chipkaart is used or may be used at a later point of time by each person living in or visiting the Netherlands. Generally every person who interacts with the OV-chipkaart, such as a traveller, a service employee, a software engineer or other can be considered as a user. Each of those user groups require a different approach for studying the usage. Since our focus of this analysis is to improve the usability of the OV-chipkaart, we define the user as those who use the OV-chipkaart for travelling and other non-professional use.

With this definition the large group of back-end users is excluded, and the focus is on the front-end user, who uses the OV-chipkaart for travelling only.

Categorisation

Even though the back-end users are excluded, the user group is still very broad and the needs are varying across sub-groups. In order to serve there needs better and to be able to focus on specific sub-groups the broad group of 'travellers' needs to be further divided.

Often user group segmentations are based on sociodemographic aspects, such as a age, income or education. However this discrimination is not relevant for the OV-chipkaart. The frequency of travelling; the experience with the OV-chipkaart; travelling for a routine or travelling randomly; using one or multiple operators; as well as the physical and mental abilities of the users of the OV-chipkaart.

Travel behaviour
- Frequency of use. This can vary from once a year to five days a week.

- Routine or random journeys. Is the user travelling on the same route or using different options.

- Transfer or not; is there at least one transfer in the journey.

User properties
- Technology understanding.

- Physical and/or mental handicap, including language barriers.

- Knowledge of the OV-chipkaart system.

Combining these factors led to six groups user groups, which formed the basis for the observations and interviews.

Commuter. Travelling at least 3 times a week from home to work in a fixed pattern, using the same trains, busses and trams. This user is experienced on his common route and knows where to check-in and check- out.

Incidental traveller. Mostly using the same type of vehicle, a few times a year. The motivation for making use of public transportation can vary from having no car availability or going on a journey.

Tourist. A tourist is using the public transport system for a short period, but this can be very intensive. Knowledge of the system is little and the language often forms a barrier.

Self-employed. This group can be compared with a commuter; using the public transport for work purposes a few times a week. The main difference is the route, which can differ on each journey.

Disabled people. Although the motives of this group are not necessarily different from other groups, the travel behaviour can be affected by a disability, forming an extra barrier to choose and use the public transport. Of course, all users can encounter specific barriers before, during and after entering the public transport system. The term disabled includes physical and mental forms of restrictions. According to 'Eindbeeldstudie 65' especially blind people have trouble in using the OV-chipkaart system; finding validators is hard and it is impossible to know what information is communicated through the validator. Apart from that there are groups that have problems in understanding the information or required actions due to illiteracy, dyslexia, intellectual disorder or a low intelligence.

Student. This frequency of use for this group is somewhere between the commuter and average user. During the midweek and weekend for travelling from home to school, during the weekends also for pleasure using random routes.

4.3 Results

By interviewing and observing users of the OV-chipkaart, by studying complaints from the OV Loket and by letting participants fill in booklets to reflect on their experiences so far, a lot of raw data was gathered. In total we video interviewed 45 people of which about 1/3 experienced hardly any problems and 2/3 did encounter problems. The most important findings from each interview can be found in Appendix M. Furthermore, we video taped 52 situations in which people interacted with the OV-chipkaart system. Six examples of our observations can be found in Appendix L. Besides this, 13 people returned questionnaire booklets with detailed answers, which also served as input for our results and conclusions. Finally, we studied almost 600 complaints which the OV Loket received about the OV-chipkaart. A condensed list of entries can be found in Appendix O.

4.3.1 Usability issues per usage step

Based on the raw data, we formulated our findings per phase of the customer journey map. Figure 23 summarises these findings in a customer journey map. Appendix N lists the usability problems of all phases. An overview of the entire journey is given below, followed by the journey step by step.

Phases: € Purchase   🏠 Pre-travel experience   🚌 Travel experience   🏆 Post-travel experience

Steps: Orientation › Purchase › Activation › Loading › Preparation › Check-in › Station › Travelling › Interchange › Check-out › Evaluation

Step	Action
Orientation	Users of the OV-chipkaart get in contact with the system (for the first time).
Purchase	Aquiring a card with or without products.
Activation	Activating the card and collect travel products.
Loading	Add value to a card.
Preparation	Travellers prepare their upcoming journey by checking their route or the time schedule.
Check-in	Check-in action just before or after entering a vehicle or station.
Station	The time travellers stay at a station.
Travelling	The time users are actually in a vehicle, going from A to B.
Interchange	Changing from one vehicle to another, this can include changing operators as well.
Check-out	Check-out action just before or after leaving a vehicle or station.
Evaluation	Reflection on a journey by travellers.

€ Orientation

This step is the first contact with the OV-chipkaart. As described in the Innovation-Decision process (see chapter 2.3), this is influenced by communication about the card, social norms and personal variables.

Our participants often assumed, that it is necessary to buy an OV-chipkaart, because travelling without such a card gets increasingly difficult. When the participants started to orientate, they wanted to select the right OV-chipkaart. The one that suits them and their individual travel behaviour best. In order to get information on the different cards and subscriptions, people either go online or they contact the service desk of their most frequently used transport operator. Especially participants who do not have internet access and therefore had to go from one service desk to the other (when travelling with multiple operators) experience the orientation phase as unclear.

> "Ik vind het geweldig dat je maar met één kaart door het hele land kunt reizen."
>
> OV-chipkaart user, Delft, woman +- 25 years (IV_D_22)

> "Ik vind het schandalig dat je bijna gedwongen wordt om zo'n kaart aan te schaffen."
>
> OV-chipkaart user, Maastricht, woman +- 44 years (IV_M_37)

The level of information may be high, but it is not equally and easily accessible for everyone. Since the information is provided by different operators, not all information is available at one central point. However, the stress our participants experienced is quite low at this stage, since future users do not experience time pressure in this step.

Summarising: unstructured information across various transport operators, can lead to confusion and uncertainty among our participants. This in turn caused some participants to interrupt the process of orientation or they get the impression that the OV-chipkaart system is complex and difficult to use.

€ Purchase

Travellers need to decide between buying an anonymous or personal card. The former are easier to acquire, the latter offers more functionality —such as season tickets and automatic top-up. For participants living in rural areas, it was more difficult to buy an anony-

> "Ik heb zelf nog geen computer thuis en de hele maatschappij gaat ervan uit dat iedereen een computer heeft. Dus dat is wel moeilijk voor me."
>
> User of the bus, Heerlen, man +- 60 years (IV_HE_30)

mous card, since they are neither available in the local living area nor sent home. Other participants, who do not use internet banking, had difficulties buying online-only season tickets.

For people living in neighbouring countries, coming to the Netherlands regularly, it has become more difficult to purchase an OV-chipkaart. For example, whereas during the introduction period it was possible to buy an anonymous OV-chipkaart in Germany it is not possible anymore.

Beside these barriers, our participants generally did not understand why the card costs 7,50 euro and this strengthened their rejective attitude towards the OV-chipkaart.

> "No, I have no idea, why it costs 7,50 euro."
>
> OV-chipkaart user, Delft, man, +- 25 years (IV_D_21)

After the purchase of a personal OV-chipkaart, many of our participants assumed that they were able to travel as soon as the card arrives at their homes. Participants were often disappointed that it toke two weeks

> "...maar dan ben ik toch mijn kaart kwijt. Kan ik dan twee weken niet met de bus mee? Dat vind ik wel een beetje vreemd."
>
> User of the bus, Dordrecht, man, +- 70 years

between the moment of application and the moment they could activate the card. When 'purchasing' a new card (replacing an expired card) some participants assumded that they will receive a temporary card, which offers the same functionalities. In both cases, some of our participtans were disappointed.

Summarising: a lack of customer service and support in terms of inability to pay or disadvantages due to not having internet banking, lead participants to experience financial disadvantages and decreased trust in the system. Sometimes the disadvantages caused participants to return to the orientation phase, whereas they almost bought an OV-chipkaart.

Activation

In order to activate the card, users need to go to a pick-up device or a ticket machine, where they hope for a supportive interface, which guides them through the process. Our participants sometimes felt lost, if they forgot to bring the instruction letter as a supportive tool. As we have observed, some participants assume that the products, which actually need to be loaded onto the card, are already on the card since they have a green checkmark behind their name on the NS ticket vending machine (see Figure 20). Sometimes our participants did not see the blinking button at the upper right corner of the NS ticket machine display and stopped without activating the products.

Figure 19: Customers consulting the service desk to solve a problem

People making this mistake would only recognize that something went wrong at the end of their journey. Since they assume, that they did follow every step of the activation process according the letter, they will usually not blame themselves, but the transport operator instead.

During the activation phase, the information given by the ticket machine (e.g. information that the travel products are not activated yet) is limited. Likewise the support provided is limited. It was easier if participants had the letter at hand, but in many cases they did not bring the letter with them, which leaves them alone and increases their stress level. The activation of the card is generally done just before a journey, adding pressure to finish the task successfully and on time.

Summarising: a lack of information and guidance lead to unawareness with some participants of having made a mistake during the process of activating their card. The following financial disadvantage participants will experience at the end of their journey lead to a decreasing trust in the OV-chipkaart.

Loading
As long as travellers have not activated automatic top-up, they have to go to a ticket vending machine or a retailer that has an add-value machine every now and then. For the majority of the Dutch inhabitants this does not cause any problems. Their debit cards are accepted at every machine, and after having done it once, users learn they have to present their card twice to the NS ticket machine, which only causes stress when add value for the first time.
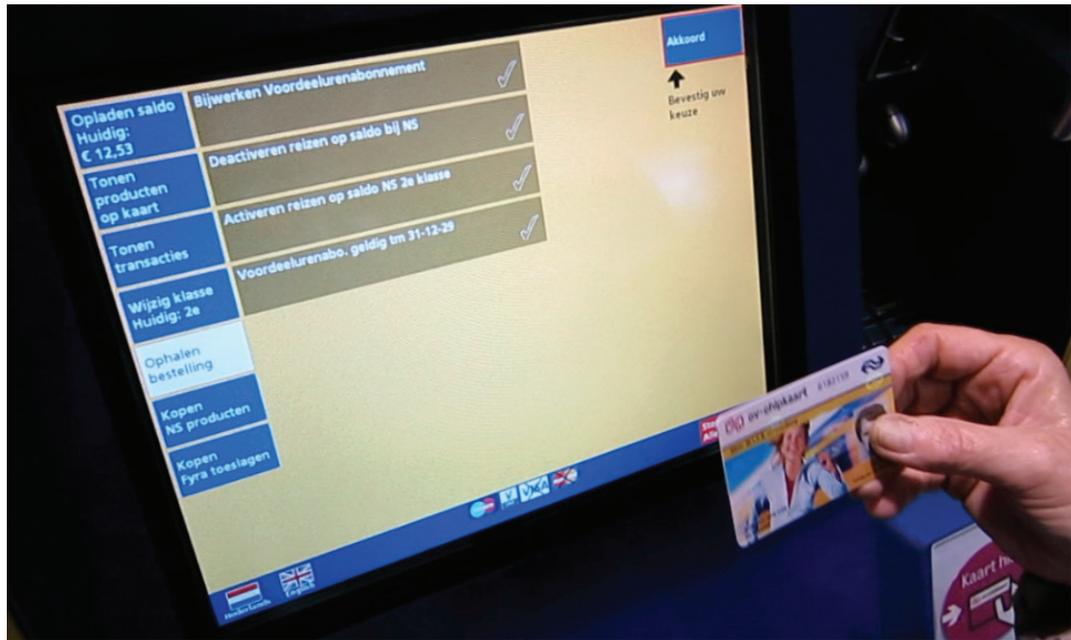
Figure 20: Traveller attempting to load products to an OV-chipkaart

However, participants were not necessarily aware of the minimum amount of money they need to add to their card in order to check-in.

Apart from this, some people cannot (or only with difficulty) afford the 20 euro deposit which is required for travelling with the NS trains.

"Ik vertrouw hem nog niet, gebruik hem alleen in de bus... bij de NS betaal ik de volle prijs ofwel ik korting zal moeten hebben... bijna een uur een telefoongesprek erover gehad (klantenservice NS)... en schijnbaar moet ik deze kaart activeren... nu maken ze er ook reclame voor op televisie."

User of the bus, Heerlen, male, +- 60 years (IV_HE_30)

When adding value at a ticket or add value machine, the amount of information and support given is quite low. Participants had to get used to the fact that they sometimes have to present the OV-chipkaart to the ticket machine twice. The perceived stress level is higher than the information given, which often is caused by limited time.

Summarising: even though in most cases the loading process is successful, when encountering a problem (such as not being able to check in) some participants kept bouncing between the point of check-in and the top-up location. In this case a lack of information and traveller support made participants feel fighting the system in vain.

Preparation

This step generally does not cause any difficulties with the OV-chipkaart. The expectations of our participants that they will find the required information and that it is still valid when travelling are met in most cases. Participants without mobile internet access needed to go to the service desk or consulted the information screens at the station.

In this step the level of information is quite high, whereas the level of support is medium. Both lead to a low stress level of the traveller, except during disruptions of the schedule.

While preparing a standard route when travelling with the OV-chipkaart for the first time, some participants were surprised by the price difference between paper tickets and electronic tickets. The awareness of the price differences sometimes lead to a feeling of distrust (price increase) or trust (price decrease).

Check-in

Most of the participants assumed that if they had sufficient money on their card, the check-in would not cause any problems. However, the definition of sufficient varied among participants. Whereas one knows that a journey by train requires at least 20 euro and a journey by bus 4 euro, other participants were not aware of this, since they usually take the bus only. Again other participants assumed it was sufficient that the card holds enough credit to pay for the planned journey. These differences in understanding caused problems.

Besides these problems, it may happened that validators did not work. In such a situation, participants were uncertain how to behave. If participants were in a hurry, they tended to enter the train without a valid ticket.

Sometimes participants were insecure about whether they already checked-in. Such situations occured when people absent-mindedly checked-in (out of routine, while in a conversation or likewise) or when it was crowded at the validator (e.g. peak hour, or after a concert or soccer game). Participants did not have an accessible way to check the status of their card themselves. Our participants then had to decide whether they (1)

"Het apparaat gaf aan dat er toch echt 5,37 op stond dus ik zou gewoon moeten kunnen inchecken. Ik liep terug naar die paal en probeerde voor de 3e keer om in te checken maar er stond nog steeds "saldo te laag". Ik hield hem daarna bij de andere paal ernaast maar die gaf ook aan dat mijn saldo te laag was! Ik werd gepasseerd door andere mensen en die kregen dezelfde melding. Uiteindelijk ben ik ook maar doorgelopen."

(OVL 284)

assumed they were checked-in, and might be fined by the conductor if this assumption turned out to be wrong; or (2) they decided to check-in again, which could mean be a check-out and would probably have lead to missing a train. This occured only at stations without gates.

When the validator denied the check-in, our participants did not always get a clear message about the cause of the denial and on how to solve the problem. The stress level in such a situation is quite high. Participants were left alone with their problem, had little control over the situation and were not always provided with enough information or guidance to solve it.

Summarising: the lack of information and guidance causes a feeling of insecurity, uncertainty and of having no control of the own situation. Participants missed the train, took the train without having a valid ticket or bought a paper ticket instead, remembering that the OV-chipkaart causes problems they never had with a paper ticket.

Station

At the station, participants' goals and expectations varied from finding the right train and platform, buying something to eat or drink, buying a newspaper or magazine, or simply relax and think about the day.

The insecurity participants felt with regard to whether they wre checked-in already (as described in the Check-in step) is part of this step.

> "Ik kan niet met zekerheid zeggen of de incheckmachines die voortdurend op rood stonden wel of niet zijn gaan werken."
>
> (OVL 268)

Travel

The goal of users is to travel seamlessly from point A to B. Some people like to work during transit, whereas others like to talk to others or relax and look out the window. However, most of the travellers we have observed and interviewed have something additional on their mind. Some participants kept holding their OV-chipkaart constantly in their hand, in order to prevent themselves from forgetting to check-out. The

> "Ik heb het kaartje nu al in mijn hand om te voorkomen dat ik zo meteen niet vergeet uit te checken."
>
> User of the bus, male, Heerlen, +- 40 years (IV_HE_30)

required alertness influences the travel experience in a negative way for this group of users.

Finally, not all participants understood why the OV-chipkaart, a ticket which is supposed to work for all transport operators at any time, does not allow them to use the night busses. Participants experienced this as inconvenient.

Summarising: for some participants, the lack of information during the journey and a perceived financial disadvantage causes insecurity, fear that the conductor will come and distrust towards the system in general.

Interchange

Many participants experienced this as a stressful situation. They had to find the right train and platform, had to think of their luggage and were usually in a hurry too. Inconstitently placed validators did not simplify the transfer process. Meanwhile most of the participants were aware of the fact that they need to check-out and -in again when changing vehicles. However, it was not clear to some participants when they have to do so for trains and when they should not do so.

Users are required to know which operator runs the next train they are taking in order to know how to behave.

Apart from this extra mental effort, participants often got confused due to different types of feedback the validators gave. Whereas, for example, the validator of the NS provides the traveller with an audible 'beep' and visual information, the validator of Arriva provides vis-

> "Wanneer je bij drukte niet zeker bent of je bent ingecheckt (en je dat wel was) check je weer uit. Als je dan de trein wilt halen en dus inchecken lukt dat pas na 3 minuten. Trein weg dus!"
>
> (OVL 275)

Figure 21: Interchange at Dordrecht sation, still from video OB_DD_31

ual information only. The insecurity of our participants had with regard to correctly completing their actions, caused more waiting time for peer travellers who needed to check-out/-in as well.

Finally, people who have a season ticket which allows them unlimited travelling (may be on a specific route only) or students who do not pay during the week or the weekend, need to check-in and -out as well. Many people in these user groups do not understand why and feel that they only have to do so in order to allow the transport operators to follow their individual travel behaviour. Especially the first mentioned group feels that buying such a travel product, which provides the operators with guaranteed income, should be rewarded with the convenience of not checking in and out.

Summaring: the stress level is high. Users have to handle and remember a lot of things at the same time, which can cause mistakes. The lack of information and guidance and the resulting stress participants felt while transferring, caused mistakes such as checking-out and –in when it is not necessary or not checking-out and –in although it is necessary. Both scenarios caused a financial disadvantage for some participants, which lead to a decrease of trust in the system for them.

Check-out

In the last step of the travelling experience, users are often no longer concerned about their journey but with the next event to come. Our participants therefore sometimes forgot to check-out. We learned that participants often assume that asking for a refund will be too difficult so that they do not even try.

"Als ik ergens aan de andere kant van het land reis, hoe moet ik dan weten van welke vervoerder de volgende trein is en of ik dan wel of niet in en uit moet checken."

(OVL 231)

Participants who were aware that something went wrong, could often not point out the moment when and where the mistake happened. This made it difficult for the affected participants to solve their problem on their own.

When something goes wrong in this step of the journey, the stress level of the participants was high, due to a lack of information and guidance.

Evaluation

Even though the evaluation is a continuous process, which takes place at all steps of the journey, the visualisation sets it at the end of the process. The evaluation of the OV-chipkaart and its system is of great influence for the following journey, the expectations and the attitude users develop towards it.

> "Ik ga er niet meer achteraan, want ik heb al zoveel geld verbeld."
>
> User of the bus, female, Sliedrecht, +- 70 years (IV_SD_14)

> "Over het algemeen ben ik erg teleurgesteld dat tegenwoordig alles gedigitaliseerd wordt en dat de gebruiksvriendelijkheid hierdoor enoorm afneemt. Een dagje reizen wordt nu beheerst door de OV-chipkaart."
>
> User of the train, male, Sliedrecht, +- 40 years (IV_SD_17)

4.3.2 User group segmentation

After analysing the results we gained from the different applied methods and after clustering these results in the different steps of the customer journey, we recognized that our original division of user groups (see page 40) was not valid anymore. The statement that certain user groups have these kind of problems whereas another user group has those kinds of problems could not be maintained. Our results showed that everybody encounters problems, and that the routine of problem solving increases and the frequency of encountering problems decreases if travellers use the OV-chipkaart more often. Therefore, we conclude that the division into user groups is not suppotive in order to improve the usability of the OV-chipkaart. What we conclude is that there are three dimensions, which determine the overall perception of the OV-chipkaart.

These dimensions are: travel frequency, technology understanding and amount of operators. Table 4 compares the influence of each dimension throughout the steps of the customer journey.

	Frequent travellers	Infrequent travellers	Technology uderstanding	No technology understanding	One operator	Multiple operators
1 Orientation online				■		■
2 Online payment				■		
2 Offline payment		■				
2 Wating new/first card	■	■	■	■	■	■
3 Activation		■		■		
4 Loading		■		■		
5 Preparation				■		■
6 Check-in		■		■		
6 Status of the card	■	■	■	■	■	■
7 Station: way finding		■				■
8 Travelling						
9 Change: recognition		■		■		■
9 Change: way finding	■	■	■	■		■
10 Check-out		■		■		■
11 Evaluation	■	■	■	■	■	■
	4	11	4	12	3	9

Table 4: Overview of the problems encountered per dimension.

€ Purchasing phase

In the purchasing phase it is not important how often the user is going to travel. This phase is only encountered once, apart from switching the subscription or getting a new card after five years. The future travel behaviour is not of any importance in this phase and is probably not going to influence the evaluation of the ease of the purchasing process. It is important, that the purchasing process is easy to understand when people first get into contact with the system.

When buying an anonymous OV-chipkaart, the technology understanding and experience with Self-Service-Technologies is important, otherwise the user will probably fail in purchasing the card. Purchasing a personal OV-chipkaart also requires information technology understanding; online research while orientating is helpful and one needs to have a digital photo of oneself.

In the purchasing phase, the later travel behaviour and the number of operators involved is not relevant. However, selecting the right subscription might get complicated if the user wants to cross concessions and travel by more than just one operator.

Pre-travel phase

Within the pre-travel phase the frequency of travelling is of great influence for the experiences. The more often the traveller goes through this stage, the easier he will do so. Also the preparation stage might be redundant after some time. A frequent traveller is likely to forget problems he might have encountered in the beginning, whereas an infrequent user will probably encounter the same problem over and over again.

> *Technology acceptance and experience with technology-based self-services are required. The stages of activation and loading demand a certain level of understanding and experience of the traveller in order to understand and execute the required steps. In the pre-travel phase it is not important to take into account in which region people are travelling, whether they are crossing concession borders or using multiple operators. No matter where someone lives or travels, the steps of the pre-travel phase are the same and mainly dependent on the technology understanding and on the frequency of execution.*

Travel phase

In this phase the frequency of travelling becomes important for the efficient pass through of the system. Frequent travellers know where to check-in and check-out, where the vehicle leaves, where to find information and so on. Even if they encounter a new situation, they are able to adapt his knowledge to the new situation in order to solve their problem efficiently. An infrequent traveller does not have this knowledge and has to be constantly alert. Besides, he feels more insecure, due to a lack of own knowledge as well as external information and guidance.

A seamless pass through the travel phase does not require the understanding of technology. Users have to remember to check-in and to check-out, but they are not in contact with the underlying system. The operators not due to technology understanding but to the support and guidance offer being uncertain which validator to use when changing operators. When encountering a problem, at for example a validator, even people with a high degree of technology-based self-service experience do not know how to behave, since the machine is not facilitating self-service, currently.

> *For the travel experience, the amount of different operators is of importance to the overall perception of the system. Whereas travelling with one operator is relatively simple and only a few things can go wrong, travelling with multiple operators requires more knowledge and more alertness of the traveller.*

Post-travel phase

In the post-travel phase, users evaluate their satisfaction with the system. Depending on their travel behaviour and their understanding of the system, the evaluation differs. Furthermore, in the purchase phase, pre-travel phase and travel phase, it is a completely different set of people that encounters problems. Taken as a whole these experiences lead to a variety of evaluations by travellers in the post-travel phase.

Combination of dimensions

Combining the dimensions with each other eight clusters can be identified. These clusters only consider the two most extrem scenarios of each cluster. As it can be seen in the visualisation (see Figure 22), the cluster of infrequent travellers with a low understanding of technology and travelling with multiple operators is likely to have the greatest problems and the most negative evaluation. The cluster of frequent travellers, with a high technology understanding and travelling by one operator only are likely to experience the least problems.
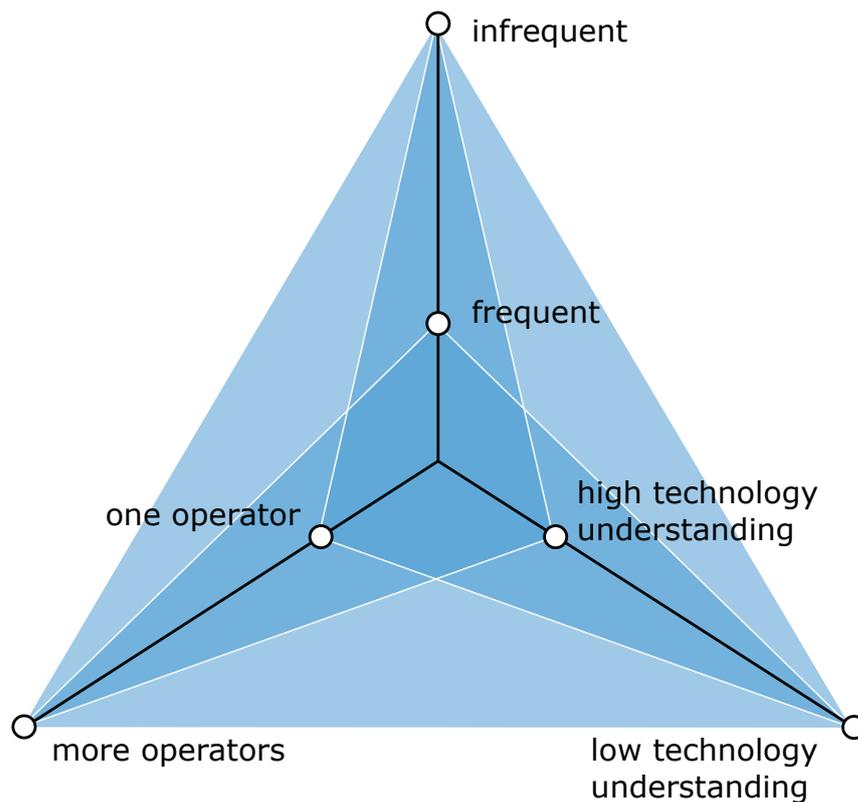
Figure 22: User group segmentation

4.3.3 Stages of experience

Besides the user groups, four stages of experience have been defined. Some users might skip the first stage of experience and enter stage 3 or 4 immediately. This is determined by their openness towards the new system and their experience with other technology-based services. We assume that every user goes through certain stages when adapting to the OV-chipkaart. Whereas some users will transit those stages quickly others will have difficulties during this process. The aim of an improved OV-chipkaart system therefore is to let every user pass those stages quickly and to make the system for people without a lot of pre-knowledge easily accessible. This can be achieved by an overall simplification of the customer journey and user group specific improvements. The four Stages of experience are defined as following:

Stage 1 - Non-users

People, who are in stage one, do not have an OV-chipkaart yet. This can be due to two reasons, either they do not travel by public transport at all or they just avoid the OV-chipkaart as long as possible and keep on travelling with paper tickets. The first group is excluded from the further research, since it is assumed that people not travelling by public transport have good (personal) reasons for it and the probability of convincing this group of people to change their mind will most likely not depend on the type of ticketing. However, the second part of this group will be wiped out soon by the abolishment of the paper tickets. This group is interesting to investigate, since they will either stop travelling by public transport or move to the second stage.

Stage 2 - Have to

People, who use the OV-chipkaart only because they are dependent on public transport, characterize the second stage. Travellers within this group feel forced into the usage of the OV-chipkaart, therefore they do not like it and most likely are struggling with the whole system in general.

Stage 3 - Adopting

People, who are actively trying to adept the OV-chipkaart as quickly as possible to their own needs characterize the third stage of usage. In this stage travellers may either have a positive perception of the OV-chipkaart since it is finally working as they want it to do, or they may have a negative perception since their effort of adaption is not paying off for them.

Stage 4 - Using

Once the traveller has adapted the OV-chipkaart to his own needs (or has been happy from the beginning) he enters the fourth stage of usage. This stage is characterized by a completely positive perception of the OV-chipkaart and travelling with public transport.

4.4   Problem areas in the Customer Journey

To capture the rich insights a customer journey map was created (see Figure 23). In the first three rows the goal, expectations and assumptions the traveller has in every step are described. Not only the touchpoints, but also how well the expectations are met, shape the current experience. The traveller's experience is enriched by a quote to further illustrate the situation. Combining these data, three curves on the travellers stress level, the information provided and the available support are drawn. Three main problem areas could be identified. To further support those curves and to deepen the understanding of what causes those problem areas, the occurring problems and what they mean to the travellers experience are described for each step.

Problem 1: Orientation and guidance in the pre-travel phase.

The first problem area occurs at the purchase and pre-travel phases. In the orientation step a lot of information is given on the Internet, all information is there, but travellers do not seem to find or to be guided to the correct information that is applicable for them. On the other hand activating the card and adding value to the card is characterized by a lack of information and guidance, which leads to uncertainty and insecurity with travellers.

Besides getting the right information, activation might not be possible due to broken payment equipment, unavailability of the product at the ticket machine, or a lack of understanding of the user how to activate a product. These problems are often related to the interface of the ticket machine. Another problem travellers encounter is the lack of payment options. This might be due to an international debit or credit card, which is not accepted at the ticket machines.

Travellers are aware they have to collect their products and that they have to add value to the card. If users are not capable of doing so, they already know that they cannot start their journey. Without knowing what exactly went wrong during this process, they realize how serious the situation is and that they will experience financial disadvantages when travelling without checking-in. What is striking in this situation is that travellers do not get any feedback on how to solve their problem or how to do it better the next time.

Problem 2: Check-in and the consequences in case of errors.

The second problem area manifests itself at the point of check-in. Often travellers assume that they have loaded their products successfully on their card, or they just added value to their card without being aware of the minimum required amount of 20 euro. Again there is a lack of information and guidance by the transport operators. The situation the traveller encounters is a, from his point of view, not working check-in validator. This situation leads to stress and insecurity about what to do. Travellers do not know whether the validator is not working correctly or whether they have made a mistake. If time allows, travellers often go back to the ticket vending machine to check their balance or to buy a paper ticket instead. Often time does not allow

Stages	Purchase		Pre-travel experience			Travel experience	
	Orientation	**Purchase**	**Activation**	**Loading**	**Preparation**	**Check-in**	**Station**
Goals	Making the right decision on which OV-chipkaart is most suitable for the personal situation. 'anonymous vs. personal' and choice on subscription	Buying a OV-chipkaart and start travelling by OV-chipkaart immediately.	Activation of the card and collecting the travel products	Load money on the card in order to be able to travel.	Selecting a fast and easy route to the final destination. Make sure that sufficient saldo is on the card.	Check-in to enter the vehicle	Finding the right platform, probably getting a newspaper, something to eat and/or drink, or simply relax before the journey starts.
Expectations	Support of service desk personnel or online support to select the most suitable card.	Point of purchase easy accessable and Being able to travel with the OV-chipkaart immediately.	Immediate use of the card, which enables to travel easier. Supportive interface to guide through the process.	Product will be available at any ticket machine. Supportive interface to guide through the process.	Payment can be done with the OV-chipkaart. Reductions will be calculated automatically by the system.	Since money is loaded on the card, check-in should be easy.	Information on delays, platforms. Shops Top-up possible at station
Assumptions	The OV-chipkaart is the new way of travelling.	Temporally OV-chipkaart wil be provided to bridge the waiting time.	Products, which are shown on the screen of the tichet machine that have a checkmark are succesfully loaded on the card.		If saldo on the card is high enough to cover the travel expenses it will be sufficient.	If saldo on the card is high enough to cover the travel expenses it will be sufficient.	
Touchpoints							
Current experiences	Orientation is extremely difficult without internet access.	Two weeks of waiting before the card arrives; immediate travelling as expected is not possible; anonymous card not available for specific groups	Assuming that products are loaded already -> experience at check-out Unawareness of activation -> experience at check-out	card has to be presented twice -> stress too little money loaded on the card -> experience at check-in	easy to select a route, provided information on duration, price and interchange moments are good.	Denied check-in Error messages are formulated unclear and are therefore confusing, do not empower the user to solve the problem on his/her own.	Insecurity about status of the card. Not possible to top-up card at the station as expected.
Quotes	"Ik heb zelf nog geen computer thuis en de hele maatschappij gaat ervan uit dat iedereen een computer heeft. Dus dat is wel moeilijk voor me." (IV_HE_30)	"Als je een OV-chipkaart aanvraagt, duurt het erg lang voor dat je ze hebt. Studenten moeten dan weer papieren kaartjes kopen ofwel ze eigentlijk gratis mogen reizen." (IV_EH_33; OV loket 35)	"Ik vertrouw hem nog niet, gebruik hem alleen in de bus... bij de NS betaal ik de volle prijs ofwel ik korting zal moeten hebben... bijna een uur een telefoon-gesprek erover gehad (klantenservice NS)... en schijnbaar moet ik deze kaart activeren... nu maken ze er ook reclame voor op televisie." (IV_HE_30)	"Ik vind het schandalijk dat er € 7,50 betaald moet worden voor iets waar je toe verplicht wordt." (IV_M_27)	"Ik vind het niet prettig dat je minimal €20 op je kaart moet zetten voor de trein." (IV_RD_09)	"There are so many 'pieps' and so many people, I have no idea whether I'm checked-in correctly." (own travel experience)	"Am I checked in already?" "What is my saldo on the card?"
Curves							
Problems	Too many products, too few information People are not sure if they will select the most suitable product Visitors are not aware of the card	Lack of customer service + support Not able to pay No internet access subscription not possible lack of money	Lack of information and guidance Unawareness of this step Activation not possible, due to broken machine, product not available, no understanding how to do it	Lack of information and guidance unawareness of minimum load loading not possible, due to living area or broken machine financially not able to load	Awareness of price differences comparing journey prices realizing that wrong subscription is chosen	Lack of information and guidance CICO's don't work doubts about own actions; checked in already? no information about journey price	Information not available checked in already? hights of own saldo? costs for the trip?
Results	Insecurity People stop the proces of orientation	No more trust People experience financial diasadvantages people can't protect their privacy Back in orientation phase	Uncertainty and insecurity financial diadvantage without knowing what went wrong; eventually losing trust not in state to solve problem independantly	Feeling of having no control hopelessly fighting against the system not knowing how to do better going back to paper tickets	Distrust or trust to gain back price control, buying paper tickets trying to get rid of 'wrong' subscription cheaper travelling leads to favourable	Insecurity + having no control missing the train going without valid ticket going back to paper tickets	Insecurity

Figure 23: Customer Journey Map

Post-travel experience

Interchange	Check-out	Evaluation
Getting to the connection on time. Check-out and check-in Quick orientation at the station to find the connection.	Check-out and leave the station, going home, to work, to an appointment...	
Logic location of the check-out pole	Check-out will be possible. Checking-out, not in.	
Checking-out/ in in necessary.	If I forget to check-out my money will be taken.	

| CICO equipment provides different feedback.

Being busy with looking for In/Out-check pole. | Actively looking for a check-out pole.

Forgetting to check out.

Too much money is charged from the card.

Checking-in | It is a difficult system, which requires constant alerness

No chance to solve problems individually.

Feeling of having no comtrol of own costs.

Unaware about possibilities and insecure about own behaviour. |
| *"But I did check-out! ... No, I didn't know that there were differences in the validators."*
(OB_DD_33) | *"Ik ben nog nooit vergeten om uit te checken, want voordat ik moet uitstappen haal ik hem al bij de hand."*
(IV_M_26)

"Ik heb eigenlijk geen idee wat de gevolgen zijn als je met je studenten OV vergeet uit te checken." *(IV_D_22)* | *"It is too much effort to ask the money back."* *(QB_4; QB_6)*

"I think it is really astonishing to travel through the whole country with only one card. Its really comfortable and useful." *(IV_D_21)* |

(3)
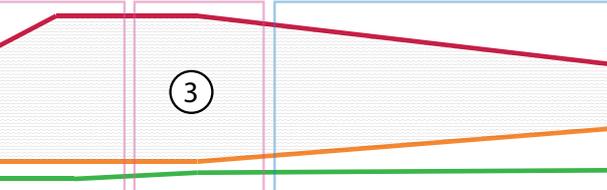
| touchpoints, locations + feedback
unaware of need to CICO

unawareness of which TO is be the next

dubbel opstaptarief

Beeing unaware about the different TOs | Lack of information and guidance
simply forgetting to check out due to other things on mind | Lack of customer service

no control of costs

not sure who is responsible

blocked card 'without a reason' |
| Insecurity + stress

loosing money leads to loosing trust

the system makes everything more complicated | Financial disadvantage | Insecurity, powerless, uncertainty

not able to solve problems by themself

negative image of the OV-chipkaart

negative image of the TO's |

travellers to do so, which may trigger them to enter the vehicle without a valid ticket. In those situations travellers are not in charge of their own situation and is forced to decide whether they will cheat, miss the train or use paper tickets. All of these options do not work in favour of the OV-chipkaart in general. Besides this, it is worth to notice that providing better information in the activation and loading step would prevent several problems, travellers might encounter within this stage of their journey.

Problem 3: Ending a journey and consequences for the evaluation.

The point of checking-out influences the whole evaluation phase. Again a lack of information causes insecurity, fear and stress. Having little possibility of reassurance while travelling users can only hope that they did check-in. Besides not trusting the system, travellers also doubt their own ability to remember to check-out as they have arrived at their final destination. In order to prevent theirselves from such a mistake, which would be punished with the maximum fee, they prefer to hold the card during the whole journey in their hands. In other words, during the whole journey travellers are reminded that they are not in control of the situation, which does not lead to a positive image of the OV-chipkaart.

When changing from one train operator to the other or when leaving public transport completely, travellers have to be very aware of the operator they were travelling with or are going to travel with. This is important in order to make sure that they will choose the right validator. Financial disadvantages can be caused by: unawareness of travellers, a difference in validators and that each journey at one operator has to be completed with a check-in and check-out. Losing money in this case goes hand in hand with losing trust in the system since the customer service is not clear and supportive enough for travellers. They do assume that requesting a refund is too difficult, and therefore do not even try it. What stays is the impression that operators try to get as much money from travellers as possible. Insecurity, powerlessness and uncertainty of travellers and the inability to solve problems independently leads to a reinforced negative image of the PTOs and the OV-chipkaart. Again, by providing better information at an early phase, and by enabling customers to actively take care of their own situation this problem area could be foreclosed.

4.5   Conclusion

Looking at the described usability issues per usage phase, the user group segmentation, the different stages of experience and the summarising customer journey map, we conclude that the usability problems occur amongst the different steps of the customer journey, that different types of users experience different problems at different stages, that their level of experience and their level of technology acceptance is highly important on the severity and frequency of problems they encounter and that three main problem areas can be defined.

The pre-travel phase, the travel experience, as well as the check-in and check-out stages, create multiple problems and due to a lack of guidance and sufficiently structured information the stress level of the traveller rises. Beside these two factors, the problems are related to a different understanding of the underlying organizational structure (e.g. not knowing that the OV-chipkaart is not developed by one company), and that travellers' service expectations are not always met (e.g. long waiting time for a new OV-chipkaart). Virtual services, which are loaded on a nation wide used card that is operated regionally, is exceeding the understanding of some users.

Many users look upon the OV-chipkaart favourably, and many who are opposed to the OV-chipkaart who developed this attitude due to problems they recently met would still often acknowledge the potential of the card, shows the high potential of this service.

Quantitative surveys conducted for transport operators (Stadregio Rotterdam, 2010) and the government (Lubbe & Larsen, 2007; Broek & Radewalt, 2009) indicate a majority of the travellers say the OV-chipkaart is an improvement and works well. Our qualitative research supports this view in general, but we found that travellers also tend to overlook the problems they experience once those are solved. A large part of the satisfied travellers we spoke to still run into problems at times. While the surveys thus indicate satisfaction, we conclude that there are still many issues that could be improved.

5 International examples

Several cities around the world have successfully implemented electronic ticketing. The Netherlands could learn from the experience others have. Especially, London and Hong Kong have interesting systems. London has one transport authority, but several concession holders, and it is a system familiar to the OV-chipkaart and appreciated by Dutch tourists. Hong Kong has one of the oldest electronic ticketing systems based on smart cards, this was the basis for the Dutch system and has since progressed to add more services.

We conducted field research in both cities: observing and interviewing users, as well as interviewing experts. As in the Netherlands the qualitative research lead to understanding of the usage of the smart card system.

This chapter summarizes the findings from London and Hong Kong and compares them with the Dutch situation. From this comparison, three main focus areas for the further project could be identified. The chapter will conclude with a reflection of the insights gathered.

5.1 Method

5.1.1 Aim
The research questions were mainly the same for the Netherlands and the two international examples, since we aim at comparing the usability of the three systems, with using the same kind of questions this is more likely to achieve.

5.1.2 Research questions
- Who are the users and what are their properties?
- How do travellers experience the Oyster/Octopus and what causes this?
- When, where, and how do travellers interact with the Oyster/Octopus system?
- What are travellers actually doing at a ticket machine and a validator?
- What do people think about the Oyster/Octopus?
- Which problems can be identified during a journey of a traveller?

5.1.3 Methods

In London and Hong Kong we started with gaining personal travel experiences. Due to this approach we were able to observe and experience the first contact with the system. By experiencing it ourselves, we were able to respond to the answers of the participants.

The observations helped us to develop a deeper understanding of the system and to recognize other usability problems, which only show when many people are interacting with the system at the same time. An overview of the participants that we have interviewed in London and Hong Kong as well as a summary of those interviews can be found in Appendix P to Appendix S.

Interviews with travellers helped to understand the perception of the usage of the system in their country. Interviews with experts of Mass Transit Railway (MTR) and Transport for London (TfL) gave information about the thoughts the developers had when developing the system, what they think of their system now and how they envision the future of the system.

5.2   London

5.2.1   System

The Oyster card was first issued in 2003 by TfL and is valid on several travel modes across London. These travel modes include the London Underground, buses, the Docklands Light Railway, London Overground, trams, some riverboats and most of the National Rail within the London fare zone. The whole system is designed to increase the efficiency at the stations.

The Oyster card (Figure 24) has a strong, consistent and recognizable appearance. The standard card is a blue credit-card-sized contactless smartcard. Until now only 5 special edition cards have been issued by Transport for London, which results in a strong recognisability of the card. The card was designed in order to reduce the actions at ticket offices and in order to reduce the amount of paper tickets. Travelling by Oyster card is encouraged by considerable cheaper prices compared to travelling with paper tickets.
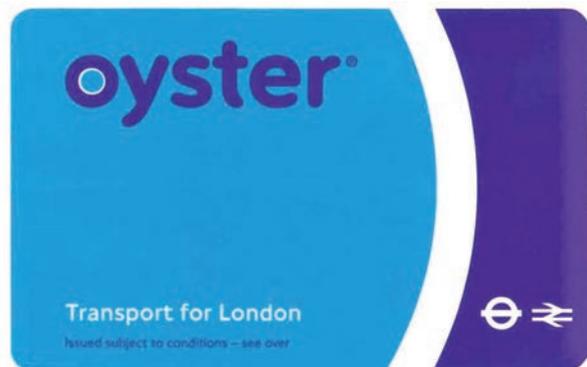
Figure 24: Oyster card

To make travelling also attractive for frequent travellers, TfL currently applies daily capping. Daily capping means that no matter how much one travels a day it will never be more expensive

than a daily card. In order to reduce the amount of available tickets, TfL is now busy looking at the possibilities weekly capping could offer. Next to this development, TfL clearly indicated that they are working on future concepts in which the Oyster card may be replaced by bankcards.

Issued Oyster cards are generally not registered to a certain user, but hold the possibility to be registered to protect the user from money loss in case of lost or theft. Oyster cards can be purchased via multiple channels, such as the service desk at underground/overground stations, special Oyster card vending machines, convenience stores located all over the city of London, travel information centres, online or via telephone from TfL. When purchasing an Oyster card a deposit of 5 pounds is charged, which will be refunded when the card is returned to TfL. This is especially interesting for visitors. Besides, for the inhabitants of London this means a low threshold in purchasing a new card when the own card accidentally is left at home, since purchasing a card doesn't actually 'cost' money. Loading can be done, online, automatically, at the ticket vending machines or at the one of the several small retailers.

5.2.2 Usage of the Oyster card

When travelling with the Underground, Overground or National Rail the user needs to check-in at the beginning and check-out at the end of the journey. To do so, the user has to pass a gate, which makes it almost impossible to forget to CICO. However, if something goes wrong supportive staff at each station is able to help and open the gate manually. At buses, boats and the tram a flat fare system is applied, which means that the traveller needs to check-in only and a fixed price will be charged from his card no matter how far he will travel. This can be done in London, since the distances one would go by bus tend to be shorter. When travelling longer distances the underground is much more suitable. However, this system makes travelling by public transport affordable for everybody. The possibilities and restrictions of the usage of the Oyster card are summarized in Figure 25 on page 69 and explained below.

€ Purchase

First of all it can be stated that purchasing an Oyster card is made very easy. It can be bought at ticket machines and service desks, in other words at every underground and overground station. Besides the Oyster card can be purchased in convenience stores as well, which extends the points of purchase extensively across the whole city. When purchasing an Oyster card one can pay with coins, bills, debit cards

€ "The Oyster advantages are that you don't have to carry cash, no messing with your handbag to get your purse out, its just in your pocket, very easy, if you lose one they send you a new one within two days, they cancel the old one, give you a new one, its really convenient."

(6) female, 45, frequent traveller

or credit cards at all points of sale. This makes the Oyster card easily accessible and available for everybody. Also it should be mentioned, that the Oyster card itself does not cost anything but a deposit of 5 pounds is paid, which will be returned to the user when he is handing in the card. This regulation makes the Oyster card very attractive for tourists, but also inhabitants of London communicated in the interviews, that they do have several Oyster cards. If they forget to take their Oyster card with them, they simply buy a new one, without having the feeling of spending extra money. As they perceive it, the card is necessary in order to travel and obviously one has to pay for the trip only, not for the card itself. Following this strategy Transport for London is able to function as a bank, using the money of their customers for other purposes as well.

The main advantage of the Oyster card is that it makes travelling cheaper by using it instead of travelling with a paper ticket. Furthermore it is perceived as more convenient and time saving.

Pre-travel experience

The Oyster card does not know many different travel products or subscriptions. According to TfL, about 50% of the people using the Oyster card use the 'pay as you go' option only. In London the service of automatically top-up is not used frequently, since people are afraid of losing their card. For travellers (using 'pay as you go' only) the card does not have a higher value than the current amount of money loaded on the card. Therefore they are not worried about losing their card. Activating auto-top-up would implicate a greater need to pay attention to the card. Travellers are always able to check-in as long they have a deposit of at least 2 pounds on their Oyster card and get charged after completion of their journey. The top-up of cards is mainly done at convenience stores. As we have learned from users the main reason for this behaviour is, that they have to go to a convenience store anyway and that it saves them time at the station.

> "It's just easy, simple to use, you don't have to go to machines al the time, you can just go in and out, you can go all over London, as far as you want, just without buying tickets. So it saves a lot of paper."
>
> (21) female, 20, frequent traveller

Travel experience

Users are experiencing a journey with the Oyster card as cheap, convenient and easy. A lot of services, which help to support this feeling, such as daily capping or automatic product load when checking-in are taken care of in the back office. When the traveller encounters a problem, such as an unclear error message at the gate, service personnel will be present in order to solve the problem for him immediately. According to Reinders et al. (2008) personal support in a problem situation has a positive effect on the service perception.

Post-travel experience

The post-travel experience in general is positive. Travellers like the Oyster card, mainly due to the perceived cost savings. Refunds are done quickly and easily and in most of the cases automatically as well. The only possible improvement we have learned from travellers would be to get an overview of the last transactions in order to keep track of the own expenses.

Summarizing it can be said, that the Oyster card is easy to use, due to a limited number of tickets, gates or a flat fare system. Besides it offers the possibility of cheap travelling for everybody within the borders of London.

"When I forget the Oyster card at home its like a nightmare to travel."

(14) male, 30, frequent traveller on the bus

5.2.3 Overview of the Oyster card system

The public transport system of London sounds promising, however when taking a closer look not everything is as functional as it may seem at first glance (Appendix T).

- A lot of service personnel is required at each station in order to keep the system working. If gates do not respond, check-in or check-out is not possible, machines present error messages, which are completely unclear to the user, personnel is necessary to solve the problem. Since the encountered problem is taken care of by service personnel, the traveller perceives the problem not really as an actual problem.

- Even though the whole system is designed for an efficient pass through of travellers, busy stations such as Victoria Station regularly cannot handle the amount of people during morning peak hours. This leads to the necessity of closing down the station for a couple of minutes, just to close it down again only a couple of minutes later. This problem impressively shows how burdened the system is and it is getting worse the more people get attracted by the city of London. This overload of travellers at certain hours led to active propaganda by TfL in order to keep them out of the London Underground and let them take the bus or walk instead. This problem will only intensify within the next years and it will be interesting to see how TfL will tackle this problem in a lasting way.

- Changing the travel mode in London, mostly does not cause any problems, since a gate will be passed or flat fare is applicable. However, when London Underground meets the tram or Light Rail system, as it is for example the case in Wimbledon it gets more complicated. Like in the Dutch system, the traveller is supposed to check-out of the first travel mode and check-in to the second. In this case, validators are located on the platform. However, since the traveller in London isn't used to this system at all, he is likely to forget this extra action. Depending on where he

is going to, he will either leave a flat fee vehicle or will encounter a gate, where personnel will most likely let him through and reset the card, to enable the next jouney.

Finally it has to be mentioned, that the Oyster card is designed for one city and not for a whole country. Overall it works well, which is due to short trips, one operator and a lot of actions are taken care of in the back office, such as daily capping or auto-refunds. To the user, the Oyster card is easy to use, makes travelling cheaper and generally more efficient. Also the adaption to the Oyster card has been easy for users, since they were already used to a closed system and magnet stripe tickets. Figure 25 shows the possibilities and restrictions of the Oyster card by the means of a brief customer journey, focussing on the different phases the user has to pass.

€ Purchase	Pre-travel experience	Travel experience	Post-travel experience
with coins, bills, credit cards and debit cards	always able to travel until a deposit of less then 2 pounds	information desk is located outside the payed area	refunding of the card is easy and quick
at the ticket machine, service desk and in convenience stores	travelling with bus, tube and selected trains	at every gate personnel at any time of the day	not possible to get an overview of last transactions
no initial costs, but 5 pound deposit	flat fee in busses	people perceive it as convenient and cheap	
no expiration date	fast gates	automatic product load is done when checking in	
extra plastic wallet	monthly tickets, weekly tickets next to pay as you go	daily and weekly capping guarantee low prices	
main advantage: travelling by Oyster card is cheaper than travelling with paper tickets	concessionary tickets for elderly and children	auto-fill and auto-refunds	
	auto top-up not commonly used	paying when checking out	
	top-up mainly done at convenience stores	zone based pricing	
		negative: error messages are not clear to traveller	

Figure 25: Possibilities and restrictions of the Oyster card.

5.3 Hong Kong

5.3.1 System and stakeholders

Octopus Cards Limited launched the Octopus Card (Figure 26) in 1997. The technology of the Octopus Card was used for the development of the Oyster card and the OV-chipkaart. The Octopus card can be used as an electronic payment card for all public transport in Hong Kong. Besides, the Octopus card can also be used at convenience stores, fast-food restaurants, supermarkets, car parks, parking meters, vending machines and other point of sale applications. This makes the Octopus card an integrated part of people's life in Hong Kong, which fits the company's slogan 'Making Everyday Life Easier'.

The transport operators of Hong Kong founded Octopus Cards Limited. With about 70% of the shares, MTR (Mass Transit Railway) is the main shareholder.

The Octopus card system knows three types of cards; on-loan cards, sold cards and Airport Express Tourist Cards. The on-loan cards (the most common cards) can be further classified in elderly, child, adult and personalized cards. With an exception to the personalized cards, these cards are anonymous and can be purchased at all MTR
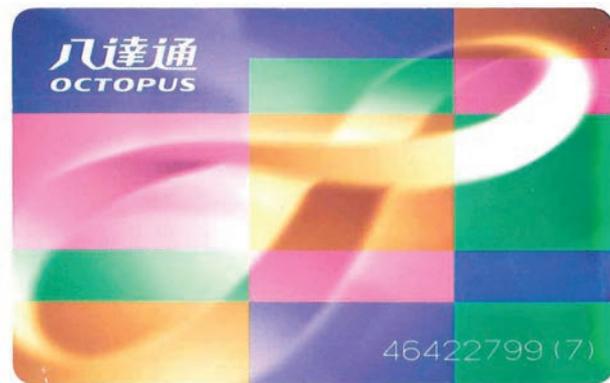
Figure 26: Octopus card

stations and Octopus Service Centres without any registration. The personalized cards (which include student cards) hold as the name indicates personal information of the user. Personalized cards offer the possibility to block the card in case of loss, to protect oneself of money loss.

Sold cards are sponsored and branded cards. They can be purchased at selected MTR stations and all 7-eleven stores. Those cards are more likely to be souvenir cards and have to be purchased, unlike the on-loan cards, which are given out for a deposit of HK$ 50. Next to these special event cards, Octopus cards can appear in different product forms, such as watches or key chains as well. These cards are sold cards too and can be purchased at different prices. All of these cards do not come with an initial value on it, but need to be loaded before use.

Finally the Airport Express Tourist Card, functions like an on-loan card. For this card one must pay a deposit of HK$ 50 which will be returned to the visitor when handing in the card back. The Airport Express Card is always sold with a one way or return ticket to the city. The Airport Express Card also offers 60 hours of free travelling starting from the first check in. After this period the Airport Express Card can be used as the common on-loan Octopus card.

Besides these types of electronic tickets, the Octopus system also knows single journey tickets (see Figure 28 on page 75). Single journey tickets can be purchased at ticket machines and service desks at all MTR stations. When entering the station the magnet stripe is read by the gate, opens the gate and the card is returned to the traveller. When leaving the station, travellers are inserting the ticket into the gate. This action opens the gate. However the ticket will be kept and not returned to the traveller. On the bus, mini bus and tram, travellers can also purchase a single journey ticket from the bus driver. Here they can only purchase the ticket with cash and do not get change, since the bus driver does not carry any money.

5.3.2 Usage of the Octopus card

Like in London, the user either needs to check-in and check-out, except he is travelling in a travel mode that makes use of flat fees. Most of the system is closed, which means that the user has to pass gates, only at the Light Rail Network in the north-west of Hong Kong the system is open. Here travellers have to CICO at validators. These are consistently placed at strategic spots that travellers have to pass when entering or leaving the train. These validators are comparable with the poles of the Dutch system. However, in Hong Kong every validator has its own function: checking-in, checking-out and for checking the status of the card (see Figure 27).

Figure 27: Side-view of lightrail validators in Hong Kong. From left to right: Exit, Entry, and Enquiry.

In order to make travelling by metro more attractive to the user, MTR placed 31 fare saver poles at strategic positions in the city. These fare savers offer a HK$ 2 discount on the next trip at the same day. Beside this MTR also introduced a bonus points system to lure people into the metro. Having collected 10 bonus points the traveller gets one journey for free. In order to actually make use of this free journey the traveller is asked to exchange his bonus points for a paper ticket at the service desk. The possibilities and restrictions of the usage of the Octopus card are summarized in Figure 28 and explained below.

€ Purchase

The Ocotpus card can only be purchased at the service desk at each MTR station. It is possible to pay for the card with coins, bills or credit cards. When choosing a regular Octopus card, no extra money for the card itself has to be paid but a deposit of HK$50 is required. When delivering the card to the MTR or to Octopus Ltd. the deposit will be returned to the user. When returning the card within 30 days, a fee of HK$9 will be charged. Like TfL, by following this strategy MTR functions as a bank by taking care of the deposits.

In case the traveller is not choosing a regular Octopus card, he can choose from a range of products, such as watches or key chains. These items function as an Octopus card but offer more convenience to the traveller due to their different product form. Since these products have an added value for the user and increase the usability for the user, they are only available at extra costs, differing from one product to another.

> € "When I applied for my personal student card I got a temporary card from the MTR."
>
> (10) male student from the US, 20, uses the Ocotpus card for a couple month

The main advantage for users of the Octopus card, and the reason why they buy it, is the price difference compared to regular paper tickets. Beside this, users appreciate the wide range of applications of the Octopus card.

🏠 Pre-travel experience

The Octopus card does not know many different travel products or subscriptions. Monthly tickets are available for four predefined routes and can be either personalized or not. Furthermore, concessionary tickets for elderly and children are available. As in London auto-top-up is not commonly used for the same reasons and top-up is done either at the retailer or a ticket machine.

> 🏠 "I don't want to put more money on my card, because if I lose it will cost me a fortune."
>
> (6) male student, 20, frequent traveller

🚌 Travel experience

Travellers perceive travelling with the Octopus card as convenient and cheap. When encountering a problem, for example when CICO is not possible, service desks are halfway positioned inside and halfway outside the paid area and are therefore accessible for all travellers.

> 🚌 "I always take the Octopus card, sometimes instead of cash as well."
>
> (11) female student, 20, from Hong Kong

We have experienced travelling with the Octopus card as very easy, also due to a special visitors Octopus card, which we received at the airport and which allowed us to travel for free within the first three days. Here-

after this visitor's pass functioned as a regular Octopus card and we could easily top-up the credit on the card. However, the prices are not always clear and sometimes even differ though the same route was taken.

Post-travel experiences

As the Octopus card can be used for multiple purposes apart from travelling, the card is a constant companion and due to this has an added value to users. The evaluation of the card therefore is very positive, since life without the Octopus card would mean a significant decrease in daily convenience for a lot of people. However, as we have heard in the interviews the accessibility of the transactions is limited. Only the last 10 transactions can be seen at a special machine at the stations. Since the card is used for so many purposes, 10 transactions are quite few. Some people criticize this matter of fact and it may lead to a decrease of trust in the system.

"Sometimes it is not possible to leave the station, the card is rejected then. In that case I go to the service desk and they make my card work again."

(17,19) female student from Hong Kong, 20 years

Summarizing it can be said, that the Octopus card cannot be reduced to an electronic ticketing system, but serves as a digital purse for multiple means. As far as the research could reveal, the main advantage of the Octopus card is its convenience.

5.3.3 Comparison with the Dutch system

Comparing the Dutch situation with Hong Kong quite some similarities can be seen. Like in Hong Kong several transport operators developed the OV-chipkaart. Likewise in both situations the e-ticketing company has one main shareholder and several smaller ones. However, in Hong Kong only one company issues the card and determines the possible subscriptions therefore all cards function the same way. Besides this, the Octopus card is much more integrated in people's lives. Not only due to its ability to purchase at the convenience store but also because it is available in different product forms, which allows the user to chose that kind of format that suits the individual situation best.

Based on the executed research it is difficult to mention negative points of the Octopus card. This might be like that, since the card meets user's expectations but culture might also be an explanation to the positive comments. What can be mentioned is that people do miss transparency of their payments. Whereas in the Netherlands it is possible to have a look at all previous transactions, in Hong Kong this is possible for the last 10 transactions only. For some people this might lead to a decrease of trust in the system in general. Figure 28 shows the possibilities and restrictions of the Octopus card by means of a brief customer journey, focussing on the different phases the user has to pass.

Purchase	Pre-travel experience	Travel experience	Post-travel experience
with coins, bills and credit cards	always able to travel as long the deposit is positive	service deska at every station and from payed and not payed area accesible	Octopus card can be used for multiple purposes besides travelling only
at service desk	travelling with bus, minibus, ferry and metro	peole perceive it as convenient and cheap	bonus points system and fare saver 'service' generates more demand for public transport
no initial costs but HK$50 deposit	flat fee in busses and on the ferry	special visistors card is sold at the airport	main disadvantage: only the last ten transations are visible to the user
costs of HK$ 9 when delivered within 30 days	fast gates	paying when checking out	
keychains, watches, phone covers with integrated Octopus card are available for extra costs	monthly tickets for four predefined routes	negative: Prices are unclear to traveller and prices are not always the same	
main advantage: travelling by Octopus card is cheaper than travelling with paper tickets	monthly tickets can be personalized or not		
	concessionary tickets for elderly and children		
	auto top-up not commonly used		
	top-up mainly done at retail or at the ticket machine		

Figure 28: Possibilities and restrictions of the Octopus card

5.4 Key Insights

5.4.1 Comparison of the three systems

Comparing the three systems with one another one can recognize some similarities in how they function in general and big differences in how they are applied within the three studied contexts. All systems are based on the same technical considerations. Due to the fact, that Octopus Ltd. was involved in developing the system for London and for the Netherlands, this is not really surprising. And even though the systems of London and Hong Kong do not function perfectly, they are interesting benchmarks. Based on the insights, gathered in London and Hong Kong, which are briefly described per phase (see Appendix S) and visualized in Figure 29 to Figure 32, the interactions and difficulties people have with the current system in the Netherlands, implications on their emotional state, and possible solutions based on inspiration from London and Hong Kong are illustrated. Table 5 gives a brief overview of the differences between the e-ticketing systems

	Netherlands	London	Hong Kong
Service staff	At bigger stations	Every gate line	Every station
Service points	Mostly self-service	Self-service & staff	Self-service & staff
Domain	Public transport	Public transport	Public transport & retail
Season tickets	Many & complex	Few	Almost none
Size of system	Country	Metrolpolis	Metropolis
Organisations	Many	Few	Few
Card costs	Purchase	Deposit	Deposit
System	Open	Almost closed	Almost closed

Table 5: Brief overview of current e-ticketing in the Netherlands vs Londen and Hong Kong

Purchase

Comparing the three systems differences can be recognized as far as the users' first contact with the card and its initial purchase is concerned. Whereas in the Netherlands the OV-chip-kaart can be bought at multiple transport operators with multiple and different kinds of subscriptions, the choice of products is more reduced in London and Hong Kong. Besides, in both cities the card is only issued by one operator only, which makes an orientation redundant. It is much easier for travellers to get an overview about the choices, to understand the implications and to make a sensible choice on which card suits their travel pattern best.

online purchase @ pc

offline activation @ service — *difficult to understand*

product load @ ticket machine

Purchase €

one step purchase

initial costs of € 7,50 — *no advantage of travelling by OV-chip*

no costs deposit is enough

expiering after 5 years — *inconvenient*

no expiration date

ec-card like product-form only — *increase individuals travel convenience*

different product forms

no added value of having it — *make the OV-chipkaart sth. travellers want*

generate clear advantage

Figure 29: The current situation of the Dutch systems on the left and an improved situation
on the right inspired by the analysis in London and Hong Kong in the purchasing phase

When purchasing a personalized card in the Netherlands (which is mainly promoted by the transport operators), it involves a lot of steps, such as purchase, activation, and loading before the card can be used in the Netherlands. Purchasing an unregistered card (which is mainly promoted by the transport operators) in London or Hong Kong requires one step only. Besides, the Octopus or Oyster cards do not have to be purchased at all, only a deposit is required. This difference leads to a more positive perception of the card, in London and Hong Kong users easily buy a new card, whereas in the Netherland the card is perceived as expensive which excludes a certain user group from travelling by public transport. Finally the Octopus card and Oyster card are purchased a lot by people since it adds value to the daily lives of users. In London, travelling with the Oyster card is much cheaper, whereas in Hong Kong the main advantage is the increased convenience and the possibility to use the card for multiple purposes as well. On the

large amount of products — *increase certainty and understanding*

less products

buying online collecting @ machine — *unawareness of extra step*

Pre-travel experience

one step purchase of products

make use of empty spot — *increase travellers convenience*

enable retail top-up

only coins or dutch debit cards — *include all travellers*

purchase possible with all means

Figure 30: The current situation of the Dutch systems on the left and an improved situation on the
right inspired by the analysis in London and Hong Kong in the selection and loading phase

other hand the OV-chipkaart currently does not offer any added value to users, which is why they are reluctant to purchase it.

Selection and loading

Due to the broad offer of different travel products, users in the Netherlands are uncertain about which product to choose. A lower amount of products will definitely lead to a better understanding of the system. However, since users in the Netherlands are already accustomed to a broad offer, reducing it would probably cause frustration. In the Netherlands a lot of problems occur due to unawareness of the activation, which is fore come in London and Hong Kong since this step is not necessary there. Loading money on the card is not everywhere available, which lowers the convenience for the traveller. In London and Hong Kong the places at which it is possible to top-up the credit of the card are widely spread across the whole city. Besides, the means by which the top-up can be paid are quite limited in the Netherlands and further decrease the convenience of the traveller.

Current Situation + Consequences	Possible changes + Improved Situation
the Dutch system and consequences for users	*based on the analysis of London and Hong Kong*

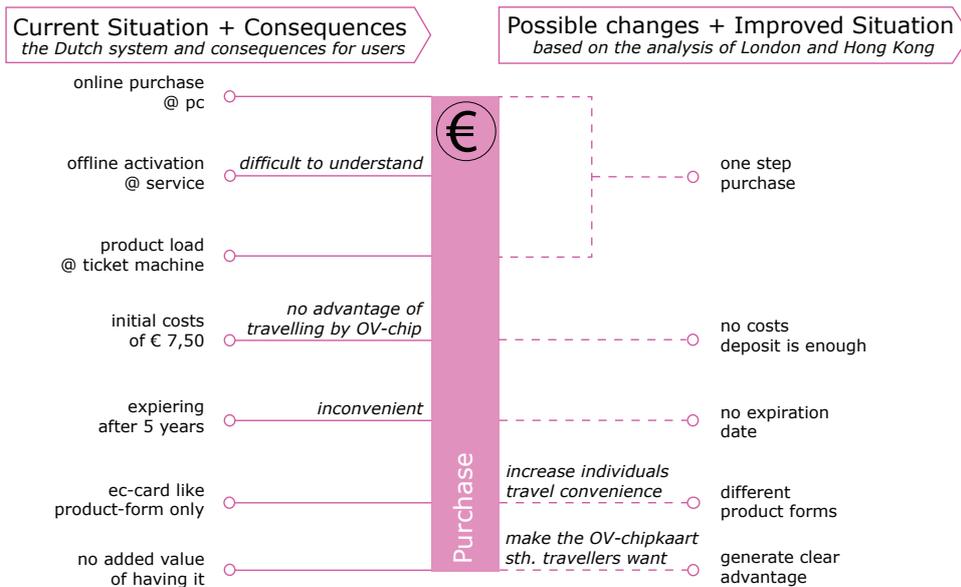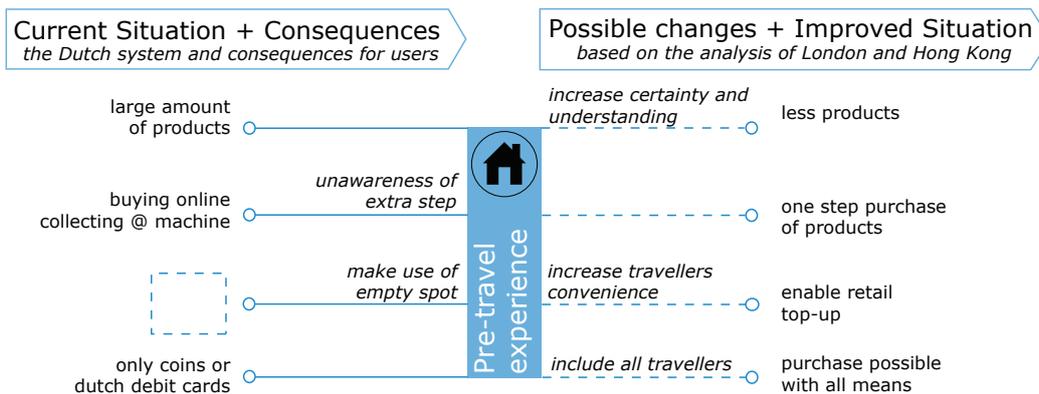| Current	Consequence	Improved
'paying' before travelling	*more money than afforded is needed*	after travel payment
active search for CICO required	*reduce stress and frustration*	consistent placement of CICO machines
invisible status of the OV-chipkaart	*active support and seamless travel*	information possible if requested
few service people present	*feeling of beeing alone and powerless*	(human) support always present
error messages are unclear	*no understanding*	describing the problem
non-supportive error messages	*empower traveller user satisfaction*	giving solution space
own responsibility to bring card to station	*extra mental effort*	forgetting the card (almost) impossible
no clear advantage of the OV-chipkaart	*essential part of traveller's life*	generate clear advantage

Travel experience

Figure 31: The current situation of the Dutch systems on the left and an improved situation on the right inspired by the analysis in London and Hong Kong in the travel experience phase.

Travel experience

The overall travel experience is influenced by a lot of factors, which determine how seamless the whole journey is designed. Due to the fact that both London and Hong Kong already worked with magnet stripe tickets before publishing the new electronic ticket its acceptance was high right from the beginning. People were already used to pass through gates and wait for their ticket to be disgorged after reading it, this step was overjumpt now and made checking-in or out even quicker than it has been before. Gates also prevent travellers from forgetting to check-out, which is considered as a problem by many users in the Netherlands. The transition to the new system was much easier for users in Hong Kong and London.

In all three systems, travellers encounter problems with for example the validators. In all situa-
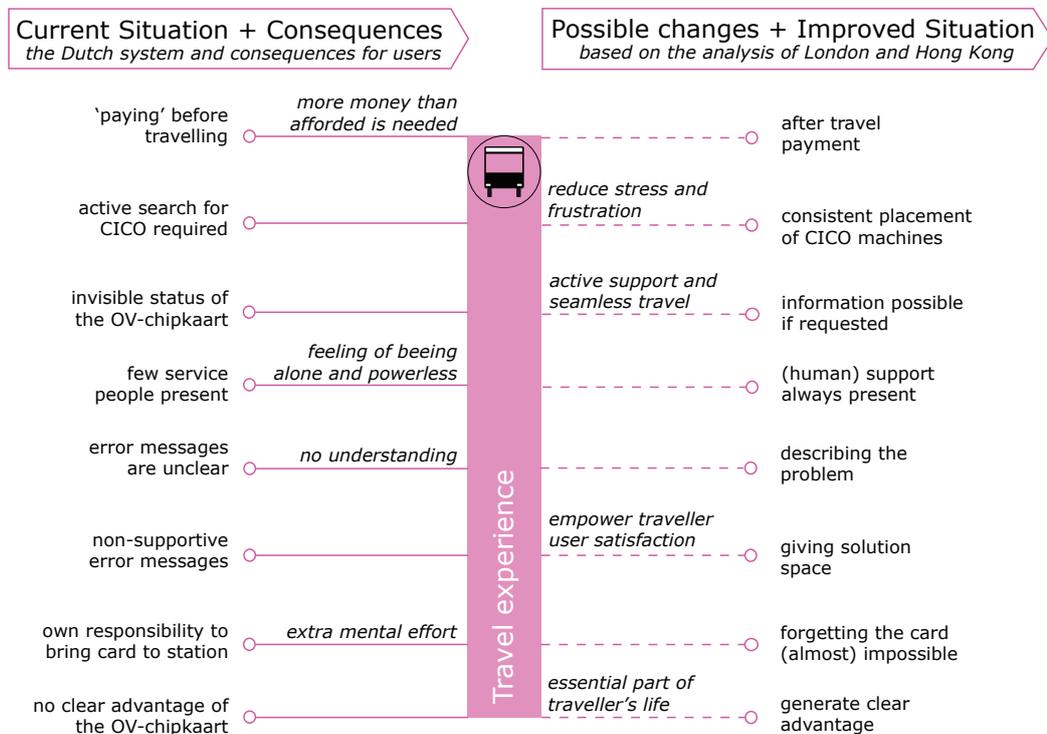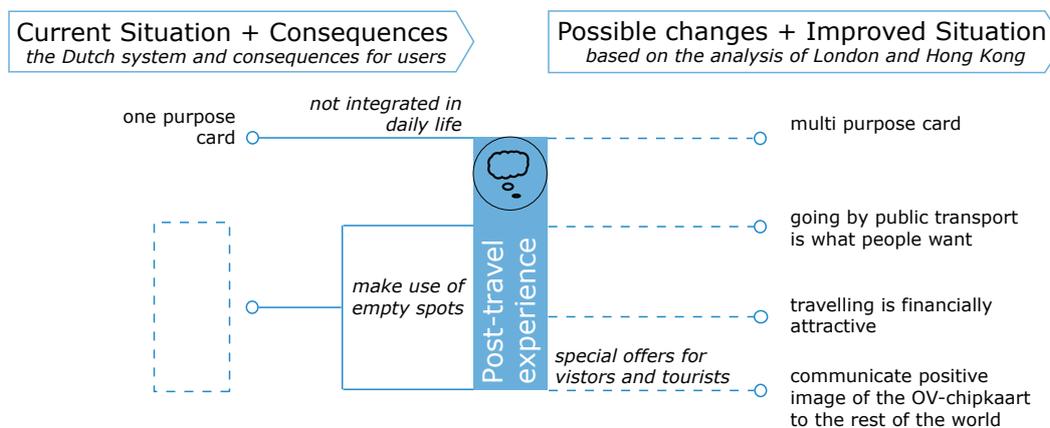

Figure 32: The current situation of the Dutch systems on the left and an improved situation on the right inspired by the analysis in London and Hong Kong in the post-travel experience phase.

tions the error messages given are unclear to the traveller, but whereas in the Netherlands the traveller has to find a solution by himself, in the two studied cities service personnel is available which helps the traveller through the process.

Finally, since the card is much more integrated into people's daily lives in London and Hong Kong, it does not feel as an extra duty to have the card available when travelling, but it is normal to take the card when leaving the house.

Post-travel experience

The differences described above have a great impact on the overall evaluation of the three different cards. In the Netherlands the OV-chipkaart has one purpose only, which is travelling and is not as integrated into daily life as the Octopus card or the Oyster card is. In London and Hong Kong the card has an added value for users, which is why everybody wants to possess a card and can hardly image life without it. This feeling is due to its functionality, the implementation strategy, the possible applications, financial advantages and accessibility. The feeling a lot of users of the OV-chipkaart share, is quite the opposite and impressively illustrates the possible range for improvement.

6   Conclusions

Combining the insights as described in chapter 4 and 5 gives an overview of the current situation of the usage of OV-chipkaart. This current situation and ideal situation for travellers are explained briefly and visualized in a customer journey map.

In describing the current situation and the ideal situation the gap between both can be identified. This gap leaves room for improvement for user-centered solutions. Five guiding principles will be guiding in the evaluation of the design solutions.

Three design briefs are formulated according the design opportunities. These briefs are the start of three individual design phases in which solutions will be generated for the three focus areas.

6.1   Results

Based on the results from chapter 4, the inspirational cases of chapter 5 and embedded in the given context as described in chapter 3 the findings are described per phase below and illustrated in the customer journey map.

Orientation

Due to many different sources of information, the information given is not structured and confusing to users. A low level of support makes orientation difficult. Besides, some information is not accessible offline, which excludes a huge group of users. Preferably, the level of information should be very high, which demands a good structure of the provided information as well. It should be easy for any user to find the right information (online and offline) to make a good and reasonable choice.

Purchase

Currently, purchasing a (personal) OV-chipkaart requires a lot of steps on part of the users. Not all steps are well communicated and users may be unaware of the necessity to take a certain step. Apart from the confusion the user may experience, the payment of (any) OV-chipkaart is not possible with all means. Preferably, the purchase of OV-chipkaart should be easily accessible and the user should be guided through the process smoothly. Furthermore, after having

paid for the card, the user should immediately be able to use it, instead of waiting for two weeks for the card to arrive by mail.

Activation
Apart from activating the card, the travel products also need to be activated one by one. Users may be unaware of this step, which causes them troubles, such as not being able to check-in or recognizing a higher travel price than expected when checking-out. Both experiences have a negative impact on the overall perception and should be avoided. The activation should be done automatically by the service provider/operator to simplify the journey for the user.

Loading
Due to the fact that the user pays the exact amount of money after the journey is completed a higher balance on the OV-chipkaart is required than needed for the journey. Users often feel that they are paying money to 'keep the card alive' only. They feel that they have to save money, which they will never be able to use. Since changing the payment policy is not an option, the information should be increased on how the system works according to payment. Besides, making the payment possible with different means would increase the level of travellers support and the overall perception of the system.

Preparation
For users who have internet access the preparation is mainly easy and quick to do. Users without internet access at home need to go to the service desk or find another way to get the information they need. However, when travel informations change the preparation of the adapted route is more difficult for both groups. In this case the level of information and support should be increased to reduce the stress level of the user. The provided information should be designed in such a way, that it is easy accessible to those people who are in need of it and invisible to others.

Check-in
In most of the cases users do not experience any difficulties with checking-in, but occasionally the validator may not accept the user. This experience leads to a very high stress level, due to limited time in most cases. Users are not provided with supportive information, which in an ideal situation they would be. Preferably each user would be able to fix his own problem right away, or service personnel would be available to solve the user's problem situation.

Station
Currently, users sometimes feel unsure about the status of their card, while being at the station. Depending on the time they have left before the vehicle arrives, this causes a lot of stress
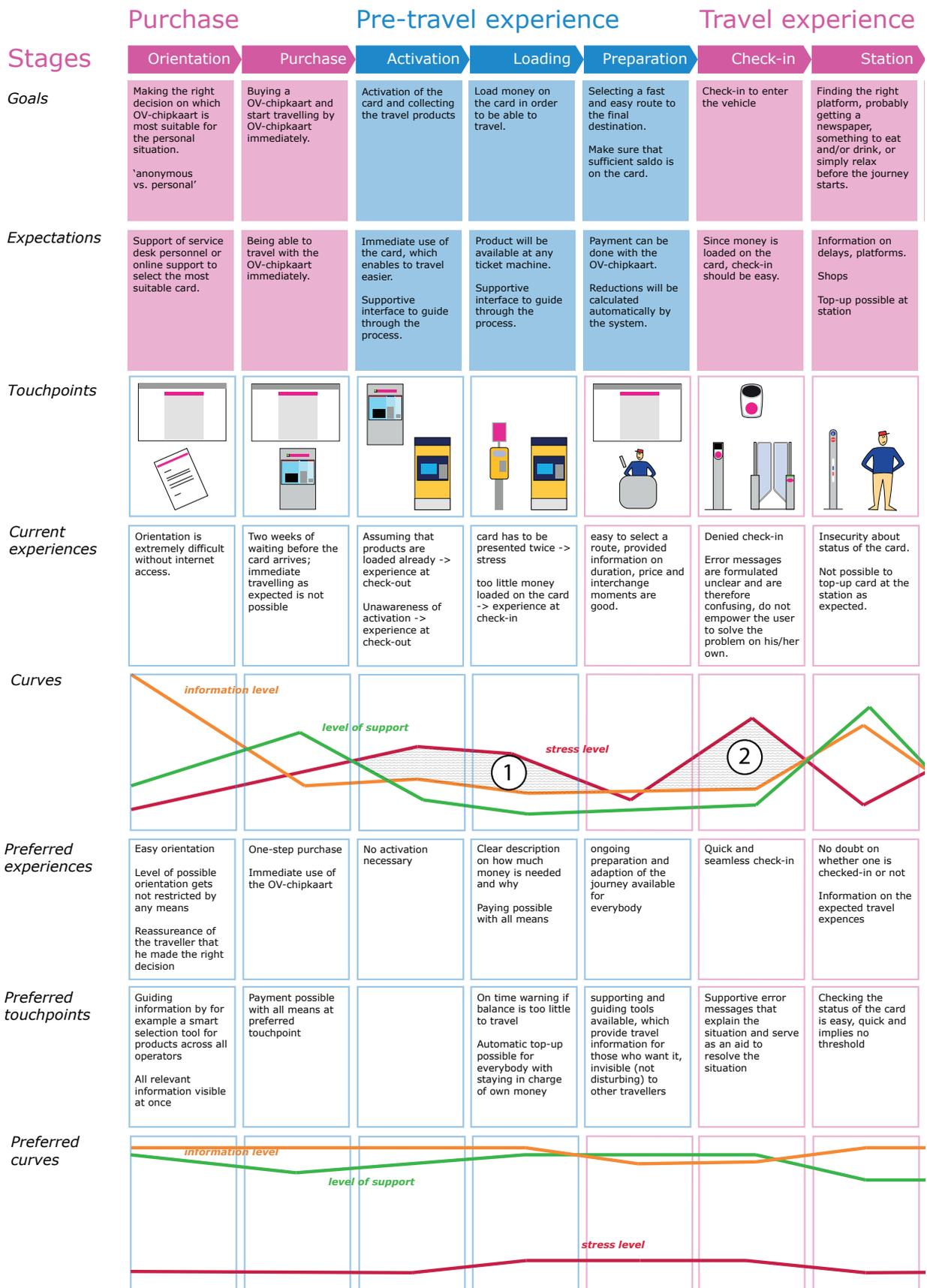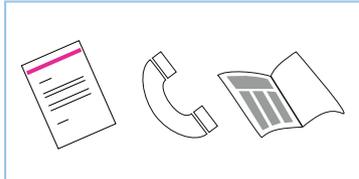
Stages	Purchase		Pre-travel experience			Travel experience	
	Orientation	Purchase	Activation	Loading	Preparation	Check-in	Station
Goals	Making the right decision on which OV-chipkaart is most suitable for the personal situation. 'anonymous vs. personal'	Buying a OV-chipkaart and start travelling by OV-chipkaart immediately.	Activation of the card and collecting the travel products	Load money on the card in order to be able to travel.	Selecting a fast and easy route to the final destination. Make sure that sufficient saldo is on the card.	Check-in to enter the vehicle	Finding the right platform, probably getting a newspaper, something to eat and/or drink, or simply relax before the journey starts.
Expectations	Support of service desk personnel or online support to select the most suitable card.	Being able to travel with the OV-chipkaart immediately.	Immediate use of the card, which enables to travel easier. Supportive interface to guide through the process.	Product will be available at any ticket machine. Supportive interface to guide through the process.	Payment can be done with the OV-chipkaart. Reductions will be calculated automatically by the system.	Since money is loaded on the card, check-in should be easy.	Information on delays, platforms. Shops Top-up possible at station
Touchpoints							
Current experiences	Orientation is extremely difficult without internet access.	Two weeks of waiting before the card arrives; immediate travelling as expected is not possible	Assuming that products are loaded already -> experience at check-out Unawareness of activation -> experience at check-out	card has to be presented twice -> stress too little money loaded on the card -> experience at check-in	easy to select a route, provided information on duration, price and interchange moments are good.	Denied check-in Error messages are formulated unclear and are therefore confusing, do not empower the user to solve the problem on his/her own.	Insecurity about status of the card. Not possible to top-up card at the station as expected.
Curves							
Preferred experiences	Easy orientation Level of possible orientation gets not restricted by any means Reassureance of the traveller that he made the right decision	One-step purchase Immediate use of the OV-chipkaart	No activation necessary	Clear description on how much money is needed and why Paying possible with all means	ongoing preparation and adaption of the journey available for everybody	Quick and seamless check-in	No doubt on whether one is checked-in or not Information on the expected travel expences
Preferred touchpoints	Guiding information by for example a smart selection tool for products across all operators All relevant information visible at once	Payment possible with all means at preferred touchpoint		On time warning if balance is too little to travel Automatic top-up possible for everybody with staying in charge of own money	supporting and guiding tools available, which provide travel information for those who want it, invisible (not disturbing) to other travellers	Supportive error messages that explain the situation and serve as an aid to resolve the situation	Checking the status of the card is easy, quick and implies no threshold
Preferred curves							

Figure 33: Concluding Customer journey map

Post-travel experience

Travelling	Interchange	Check-out	Evaluation
Seamless traveling from A to B.	Getting to the connection on time. Check-out and check-in Quick orientation at the station to find the connection.	Check-out and leave the station, going home, to work, to an appointment...	
Reaching the destination safely, comfortable and on time. Having time to relax or work, not being busy with the journey itself.	Logic location of the check-out pole	Check-out will be possible. Checking-out, not in.	
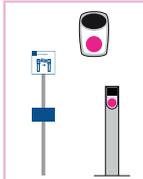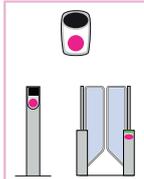
Holding the card in the hand. short & known journey: OV-chip long & unkown journey: paper ticket	CICO equipment provides different feedback. Being busy with looking for In/Out-check pole.	Actively looking for a check-out pole. Forgetting to check out. Too much money is charged from the card. Checking-in	It is adifficult system, which requires constant alerness No chance to solve problems individually. Feeling of having no comtrol of own costs. Unaware about possibilities and insecure about own behaviour.
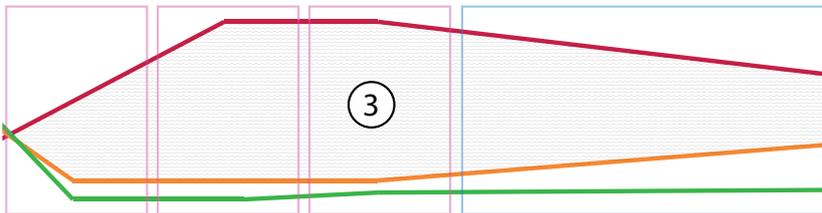
Thinking about everything except travelling	Security about own actions seamless travelling	'Automatically' thinking of checking-out	Easy to understand system. System does not require extra efford, but support the traveller on his journey in an invisible yet efficient way. Empowerd traveller. Awareness and security about own behaviour and possibilities of the system.
Personal and useful information provided by the conductor	Clear distinction of the different validators; Clear feedback; Logic and consistent placement of the validators	Logic placement of validators Individual reminding system when necessary	Regullary provided information about transactions. Information and support invisible when not needed, visible and available when ever needed. Clear instructions provided by any touchpoint.

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and uncertainty on how to behave best. In the ideal situation the user would be able to check the status of his card, to reduce the stress and to get supported in making a decision on how to behave.

Travelling

The problem, users encounter at the station they may also encounter when travelling, which stresses the importance of improving it. Usually users tend to hold the OV-chipkaart in their hand while travelling, which makes the OV-chipkaart an object, which is influencing the journey constantly. Preferably, the user would not feel the need to actively take care of his situation but could rely on the supportive system instead.

Interchange

When changing from one provider to another, users need to be aware of different validators, find the right ones and understand the different feedback provided by them. All these factors cause a lot of stress, uncertainty and insecurity. The travellers should be supported better by a constant placement and feedback of the validators. The traveller should be sure about his own actions and experience a seamless travel.

Check-out

Occasionally the user forgets to check out since the validators do not supporting him to not forget this action. Users should be guided through this process, which makes forgetting almost impossible. Preferably an individual reminder will be activated when necessary.

Evaluation

Currently, a lot of users evaluate the system as difficult to understand because it requires constant alertness, a system which makes travelling more expensive and is not setting the user in charge. In the ideal situation the system should be easy to understand, easy to use, empowering the traveller to solve own problem situations, giving better information and offering a higher level of guidance.

6.2   Current Experiences

The current situation is characterized by uncertainty on the part of the traveller. The traveller has different expectations about the system, which leads to a lack of understanding and unawareness. A lot of the problems the traveller encounters throughout his journey find their origin in the pre-travelling phase. Due to insufficient information and support the traveller makes errors without being aware of it. At a later point he gets confronted with problems, which result from the earlier mistake. Unawareness of having made a mistake and no guidance in the prob-

lem situation itself can only lead to insecurity and a lack of trust in the system. This mainly happens when the traveller is in the pre-travelling or already in the travelling phase. However, when he is still in the phase of pre-travelling and he actually has the opportunity to take another path he often turns his back to the OV-chipkaart system and for example goes back to paper tickets. In the current situation the service the traveller receives does not meet up with the service he would like or expects to receive.

6.3 Room for Improvement

In order to make this 'room for improvement' more tangible three main focus areas could be identified from these results, which are the required alertness of travellers, the support offered and the first contact with the system.

Alertness

The Dutch system requires constant alertness of the user, especially when it comes to checking-in and checking-out, both international systems support the traveller actively in this action. By passing through a gate, the traveller automatically gets reminded of the necessity to check-in or to check-out. The action of passing through a gate in order to enter (or exit) the public transport, for both cities was common before the electronic ticketing system got implemented. This of course supports the adaption of the individual traveller to the new system. The transition the system had to go through was much smaller and therefore the chances of success higher. In the Netherlands the need for constant alertness causes insecurity with the traveller. If the traveller is not alert or is focussing on other things, such as a conversation or looking for the right platform, he can easily forget to check-in or check-out without being actively aware of it. In both situations the traveller may ask himself, weather he checked in/out already. The system currently does not offer the possibility of a check-in/out afterwards and is not designed in such a way that the insecurity is prevented right from the beginning.

Traveller support

The Dutch system does not always offer enough support for the traveller. Whereas in the Netherlands the system is often perceived as a bouncer, it is more like a red carpet in London and Hong Kong. Travellers in the Netherlands are often unaware of certain steps, such as the activation of the card and due to that experience for example financial disadvantages. This matter of fact and the feeling of being left alone and having no chance to solve the problem leads to the metaphor of a bouncer. The uncertainty of how the own behaviour needs to be adapted (e.g. activating the card), will lead to the conviction that the system is more expensive than expected or denying the traveller at all. Even though the systems of London and Hong Kong also do not work seamlessly in all aspects, the traveller is always in the position to ask the service person-

nel for help. This does not solve the underlying problem indeed, however it actively supports travellers by taking care of their problems immediately.

First contact & initial purchase

The purchase of an OV-chipkaart is much more of a demanding task than it is in London or Hong Kong. Unlike the OV-chipkaart, the Oyster card and the Octopus card can be purchased in one step and are ready for use immediately. In the Dutch system, people have to figure out themselves, where to buy, which type to buy, what subscription to use, how to activate, how to load money on the card, and whether allowed to travel with reduction. Many steps, which are difficult to understand, which differ according to the provider, and which just need time to be passed before the possibility of travelling with the OV-chipkaart is actually near at hand. All those difficulties in the purchase and pre-travel process lead to people falling back on paper tickets, as long it is possible. Even though travelling by single journey tickets is not what the transport operators recommend, it might be the better alternative to excluding whole user groups from public transportation due to a challenging purchase process.

6.4 Guiding principles: ideal situation

The ideal situation for the traveller would be a situation, which does not require his constant alertness. The traveller needs a system which enables him to take care of his own situation and that reduces his internal insecurity. This can be either achieved by avoiding problems by means of better information or by helping to solve problems by a clear guidance.

Users should perceive in the future OV-chipkaart system as a 'red carpet' in the future. By the expression red carpet is meant, that the OV-chipkaart system is designed in a transparent, and personal way, which makes the user feel invited to use it. It is important that users do not encounter problems during the customer journey, which they are not able to resolve by themselves. The 'red carpet' is used as a metaphor for seamless travelling. In order to achieve this goal, the back end of the OV-chipkaart has to work with modules and has to be flexible in order to achieve innovation.

The guiding principles for the back end of the system are modularity and flexibility. **Modularity**: The OV-chipkaart system should consist of modules, which can be operated by the transport operators individually, within given boundaries. This modularity enables transport operators to be and stay innovative, while the overall goal of satisfying the user will not get lost.
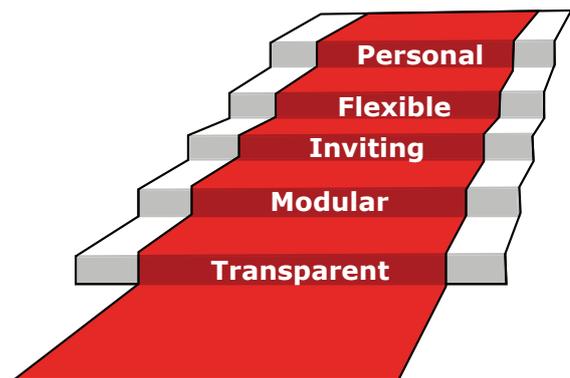
Flexibility: The OV-chipkaart system allows competition amongst transport operators, suppliers and others in order to guarantee the best possible solution at the best price at each time. The parties involved in the system are flexible and may change over time, which is not affecting the functionality and usability of the OV-chipkaart system.

The guiding principles for the front end are transparency, being inviting and personal.
Transparency: The system has to be understandable, that all information's are given to users at any point of the journey if required by the user. The system should inform users about the status of the card, the costs, and be is honest and supporting when users encounter a problem.

Inviting: The system should be attractive to users; it has to communicate an added value, which goes beyond 'having one card for all public transport'. The card, should be easy to be purchased, attracts the user on a functional and emotional basis and becomes an essential part of users' lives.

Personal: Personal refers to an OV-chipkaart system in which each user feels like being taken care of in a direct and personal way. That his complaints have effect, that help is provided at any point of the journey, that the system 'takes him by the hand' and guides him through the processes.

With these principles we will develop concepts, each of us focus on one of the three identified gaps. Taken individually and as a whole these solutions will contribute to the 'red carpet' feeling. The positive image of the OV-chipkaart will be reinforced and displace the first negative thoughts travellers currently have.

6.5   Conclusion

As derived from the previous chapters the usability problems with the OV-chipkaart manifest themselves in three main problem areas: the first contact with the OV-chipkaart; the lack of traveller support during the journey; and the lack of availabity of card data. These problem areas cause a gap in the expectations users have of the OV-chipkaart system and their experiences. Multiple underlying problems can be assigned to each phase, which the user directly encounters. Beside these 'tangible' problems some 'virtual' problems can be assigned to these phases as well. The first problem area (first contact) includes the problems of orientation, purchase and some parts of the activation process. The second problem area (traveller support) includes the loading, preparation and again part of the activation process. The third problem area (required alertness) includes the problems of the check-in and check-out, the interchange and partly the stages of being at the station and travelling.

6.6　Design briefs

Improving all problem areas would increase the usability of the OV-chipkaart during the whole journey. Each of the students will take care of one problem area. They will individually focus on the problem areas, but keep in touch with each other in order to let the three solutions connect to each other as much as possible.

How these three focus areas contribute to an overall solution is shown in Figure 34. Improving these problem areas will improve the evaluation of the system, lead to a more favourable perception and are an opportunity to increase traveller numbers.
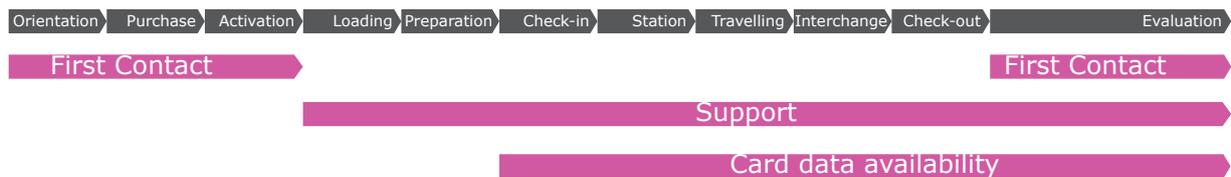
Figure 34: Opportunities for improvement

6.6.1 ʹImproving system adoptionʹ Joppien

Introduction

The OV-chipkaart is an electronic ticket, currently used in The Netherlands for all regional and national public transportation. During its introduction it became clear that the OV-chipkaart suffers from a number of usability issues. This is the reason for the OV-chipkaart Graduation Lab, an initiative of TU Delft in collaboration with transportation operators (RET, NS), the travellers' association (ROVER), and national and regional government bodies (Ministry of Infrastructure and Environment, IPO, SkVV). The overall goal of this project is to improve the public transport e-ticketing system for travellers in the Netherlands. A design vision with horizons at 3, 5 and 10 years will be created.

The outcome of this project will most likely be a design for a product-service system. The OV-chipkaart is a very innovative product, which holds great potential for users and the companies and distinguishes The Netherlands from other countries by being the first country to implement a nationwide electronic travel card system.

Analysis

One of the usage issues that surfaced during an analysis usage of the OV-chipkaart was the first contact that travellers have with the OV-chipkaart, the image they create of the OV-chipkaart due to their first experiences and the expectations they have prior to acquiring a (new) card.

It is assumed that an improvement of this first usage phase will have a positive impact on the overall perception of the OV-chipkaart. Either simplifying the entrance in the system and/or providing additional benefits of using the system could achieve this.

Providing travellers with more relevant information and a better customer support in the pre-travelling phase seems a promising way to improve users' feeling of empowerment. Simplifying and enabling the purchasing process and communicating the positive characteristics of the OV-chipkaart, would reduce the barrier for people to buy a card, enable them to select travel products (i.e., subscriptions, tickets) they benefit from and increase their confidence in the system and their own actions.

Besides this, the OV-chipkaart is currently perceived by many users as compulsory in order to be able to use public transportation. Users do not want to have the OV-chipkaart but need

the OV-chipkaart, which may provide the feeling of being forced into a system. Increasing the incentives, which trigger users to enter the system, will be a positive contribution to the perception of the system.

Problem definition

The main user issues related to the interaction with the OV-chipkaart are insecurity, uncertainty, stress, and a feeling of powerlessness towards the system. These feelings mainly occur due to (perceived) financial disadvantages, a lack of information and poor customer service. These problems are present in all phases of travel, from pre-travelling (e.g. orientation, purchase), to travelling (e.g. check-in, interchange), and post-travelling (evaluation). These problems seem to decrease traveller trust in the system.

Assignment

Improving the OV-chipkaart product-service system adoption, by facilitating a satisfying pre-travel experience, in order to increase customer satisfaction and trust of the system.

In this assignment it will be explored how to offer users a seamless, unified travel experience (with a focus on pre-travel), which enables users to quickly and easily identify the proper information sources, and who to turn to when encountering a problem. Besides exploring how the current system could be improved, it will be explored as well how the value proposition of the OV-chipkaart system can be extended in order to make the system more attractive to its (future) users.

After having analysed the system dimensions that influence the adoption of it, the most promising and relevant limitations of the current system adoption will be translated into possibilities to improve the current system adoption. About three scenarios will be developed based on these insights, which will be evaluated on business, technology and human aspects. This argumentation in addition to a user testing will lead to the final scenario. This will then be finalized, stakeholder benefits will be formulated and a roadmap for 3, 5 and 10 years from now on will be created.

Research questions
- How can the product service system be improved to facilitate user satisfaction?

- What are the limitations of the current system adoption?

- How can the entrance of the system be simplified?

- How can the usages of the system become more attractive to (future) users?

- What are the dimensions that influence the adoption?

- How can these dimensions be adapted in order to improve the overall system adoption?

6.6.2 'Support travellers in their journey.' Niermeijer

Introduction

Since 2005 the OV-chipkaart system is in use for the public transport of the Netherlands. The OV-chipkaart is a smart card, based on RFID. The entire system seems to work, but many travellers are unsatisfied with the use and service of the new system. In 2011 the national ticket, the 'strippenkaart', was taken out of the market, but many usability issues with the OV-chipkaart have not been improved since.

This assignment is part of the graduation lab OV-chipkaart. Prior to this graduation assignment a combined analysis is performed with in total three students. Three focus areas were defined of which one is the starting point for this project. The aim is to improve the overall user experience of the OV-chipkaart and come with future possibilities.

Involved parties

Several parties are involved. Permanente Structuur (in formation), SKVV (metropolitan areas), IPO (provinces), RET (public transport operator Rotterdam area), NS (Dutch railways) and Rover (travellers interest group).

Problem definition

The electronic ticketing system has big advantages for the transport operators and great potential for users, travellers who use the public transport in the Netherlands. The system should make it 'easier' and quicker to travel by public transport; not standing in line for ticket machines for every journey. Although the card should be 'fairer and smarter', the experience does not match the expectations created. This problem has different origins. One of these is the increase in the amount of rules and required knowledge and actions to use the system. Travellers tend to be directed to the Internet more and more in case of an error or other service issues. There is a lack of guidance and support in using the self-service touchpoints of the OV-chipkaart platform.

The OV-chipkaart platform is operated by all public transport operators, they all have to agree on changes to the system. The benefits should not only apply to travellers, but also to the public transport operators.

Assignment

Improving the interactions with (self-)service OV-chipkaart touchpoints in the travel domain of public transport from a user perspective. The design should support travellers in using the OV-chipkaart in the travel domain, while taking into account the interests of the transport operators and economic feasibility.

The needs of travellers in the domain will be analysed and new ideas will be explored by user tests. Future concepts will be developed, looking 5 and 10 years from now, and translated to improvements for the current system.

Research questions:

- What scenarios cause lack of support in the current situation?

- Which solutions will support and guide travellers the best?

- How should the touchpoints look like?

- What should be changed to the touchpoints in order to support travellers in their journey now?

6.6.3 'Making the invisible visible' Niks

Background

The overall goal of this project is to improve the electronic ticketing system of Dutch public transport for travellers. In order to develop an implementable design vision for the Ministry of Infrastructure, a roadmap for 3, 5 and 10 years from now on will be created. This particular project will focus on the application of new technology to improve electronic ticketing, with regard for the existing infrastructure, user expectations and cost.

Analysis

In the current situation, users of public transport in the Netherlands only have access to information when they directly interact with the OV-chipkaart system: validators, ticket machines and websites provide this. Any time in-between these interactions is information-less, whereas the user still has questions he would like answered. For example, our research showed that people are not always sure whether they really did check-in or -out. Or how much their journey costs, because they could not read the information on the validator display at check-out. Making this invisible transactional data visible will reduce the uncertainty of travellers before, during and after their journey. Increasing assurance and transparency should result in an increased level of trust in the OV-chipkaart and an improved user experience.

Problem definition

Travellers do not have payment related information at hand during all the moments they want to have it, which makes them feel uncertain and insecure. These negative feelings cause stress and decrease trust in the OV-chipkaart system and public transport. With the use of new technologies, it should be possible to support the traveller with the required information at the moment he wants to have it. This new product and/or service should fit the existing infrastructure and cost models.

Assignment

I will investigate developing technologies to determine their usefulness in the coming decade, and analyse the needs and capabilities of the different user groups. This will result in several concepts, of which one will be further developed into a design. I will take into account the needs and objectives of the different stakeholders, the current infrastructure and the cost structure of this new design. The proposed design will be evaluated with users.

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Colophon

Contents

Appendix A Technology Acceptance Model determinants

Definitions of determinants of Perceived Ease of Use and Perceived Usefulness (Venkatesh & Bala, 2008, pp. 277 & 279; Lee et al., 2003, p. 761). The term "Computer" has been replaced by "System" for consistency, because these terms are used interchangeably in Venkatesh's work.

Perceived Ease of Use	The degree to which a person believes that using an information technology will be free of effort
Subjective Norm	The degree to which an individual perceives that most people who are important to him think he should or should not use the system
Image	The degree to which an individual perceives that use of an innovation will enhance his status in his social system
Job Relevance	The degree to which an individual believes that the target system is applicable to his job
Output Quality	The degree to which an individual believes that the system performs his job tasks well
Result Demonstrability	The degree to which an individual believes that the result of using a system is tangible, observable, and communicable
System Self-Efficacy	The degree to which an individual believes that he has the ability to perform a specific task/job using a system
Perception of External Control	The degree to which an individual believes that organisational and technical resources exist to support the use of the system
System Anxiety	The degree of an individual's apprehension, or even fear, when he is faced with the possibility of using a system
System Playfulness	The degree of cognitive spontaneity in system interactions
Perceived Enjoyment	The extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use
Objective Usability	A comparison of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks
Voluntariness	The degree to which use of the innovation is perceived as being voluntary, or of free will
Behavioural Intention	The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.

Appendix B Expert interviews

Mr Wijnand Veeneman (Faculty of TPM, TU Delft), 12 September 2012

During the interview, Mr Wijnand Veeneman discussed the development of the OV-chipkaart, current problems, possible governance solutions, and Dutch public transport in general. The faculty of Technology, Policy and Management has no formal role in this project, Mr Veeneman did submit a report to the Meijdam commission.

Ms Zuhal Gul (Ministry of Infrastructure), 20 September 2012

The Ministry of Infrastructure is sponsor of this graduation project and has the OV-chipkaart system responsibility. During the interview, the responsibilities of the ministry were discussed, including the wishes, problems and preliminary solutions. The ministry is looking for ways to improve the OV-chipkaart system for travellers without interfering with local authorities and independent transport operators.

Mr Wilko van Oosten (RET) — 21 September 2012 & 12 November 2012

RET is a sponsor of this project and provides public transport services in the city region of Rotterdam. The first interview with Mr Wilko van Oosten focused on the technology used by the OV-chipkaart and the relationship with technology suppliers. The second interview focused on how one could change things within the existing infrastructure.

Mr Eric Kohler (IPO) & Ms Nienke Broekema (SkVV), 25 September 2012

IPO represents the Dutch provinces and SkVV represents the Dutch city regions, both organisations are sponsor of this project. Mr Eric Köhler discussed the history of Dutch ticketing and the transition to electronic ticketing from a governance point of view. Ms Nienke Broekema talked about current governance issues and concerns.

Mr Joost Mortier & Mr Henk Buitenhuis (NS), 28 September 2012

NS is a sponsor of this project and provides the national rail service. During the interview with Mr Joost Mortier we discussed the position of the NS with regard to the OV-chipkaart, short-term expected developments, long-term goals, innovations, and stakeholder concerns. Mr Henk Buitenhuis demonstrated the technical and usability laboratory and discussed hardware release and improvements.

Ms Minyou Rek (E-TSN, NS), 28 September 2012

E-Ticketing Services Nederland is a subsidiary company of NS develops new OV-chipkaart related products and services for the NS. The company is not a sponsor of this project. Ms Minyou Rek showed several new OV-chipkaart-based products the company is working on and discussed the development of new OV-chipkaart products.

Mr Mark Roberts & Mr Peter Lewis (Transport for London, United Kingdom), 17 October 2012

Transport for London is responsible for public transport in London, United Kingdom, and is not a sponsor of this project. Mr Peter Lewis discussed the history of ticketing in London and the transition to electronic ticketing. Mr Mark Roberts explained the technology behind the Oyster e-tickets, showed the operational command centre and compared the London system to the OV-chipkaart.

Mr Paul Chan (MTR, Hong Kong), 24 October 2012

MTR is the underground and main overground rail operator in Hong Kong and is not a sponsor of this project. Mr Paul Chan discussed the history of ticketing in Hong Kong, the transition to electronic ticketing, and the consultancy in other countries.

Mr Tim Boric (Rover) & Ms Wilma de Jong (OV Loket), 12 November 2012

During the interview with Rover we talked about the history of Rover, the implementation of the OV-chipkaart. What their current projects are, what kind of problems they experience, what their role within the stakeholder network looks like, what their main concerns are, what kind of usability problems does Rover know, how Rover collects data and how they do research on usability of the OV-chipkaart.

In order to get more information and better insight in the problems as known by Rover and their current activities Wilma de Jong of the OV Loket joined the conversation.

As we have learned during the interview Rover originated in 1971 from multiple smaller organizations. Volunteers mainly operate rover. Rover has an advisory position towards the operators and governments. Their main concern is to make the journey as simple as possible for travellers. The OV Loket collects data on different usability aspects of the OV-chipkaart and publishes their findings each quarter.

Appendix C Stakeholders of the OV-chipkaart systems

1 Travellers

Travellers are the most important stakeholders in public transport and the e-ticketing system: there is otherwise no reason to set-up the service in the first place. The amount of travellers furthermore determines the size of the public transport market. Making sure enough people choose public transport over other forms of transportation is paramount to ensuring the viability of the market and is necessary to achieve the public policy goals.

The group of people is diverse and organised in different representative organisations, which are further explained in "6 Consumer organisations" on page 6.

2 Public transport operators

The public transport operators are responsible for delivering transport services and have an interest in working efficiently to reduce cost and increase profit. The OV-chipkaart delivers valuable business data about travel behaviour and is an important tool for fleet optimisation. The main responsibility of transport operators is to increase shareholder value by operating public transport within the requirements of the concession agreement. Operators can be divided into national rail (NS) and regional public transport (all other PTOs), as well as TLS shareholders (NS, RET, HTM, GVB) and non-shareholders (Arriva, Connexxion, Veolia, Syntus and others).

Nederlandse Spoorwegen

The Nederlandse Spoorwegen (NS) operates the national trains and train stations, using the rail infrastructure operated by state-owned corporation ProRail. The NS received the concession for national rail operation till 2015 from the Ministry of Infrastructure, with the possiblity of an extension. NS is a state-owned enterprise and the largest public transport operator in the Netherlands by turnover, distance travelled, profit, and number of employees. They currently hold almost 70% of all shares in TLS.

Due to its size, the NS has the financial and organisational resources to use the OV-chipkaart system to its full-potential and to develop innovative symbiotic products. Examples are the OV-bicycles and Greenwheels autocars people can rent at train stations. NS also has an innovation lab for electronic payment—e-Ticketing Services Nederland BV—and in co-operation with banks they develop new applications and business models for smart cards and smartphones.

The NS is a supporter of the proposed Permanent Structure, hoping that it will spur regional operators to improve their OV-chipkaart implementations. Not everyone at NS considers the operator transfer check-out/check-in burden for the traveller as problematic as the Meijdam commission presents it. The e-ticketing system is seen as a success, especially 'business-wise'.

Regional and metropolitan transport operators

The regional and metropolitan transport operators use buses, trams, metro, and regional trains to transport people within their concession. They usually have detailed knowledge of traveller demands in the region, based on their market research and business data.

All regional and metropolitan operators acquire concessions by winning a tender, with the exception of the GVB (Amsterdam), RET (Rotterdam), and HTM (The Hague), which received their concession directly.

Regional operators are in full competition with each other for these concessions, which can hinder the travel experience of people crossing from one region to another. Many problems people experience with the OV-chipkaart are related to inter-operator and inter-concession product incompatibility. More often than initially expected, local transport authorities need to come to an agreement before operators can and are willing to implement improvements.

3 Governments

Government encouraged the operators to develop an e-ticketing system and liberalised the transport market. It also has the power to tender time-limited public transport monopolies (concessions) under the Public Transport Act of 2000. Independent regulators have the responsibility to ensure the OV-chipkaart adheres to the regulation.

National government

The national government, especially the Ministry of Infrastructure, was the main supporter of the development of an e-ticketing system by the operators. The ministry was responsible for public transport in the whole country, but delegated these responsibilities to local government with the decentralisation under the Public Transport Act of 2000 (Wp2000). The ministry is now only responsible for the national rail concession and has 'system responsibility' for the OV-chipkaart. Questions to the minister about the OV-chipkaart are therefore usually directed at the wrong person, since she has little formal power in this area. The ministry has come to the conclusion, though, that a greater involvement might help solve lingering problems and has taken on a growing role with regard to the public-private management of the OV-chipkaart.

Provinces and metropolitan areas

The 12 provinces and 7 metropolitan areas each have the responsibility to organise tenders to select the best operator for their public transport concessions. Some regions are split into multiple concessions and others merged into one concession. The tender allows the local government to set rules and tariffs to which the operator has to adhere. The main concern for local governments is to have good public transport available for its citizens. To manage the tenders, the local authority needs to have insight into the travel demands of both local citizens and tourists.

There are two main options for local government to arrange the financial risks and rewards in each concession: either the operator agrees to a set of rules and makes a profit or turns a loss based on the amount of travellers it can attract, or an operator receives a lump sum from the local government and the revenue goes to the government (KpVV, n.d., A). If the risk and reward lay with the operator, they theoretically have a bigger incentive to provide attractive public transport. The second model works well in concessions where commercial operators either do not want to take the risk or are not trusted with providing the level of service required in all areas.

Provinces are represented by IPO and metropolitan areas have organised themselves in SkVV. These representational organisations facilitate information exchange between the local transport authorities and work closely together.

4 Permanent Structure

To facilitate cooperation between the OV-chipkaart stakeholders, the national government tasked H.M. Meijdam to set-up a new organisation to provide a permanent structure (PS) for solving cross-concession problems with a national impact. Operators, transport authorities, and consumer organisations all have a role within the PS. This new organisation should have the power to take decisions that concern inter-concession problems and also provide a more transparent governance structure for the OV-chipkaart. The negotiations between the stakeholders are ongoing and the results are uncertain yet. Meijdam concluded in April 2012 that to create a level playing field it is best to buy-out the TLS shareholders and move the scheme responsiblity from TLS to the PS (Kwartiermaker, 2012).

5 Regulators

Four independent regulators are concerned with various parts of the OV-chipkaart system. The Dutch Data Protection Authority (CBP) keeps a close eye on the use of personal data collected by the operators. The Netherlands Competition Authority (NMa) is worried about the balance between market forces. Netherlands Authority for the Financial Markets (AFM) and the Dutch Central Bank (DNB) are concerned with the financial safety and security of the OV-chipkaart. All of these regulators have demanded changes in the operation of the system or set boundaries in the past. The CBP, for example, has fined several PTOs in the past years for keeping more personal data than allowed (CBP, 2012).

6 Consumer organisations

Consumer organisations have been consulted throughout the development of the OV-chipkaart, but have never had a direct role. Communication between them and operators has been troublesome at times.

The Wp2000 requires that a board of consumer organisations is consulted during the tender process of a concession. Regional concessions each have a ROCOV board, while the national rail has a LOCOV board. In the LOCOV the following consumer organisations have a seat: Royal Dutch Touring Club (ANWB), Council of the Chronically ill and the Disabled (CG-Raad), Consumer Report, Cyclist Union, National Union of Students (LSVb), Federation of Elderly Unions (CSO), and the Society of Public Transport Users (ROVER). Regional ROCOVs usually have seats for these organisations and several others, depending on the involvement of those groups in the region.

Travellers can bring their issues to consumer organisations (COs) in the LOCOV and ROCOV, where they will be discussed with the authority and operator. According to the Wp2000, it is compulsory for operators to consult the COs at least once a year but they are not obligated to follow the advice. If this advice does not bring the desired results, COs tend to bring the subject to the attention of the media.

7 Technology suppliers

The OV-chipkaart system was designed and build by the East West Consortium for TLS between 2003 and 2006 (TLS, n.d.) and most operators contracted either Thales France or Pro-Data to build and maintain several levels of their OV-chipkaart infrastructure. Changes to the current system either require changes to the service contracts with Thales and ProData, or to the way TLS operates. The NS is in the exceptional position that it kept more technology knowledge and development in-house than other operators, and is able to improve existing infrastructure based on new input without the need for contract negotiations.

Outsourcing all technology development and maintenance makes most public transport operators inflexible with regard to changes to their infrastructure. These changes require negotiation with suppliers and can be hindered by existing contracts. Suppliers depend on the criteria given by the PTO and some parts of the user experience are hard to commit to in a contract if those are hard to measure. The effect is that there is often no contractual agreement on usability and user experience parts of the product.

8 Retail

Retailers, like tobacco shops, convenient stores, drugstores and supermarkets, now only play a small role in the OV-chipkaart system. Anonymous cards without credit are rarely sold at the counter. Some retailer have a yellow OV-chipkaart self-service machine where users can add value or pick-up OV-chipkaart products ordered at the OV-chipkaart.nl website. Supermarkets usually only have such a yellow pick-up device.

PTOs hope these self-service machines in retail stores decrease the need for staffed service points and OV-authorities sometimes require a minimum number of pick-up devices. Currently, retailers receive a fee of a few hundred euros for the placement of the machines, paid for by the PTO. Retailers consider this to be a service for their customers.

At least one PTO is experimenting with providing retail stores with internet thin client card readers. These card readers would be connected to the cash register which would connect to PTO's backend in order to complete transactions. Interaction with the retail staff is required to complete card actions.

Appendix D Overview of the OV-chipkaart architecture

1 Decentralised system

An important feature of the OV-chipkaart system is its decentralised operation. Level 0 cards hold payment and identification information, level 1 validators contain all necessary information to complete transactions, level 2 collects data, level 3 provides operators with all their business data, and level 4 brings everything together.

This decentralisation allows the OV-chipkaart to run without constant network connections (Deutsch, 1994) and under great load. Buses, for example, do not need to use wireless data connections to validate a boarding passenger at check-in. The card provides the necessary information to conduct a transaction. Since all endpoints of the system function separately from the backend, the system load is also known and controllable. A sudden surge in travellers will cause physical delays at validators, but will not cause a delay because of a lack of network or computing power.

Decentralisation also means that the transaction data is spread over many devices in many locations owned by many operators. To ensure the validity of all transactions, a digital document signing chain is used to guarantee data integrity. Each network device contains a SAM identification chip that requests a signing key from upstream at startup. All level 1 devices store data as a signed file and most store it in the operator database as well.

2 Open architecture

The OV-chipkaart system is build as an open architecture. This means that the information exchange between the different components has been specified to the extend that it is possible to have different hardware suppliers cooperate. These technical interface specifications and communication protocols are specified in the Specification Document Open Architecture (SDOA). The intended effect of the open architecture was to have less dependence on a fixed set of suppliers, allow new suppliers to enter the system in a later stage, and encourage innovation. (TLS, 2003) Whether it will prove to achieve these goals of less dependence and more innovation is still unclear. In practice, a contracting partner has developed the Central Back Office, and the public transportation operators have used either Thales (formerly East-West Consortium) or ProData as supplier for level 1, 2 and 3 equipment. Certification of implementations by PTOs has been conducted by Technolution, in order to receive approval to connect to the CBO.

3 Central Back Office

The Central Back Office registers all transactions of all cards. With this data it can detect forgotten check-outs, fare miscalculations, and impossible trips; using the "same" card in Groningen and Maastricht at the same time. All transactions are levied, in order to finance the CBO.

Moreover, it can track fraud with cards that claim to have a credit balance but have not been charged. These cards can be black listed within 24 hours. These black lists are distributed to all level 1 devices.

4 Clearing House

Based on the data collected in the Central Back Office, the Clearing House generates the financial overview and determines how much money the transport operators should get or need to pay. Individual PTOs can check this with their own financial overviews and thus check the Clearing House's correctness. Currently, both the CBO and the Clearing House are operated by TLS.

5 System expertise and business data

Most system expertise resides with the transport operators, Central Back Office and their suppliers. Government agencies seem to have a technical knowledge deficit. This puts them at a disadvantage during negotiations when it comes to technical subjects. This is also the case with regard to business data, for which local governments rely on the operator to share this with them.

Appendix E Overview of tariff system

Products can be bought at the public transportation operators's points of sale and online via the PTO's or TLS's website. The user must 'load' these products on his or her card at a terminal if they are bought online. Anonymous and personal cards can hold a maximum of 12 products.

Card validators read all products at check-out, and determine which one to use to calculate the fare based on a priority list (Syntus, 2012, literal translation):

1. Gratis travelling

    a. Year season ticket

    b. N-star season ticket and Viziris season ticket

    c. Star season ticket in limited zones

    d. Kids Gratis, Always Gratis

2. Gratis travelling with time limitations

    a. Senior Days, Student season ticket week/weekend

    b. Off-peak Gratis

3. Discount season tickets

    a. Always Advantage

    b. Always Discount

    c. Student season ticket weekend/week discount

    d. Off-peak Discount

    e. Off-peak Advantage

    f. Other regional discount

4. Regular tariff

    a. Credit balance

Fares can be higher than the traveller expects, if the system did not use the cheapest product on the card but rather the first product on the card. For example: an "Always Advantage" season ticket offers 20% discount at any time (item 3a on the list), but a "Off-peak Discount" season ticket offers 40% at specific hours (item 3d on the list). If a card contains both products, some

level 1 equipment will always use the "Always Advantage" product, because it ranks higher on the priority list. Even in cases where the "Off-peak Discount" is applicable.

Level 1 equipment also checks first whether an applicable product has been used to check-out on a different vehicle in the past 35 minutes and will use that product to check-in for the new fare. This sometimes causes the system to ignore season tickets and thus charge more for a fare than it should.

1 Pricing of regional transport

The OV-chipkaart system uses linear pricing for the distance travelled. By checking-in and checking-out, the level 1 equipment determines the distance of a fare with that particular transport vehicle and calculates the fare based on the available products on the card. A subsequent fare on another vehicle, perhaps owned by another operator, might offer a discount price based on the previously used product for the earlier fare. This happens, for example, when a traveller transfers from one bus to another bus: the base rate is not applied for any transfer within 35 minutes of check-out.

2 Pricing of national trains

The national railway uses price digression: the longer the journey, the lower the average price per kilometre becomes. To make credit balance trips with a different tariff scheme as the regional transportation uses, a separate train credit balance product is needed. Since this separate product is not loaded on cards that are not acquired from the national railway provider, most people will have to interact with a machine to acquire this specific national train credit balance product before being able to board.

National trains use a minimum price, instead of a base rate. The minimum includes a certain amount of kilometres of travel, ensuring that someone just checking-in at the station to drop someone off will not be charged for this.

Appendix F Touchpoints

1 Ticket and OV-chip vending machines

Ticket vending machine, TVM

At these machines tickets can be bought, mostly for single journeys or time limited journeys. TVMs are often combined with an add-value option. A touchscreen monitor is the main input device. Most TVMs sell also anonymous OV-chipkaart.

Payment can be done in two ways:

- Electronically: Almost all machines accept Maestro and V Pay debit cards. Even though some promotion clips may show also Mastercard and VISA, these cards can only be used at some machines at a few big stations like Schiphol and Amsterdam CS.

- With cash: In most cases with coins only, however some machines except bank notes as well(GVB and RET).

Add value machine, AVM

An AVM is similar to a TVM but do not sell disposable tickets (with or without chip) and anonymous OV-chipkaart. Only OV-chipkaart options are available such as adding value and collecting products from the National Action List.

Pick-up device, PUD

These devices can not only be found near to stations and public transport hubs, but also in tobacco- or convenient shops and supermarkets. Different versions are currently in use with small differences in functionality. What they have in common is a PIN terminal to top-up the OV-chipkaart. And products ordered at the OV-chipkaart website can be collected. A small display and a few buttons guide the user to his products.

However, not all PUDs offer the possibility to buy products as well. A receipt is available on request at all machines.

2 Validation machines

Travellers come in contact with validators at least twice. The initial interaction is quite clear: hold your card and the validator response, either in a confirmative or a rejective response.

At vehicle

For checking-in and -out at vehicles such as the bus, tram or ferry small validators are used. They are attached to handrails near the doors of a vehicle at different heights. The exact information displayed differs per machine, depending on the manufacturer due to the size of the display, and settings by the PTO. Some information is the same for all validators: for checking-in the base rate and credit balance is shown. At check-out the price for the journey and again the credit balance. Additional information about stops, date, time and likewise differ per operator and manufacturer.

At train station

There are two main types used at train stations and some subway stations: free standing poles and gates or gate lines. Usually they can be found at the entrance of a station, at tunnels or on the platform. This largely depends on the layout of the station and whether the station is used by multiple operators.

Gates

Usually gates are placed at the entrance of a train or subway station. The ticketing part and displays are similar to the standalone validators. In some cases gates are placed between two platforms (e.g. Schiedam). Here a fast check when changing from the subway to the train without passing the tunnel.

3 Online service

Websites play a central role in the OV-chipkaart system towards travellers. Two categories can be identified:

www.ov-chipkaart.nl
For many travellers this is the central address to get information about the system, the cards and transactions. Besides getting information, people enter the site in order to buy personal cards.

On the one hand the website claims to be a central place of information about the OV-chipkaart, but at the same it refers to the PTOs individual sites. In the webshop discount subscriptions for all regional PTOs and specific subscriptions for only one PTO can be bought.

Websites of transport operators
The transport operators are responsible spread their specific information about the OV-chipkaart and through the website they have the ability to share it with their customers. Besides, travellers can claim back money for unfinished rides digitally or by requesting a paper form.

4 Employees in the vehicles

Driver
Bus drivers and some tram drivers sell disposable tickets (cash only), check season tickets ('zichtbewijs') and audit the check-in action of passengers. The driver is able to answer the most common questions about the OV-chipkaart, but is not able to look at the transactions stored at the card and resolve complex problems.

Conductor/inspector (with PVU)

Other employees of PTOs travelling in a vehicle have one main task: checking the travellers for a valid ticket. They do this with a Personal Validation Unit (PVU); a mobile validator, which can only read the information stored on the card.

Ticket desk at vehicle

Almost all trams in Amsterdam have a ticket desk in the vehicle itself. Travellers have to enter the vehicle at the doors near the ticket desk. This employee audits the check-ins and can sell time-limited tickets.
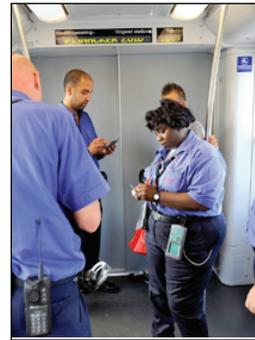
5 Other employees

Helpdesk

For most travellers the helpdesk is the last stage in retrieving information about their card and status of error resolving. A new policy among the operators is aimed at First time fix; helping the customer at their first call and if necessary refer to a more specific helpdesk.

Information desk and employees

At bigger NS stations information desks are available for all kinds of questions. Travellers use this service mainly for retrieving information on departure times, but they can also ask questions about the OV-chipkaart.

Sales desk

Only PTOs have combined sales and service desks. Travellers come to these desks after they (think they) have failed to retrieve information or to solve a problem at the ticket machine. Other travellers may straightly go to the desk when they have questions about instructions in an OV-chipkaart letter.

Appendix G List of studies with summaries

001   Landelijke dekking OV-chipkaart
The OV-chipkaart is not in use in all buses and ferries. For practical reasons exceptions were made. Regional governments have to decide whether the situation is better for travellers when using the OV-chipkaart

052   Overstap meerdere vervoerders
The transfer between two trains from different operators causes some problems in use. Different options for solutions have been proposed: creating a separate entrance and applying routing, signing and branding. NS investigates what impact would be of both options and what it will cost.

053   Enkelvoudige check-in /check-uit in treinrailketen
The principal of multiple train operators at shared stations causes problems with check-in / check-out. These problems are still unsolved. Single check-in is a promising solution. The report makes clear what the implications are and for which organisation. The different parties have to discuss the implications and decide on that.

054   Landelijke distributie
Insights are given about the national distribution of the OV-chipkaart. An overview of points of sale is produced. These points include: TVM, AVM, PUD and service desk.

055   Automatisch opladen voor anonieme OV-chipkaarten
There is a need to use auto top-up at anonymous cards. Radical technical adjustments have to be made to facilitate this. The key difference between a personal and anonymous card disappears when an anonymous card is linked to a bank acoount.

057   Bruikbaarheid en uniformiteit OV-chipkaart apparatuur
With the implementation of the OV-chipkaart a whole new set of machines is introduced, manufactured by different suppliers. The products form different suppliers are not always uniformed and consistent. Adjustments will take several years. Recommendations to improve is: a dynamic document that consist all information from all OV-chipkaart equipment; public transport parties and suppliers should follow the ITS-criteria from 'Project Bureau Toegankelijkheid' from the CG-raad; investigate whether the ITS-criteria could be used in the certification of the equipment.

058   Beschikbaarheid afhaalapparatuur NAL
Pick-up products and credit at machines is new to travellers. There is no clear and uniform communication about the possibilities of the NAL. This is also the case for products ordered by a traveller or changes of products by the operators. Recommendation: the 'Klantenoverleg' should come with a strategy for the parties involved.

059   Ketendiensten

Four pilot studies have been executed in which the OV-chipkaart is used in services before or after a journey by public transport. Two examples: GVB tested a concert ticket combined with a free ride and RET tested payment by OV-chipkaart at parking lots. These services ask for large adjustments. Optimization of the travel domain has a higher priority than adding extra services.

060   Voordelig reisadvies op basis van historisch reisgedrag

There is a need from consumers for tariff advice. This advice could be given with the transaction data of travellers. Transport operators can operate the 'advice module' but this will limit the available data to one operator only.

061   Toekomst lokale voordeeltarieve

After the introduction of the OV-chipkaart local discount prices are still possible. The OV-authorities and operators should be reserved in the number of products in order to avoid complexity of the tariff possibilities.

062   First time fix

Travellers now contact multiple organisations before their problem is solved. It is not clear to the traveller and help desks which problem belongs to whom. The traveller must be able to identify its problem(s) as much as possible. The communication towards the traveller and OV-chipkaart organisations should be uniformed and consistent.

063   Reisinformatie: route, tijd en prijs

The implementation of the OV-chipkaart has an effect on the travel information. Tariffs are calculated in a different way and applied. By using the OV-chipkaart the actions during a journey changed, the need for information increased. The disclosure of information from TLS to other parties is a point of attention.

064   Standaardisatie van historische reisinformatie

The focus for communicating transaction data to travellers is via the Internet. The website OV-chipkaart.nl should be the main source of information. This information can be nested in website of transport operators or remotely accessed at a service desk. Reading transaction data at machines is meant for a quick check only, the print functionality and probably the entire function will be removed in the future.

065   Toekomstig landschap voor mensen met een OV-handicap

Some user groups encounter more problems than others. Groups with extra handicaps are the visually impaired and people with intellectual disabilities. Check-in and check-out are the most prominent problems for visually impaired. Interacting with the products on the card is hard for intellectual disabled. Travellers experience limited accessibility to the information channels. Solutions can be found in increasing the amount of channels.

066   Groepsreizen

The OV-chipkaart is not capable of facilitating journeys with a group. This is a problem many school encounter. Temporary solutions with letters should be ended and migrated to a 'business card'; one card for the entire group. Payment is done afterwards by invoice.

Appendix H Method

Observations and interviews travellers using the public transport.

Goal
Getting insights in the daily experiences from OV-chipkaart users.

Research questions

- What do travellers experience when using the OV-chipkaart?

- What are striking things when looking at different transport operators?

- What do we experience ourselves when using the OV-chipkaart?

Locations and situations

- Special attention goes to areas we are less familiar with:

- Schiphol, visitors from outside The Netherlands.

- Regional busses, preferably cross-concession.

- Regional train, change over from NS to a regional train.

- Ticket machines from different transport operators.

Day and time; different contexts

- Morning peak; more travellers than average

- Middle of the day; travellers not bound to the morning peak.

- Saturday, end of the morning.

Method
Semi-structured interview. A set of basic questions is prepared which are asked at all time. Other questions function as a guide in the interview.

Environment
Three different locations have been selected to ask questions about their experiences with the OV-chipkaart.

These locations are:

- Platform or main hall of a station, people are waiting for a train or a friend.

- Bus stop, waiting for the bus.

- In the bus, people have 'nothing' to do. No distraction from books or work.

Traveller groups

We divide the travellers in different groups, based on 1) the frequency of use and 2) the route they travel. This determines for a big part the decisions the travellers make when using the OV-chipkaart.

Besides the use, the residence/region and age can determine which choices the traveller

Basic questions
- Where do you live?

- What is your year of birth?

- How often do you use the public transport?

- What is the route you usually take?

- What is the most important reason you travel?

- For how long do you use the OV-chipkaart?

Questions about travelling by public transport and the use of the OV-chipkaart.
- What kind of ticket did you use before the OV-chipkaart?

- Did something change since you use the OV-chipkaart?

- What are the biggest advantages?

- What are the biggest disadvantages?

- Do you use the card for other purposes?

- Are there any change that could help you in using the OV-chipkaar?

Documenting the observations is done with a compact photo camera with video capabilities.

Interview setup experts

Goal
Getting insights in the OV-chipkaart companies and the OV-chipkaart system.

Research questions

- What is the role of the organisation?
- What is their perspective towards the OV-chipkaart?

Method
Semi-structured interview. A set of questions is prepared which are asked at all time. Other questions are added after each interview and function as a guide in the interview.

Location
All interviews are conducted at the office of the interviewees.

Participants
The representatives of the organisations who are involved in the graduation lab.

Questions
- What is the relationship of your organisation with other organisations?
- What was the role of your organisation during the introduction?

Observations setup

Goal
Getting insights in the daily experiences from OV-chipkaart users.

Research questions
- What do travellers experience when using the OV-chipkaart?
- What are travellers actually doing in trying to use the OV-chipkaart at check-in / check-out?

Locations and situations
Special attention goes to areas we are less familiar with:

- Bus
- Train station
- Metro station

Day and time
- Morning peak; more travellers than average
- Middle of the day; travellers not bound to the morning peak.
- Saturday, end of the morning.

Participants
We divide the travellers in different groups, based on 1) the frequency of use and 2) the route they travel. This determines for a big part the decisions the travellers make when using the OV-chipkaart.

Basic questions
- Where do you live?

- What is your year of birth?

- How often do you use the public transport?

- What is the route you usually take?

- What is the most important reason you travel?

- For how long do you use the OV-chipkaart?

Questions about travelling by public transport and the use of the OV-chipkaart.

- What kind of ticket did you use before the OV-chipkaart?

- Did something change since you use the OV-chipkaart?

- What are the biggest advantages for you?

- What are the biggest disadvantages for you?

- Do you use the card for other purposes?

- Are there any changes that could help you in using the OV-chipkaart?

Documenting
The observations are recorded with a compact photo camera with video capabilities.

Booklets setup

Goal
Getting insights in the daily experiences from OV-chipkaart users.

Research questions
- What are the daily concerns when using the OV-chipkaart?

- What are the daily routines of travellers?

- What are the overall concerns of the OV-chipkaart?

- How do users evaluate the use of the OV-chipkaart and transport organisations?

Participants
- Random travellers will be asked to participate in the research.

- The questionnaire booklets will be handed out at different locations:

- Tram stop, Delft

- Train station, Gouda

- Personal contacts at remote areas.

Our own experiences

We experience multiple aspects of the card just by using the public transport and the OV-chipkaart in different situations. When travelling to remote areas we deviate from our standard routes and are more open to remarkable events.

Particular focus areas are:
- Check-in at busses and train stations.

- Transfer between regional and national trains.

- During the trip.

Documentation is done in writing, photos and videos.

Appendix I Participants interview and observation

Interviews

Location	Date	Name	Location	Date	Name
Rotterdam	31/10/2012	IV_RD_01	Heerlen	13/11/2012	IV_HE_32
Rotterdam	31/10/2012	IV_RD_02	Eindhoven	13/11/2012	IV_EH_33
Rotterdam	31/10/2012	IV_RD_03	Eindhoven	13/11/2012	IV_EH_34
Rotterdam	31/10/2012	IV_RD_04	Amersfoort	14/11/2012	IV_AF_35
Rotterdam	31/10/2012	IV_RD_05	Amersfoort	14/11/2012	IV_AF_36
Rotterdam	31/10/2012	IV_RD_06	Wageningen	14/11/2012	IV_WG_37
Rotterdam	31/10/2012	IV_RD_07	Wageningen	14/11/2012	IV_WG_38
Rotterdam	31/10/2012	IV_RD_08	Wageningen	14/11/2012	IV_WG_39
Rotterdam	31/10/2012	IV_RD_09	Wageningen	14/11/2012	IV_WG_40
Sliedrecht	13/11/2012	IV_SD_10	Wageningen	14/11/2012	IV_WG_41
Sliedrecht	13/11/2012	IV_SD_11	Wageningen	14/11/2012	IV_WG_42
Sliedrecht	13/11/2012	IV_SD_12	Wageningen	14/11/2012	IV_WG_43
Sliedrecht	13/11/2012	IV_SD_13	Wageningen	14/11/2012	IV_WG_44
Dordrecht	13/11/2012	IV_SD_14	Wageningen	14/11/2012	IV_WG_45
Dordrecht	13/11/2012	IV_SD_15			
Dordrecht	13/11/2012	IV_SD_16			
Dordrecht	13/11/2012	IV_SD_17			

Observations

Location	Date	Name
Dordrecht	13/11/2012	IV_SD_18
Dordrecht	13/11/2012	IV_SD_19
Dordrecht	13/11/2012	IV_SD_20
Delft	13/11/2012	IV_D_21

Location	Date	Name
Delft	13/11/2012	IV_D_22
Maastricht	13/11/2012	IV_M_23
Maastricht	13/11/2012	IV_M_24
Maastricht	13/11/2012	IV_M_25
Maastricht	13/11/2012	IV_M_26
Maastricht	13/11/2012	IV_M_27
Heerlen	13/11/2012	IV_HE_28
Heerlen	13/11/2012	IV_HE_29
Heerlen	13/11/2012	IV_HE_30
Heerlen	13/11/2012	IV_HE_31

Observations:

Location	Date	Name
Den Haag CS	03/10/2012	OB_DH_01
Den Haag CS	03/10/2012	OB_DH_02
Den Haag CS	03/10/2012	OB_DH_03
Den Haag CS	03/10/2012	OB_DH_04
Den Haag CS	03/10/2012	OB_DH_05
Den Haag CS	03/10/2012	OB_DH_06
Den Haag CS	03/10/2012	OB_DH_07
Den Haag CS	03/10/2012	OB_DH_08
Den Haag CS	03/10/2012	OB_DH_09
Den Haag CS	03/10/2012	OB_DH_10
Den Haag CS	03/10/2012	OB_DH_11

Den Haag CS	03/10/2012	OB_DH_12	Maastricht	13/11/2012	OB_M_49
Den Haag CS	03/10/2012	OB_DH_13	Wageningen	14/11/2012	OB_WG_50
Den Haag CS	03/10/2012	OB_DH_14	Wageningen	14/11/2012	OB_WG_51
Den Haag CS	03/10/2012	OB_DH_15	Wageningen	14/11/2012	OB_WG_52
Den Haag CS	03/10/2012	OB_DH_16	Wageningen	14/11/2012	OB_WG_53
Den Haag CS	03/10/2012	OB_DH_17			
Den Haag CS	03/10/2012	OB_DH_18			
Rotterdam	31/10/2012	OB_RD_19			
Delft	12/11/2012	OB_D_20			
Rotterdam	13/11/2012	OB_RD_21			
Rotterdam	13/11/2012	OB_RD_22			
Rotterdam	13/11/2012	OB_RD_23			
Rotterdam	13/11/2012	OB_RD_24			
Rotterdam	13/11/2012	OB_RD_25			
Rotterdam	13/11/2012	OB_RD_26			
Sliedrecht	13/11/2012	OB_SD_27			
Sliedrecht	13/11/2012	OB_SD_28			
Sliedrecht	13/11/2012	OB_SD_29			
Sliedrecht	13/11/2012	OB_SD_30			
Dordrecht	13/11/2012	OB_DD_31			
Dordrecht	13/11/2012	OB_DD_32			
Dordrecht	13/11/2012	OB_DD_33			
Dordrecht	13/11/2012	OB_DD_34			
Dordrecht	13/11/2012	OB_DD_35			
Dordrecht	13/11/2012	OB_DD_36			
Dordrecht	13/11/2012	OB_DD_37			
Dordrecht	13/11/2012	OB_DD_38			
Dordrecht	13/11/2012	OB_DD_39			
Dordrecht	13/11/2012	OB_DD_40			
Aken	13/11/2012	OB_AA_41			
Aken	13/11/2012	OB_AA_42			
Aken	13/11/2012	OB_AA_43			
Aken	13/11/2012	OB_AA_44			
Aken	13/11/2012	OB_AA_45			
Aken	13/11/2012	OB_AA_46			
Aken	13/11/2012	OB_AA_47			
Aken	13/11/2012	OB_AA_48			

Appendix J Participants questionnaire booklet

Gender	Age	City	Booklet Number
female	25	Delft	1
female	55	Gouda	2
male	50	Zoetermeer	3
female	58	Gouda	4
female	33	Wageningen	5
male	28	Wageningen	6
female	unknown	unknown	7
male	unknown	unknown	8
male	50	Gouda	9
male	44	Delft	10
female	35	Berkel en Rodenrijs	11
male	21	Nij Beets	12
female	37	Utrecht	13

Appendix K Questionnaire booklet

OV-chipkaart in gebruik
Onderzoek naar het gebruiksgemak

Dit boekje is van: _____

Woonplaats: _____

Geboortejaar: _____

Telefoonnummer: _____

E-mail: _____

Thijs Niks
m.c.niks@student.tudelft.nl

Johanna Joppien
J.joppien@student.tudelft.nl

Geert Niermeijer
g.niermeijer@student.tudelft.nl

Leuk dat je deelneemt!

Voor onze scriptie doen wij onderzoek naar het gebruik van de OV-chipkaart in de trein, bus, metro, tram en veerboot. Wij doen observaties en enquêtes om inzicht te krijgen in hoe reizigers daar gebruik van maken. Jouw antwoorden zullen anoniem gebruikt worden en dienen ervoor om een goed beeld te krijgen van de huidige situatie, zodat we het beter kunnen maken. Voor ons is het daarom erg belangrijk om zoveel mogelijk van jou te leren!

Maak niet het hele boekje in één keer, maar elke dag een paar vragen. We wensen je veel plezier met het beantwoorden van de vragen en het invullen van dit boekje (vergeet de gele vlakken niet).

Naar aanleiding van dit boekje kunnen we je eventueel vragen om het nog eens over dit onderwerp te hebben en dieper in te gaan op sommige aspecten.

Nadat je het boekje ingevuld hebt, verzoeken we je het naar ons op te sturen. De envelop is alvast gefrankeerd. Mocht je tussentijds vragen hebben, kun je altijd met een van ons contact opnemen.

Stuur het graag voor 25 oktober 2012 terug.

TUDelft

Dag 1: Algemeen

Volgens mij gebruik ik de OV-chipkaart:
☐ meer dan 5 jaar   ☐ 2-5 jaar   ☐ 1-2 jaar   ☐ minder dan een jaar

En ik gebruik de OV-chipkaart gemiddeld _____ keer per week/maand/jaar

Waar bewaar je je OV-chipkaart?

Wie zorgt ervoor dat het OV-chipkaartsysteem werkt?
(meerdere antwoorden mogelijk)

☐ NS   ☐ TLS   ☐ De overheid   ☐ De provincies   ☐ RET   ☐ GVB
☐ HTM   ☐ Connexxion   ☐ Veolia   ☐ Syntus   ☐ Arriva   ☐ Niemand
☐ Anders, namelijk: _____

> Wat vind je van de OV-chipkaart in het algemeen?
>
> Volgens mij...

Doet deze organisatie dat goed?

Maak je gebruik van een abonnement of een kortingskaart? En waarom?

Maak je gebruik van automatisch reissaldo opwaarderen?

Waarom (niet)? Hoe vind je het gaan?

> Wat vind je van het reizen in het OV in het algemeen?

Dag 2: Regelmatige reis

Teken een typische route waar je vaak openbaar vervoer voor gebruikt. Je kunt daarvoor ook de plaatjes op de volgende pagina uitknippen en/of eigen tekeningen maken.

besluit om op reis te gaan

eindbestemming bereikt

Dag: _____
Tijd: ___:___

Tijd: ___:___

Is het lastig om op deze route met de OV-chipkaart te reizen?

SOS en informatie paal van NS

noodknop NS

bus

check-in, check-out paal

media

buschauffeur

tram

poortje

mobiele telefoon

service balie

metro

kaartjes automaat

website

conducteur

trein
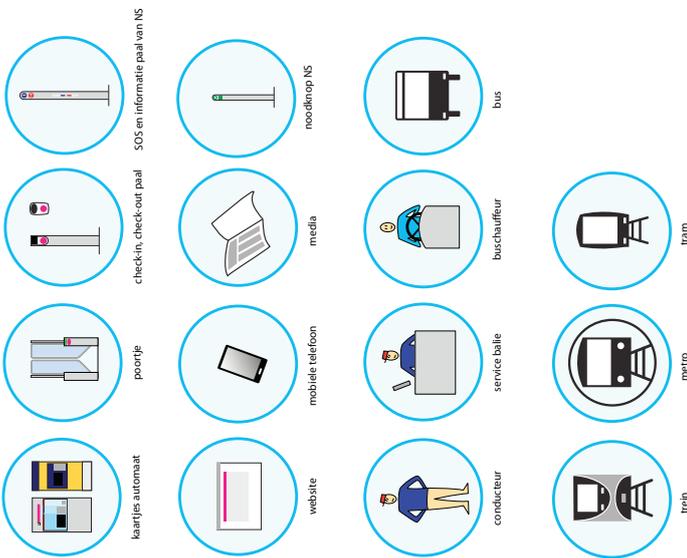
Dag 2: Bijzondere reis

Teken een ongewone route waar je vaak openbaar vervoer voor gebruikt. Je kunt daarvoor ook de plaatjes op de vorige pagina uitknippen en/of eigen tekeningen maken.

besluit om op reis te gaan   eindbestemming bereikt

Dag: _____
Tijd: ___:___   Tijd: ___:___

Is het lastig om op deze route met de OV-chipkaart te reizen?

Dag 3: Reizen met de kaart

Waarom is het soms lastig om met de OV-chipkaart te reizen?

Wat vind je over het algemeen prettig gaan?

Hoe heb je deze moeilijkheden opgelost?

Wat doe je om thuis je reis voor te bereiden?

Waar bewaar je je OV-chipkaart wanneer je in de trein, bus, tram of metro zit?

Wat doe je als je aankomt op een station en wacht op de trein/metro/tram/bus?

Dag 4: Check-in/Check-uit

Weet je altijd of je goed in-/uitgecheckt hebt?

Ben je al een keer vergeten uit te checken? Waardoor kwam dat volgens jou?

Waar bekijk jij het reissaldo en reiskosten?

Geven OV-chipkaartmachine weleens foutmeldingen en wat doe je dan?

In hoe verre heeft het in-/uitchecken invloed op je manier van reizen?

En hoe is de OV-chipkaart wanneer het druk is?

Dag 5: Bij de kaartautomaat
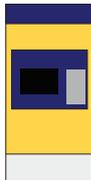
Voor welke handelingen ga je naar de kaartautomaat? Waarom?

...en wanneer ga je naar de servicebalie? Waarom?

Geef aan of je dit al een keer gedaan hebt bij een kaartautomaat (ja/nee) en geef een cijfer voor hoe je dat vindt gaan (0 is slecht, 5 oké, 10 is geweldig).

Abonnement op OV-chipkaart laden

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Reissaldo van een OV-chipkaart bekijken bij een kaartautomaat

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Reissaldo opwaarderen

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Meereiskorting laden

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Wegwerpkaartje kopen

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Met pinpas betalen

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Contant betalen

☐ Ja ☐ Nee   1 2 3 4 5 6 7 8 9 10

Dag 6: Problemen

Meestal reis ik met de:

trein

bus

metro

tram

veerboot

Als er iets misgaat ben ik vooral kwaad op:

omdat...

Heb je wel eens geld teruggevraagd omdat je was vergeten uit te checken? Beschijf alle stappen, vanaf het moment waarop je vergat uit te checken tot het terugkrijgen van geld.

Oeps, vergeten
uit te checken!

Yes, geld
terug!

Dag 7: Reflectie

Drie positieve punten over de
OV-chipkaart zijn volgens mij:

1:

2:

3:

Drie negatieve punten over de
OV-chipkaart zijn volgens mij:

1:

2:

3:

Volgens mij zou het
openbaar vervoer beter
werken als:

Ruimte voor opmerkingen en vragen:

Stuur het ingevulde boekje graag naar:

Afstudeerlab OV-chipkaart
p/a Jasper van Kuijk
Faculteit Industrieel Ontwerpen
Technische Universiteit Delft
Landbergstraat 15
2628 CE Delft

Appendix L Studying the user

Part 1: Observations

Observing travellers behaviour gives important insights in problems they have and what steps they take to help themselves. The following six situations illustrate a broad perspective of common situations travellers have to deal with.

Situation 1 - Ticket machine

An old lady recently received her first OV-chip-kaart by mail. She now wants to load money and travel products on the card.

She follows the instruction given in the letter, selects 'producten ophalen' and gets an overview of the products, which are ready to load onto the card.

Unfortunately the letter does not inform her that the products will only be loaded on the card after confirming it with the 'Accord' button. Probably due to the checkmarks behind each of the travel product, she assumes that the products are already on the card. Anyhow, the red blinking 'accord' button does not trigger her attention. Due to her believe that she has loaded the products, she now continuous with loading money on the card. She completes this action successfully, but she is unaware of the fact that she had to select the way of payment on the screen. Only due to the payment unit, which is not working until the user has selected this option, she gets aware of the missed step.

"Eerst moet ik hem opladen, en dat is al iets wat ik moeilijk vind. Even kijken, gaat dat hier? Ik moet iets doen, het is best ingewikkelt, ik moet even het briefje erbij halen."

She completes this action successfully, but she is unaware of the fact that she had to select the way of payment on the screen. Only due to the payment unit, which is not working until the user has selected this option, she gets aware of the missed step.
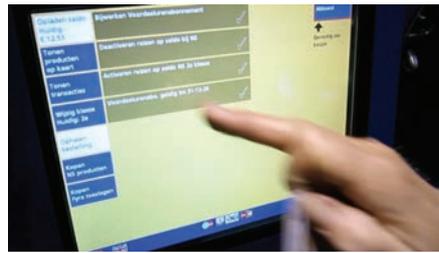
She doesn't realize that it is necessary to present the card a second time to the card reader unit. In combination with the blinking message this causes a little stress. She is sure she now has loaded the four products but doubts weather the 20 euros were indeed loaded on her card, since the screen does not give any clear information on this. She therefore chooses to take a receipt.
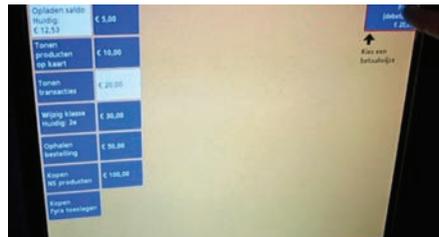
"Oh, dan moet ik eerst zeggen pinpas."

After this interaction was finished we informed her that she did not successfully load the product on her card. She was surprised, but believed us and followed the same steps again, now she selected the option 'Accord' which enables the product load. However, she swiped her OV-chipkaart very quickly over the card reader. As a result she just loaded one of the four products on her card. She then had to start for a third time.

Without our interference, she would have travelled with the OV-chipkaart, wondering why she never gets any reduction.
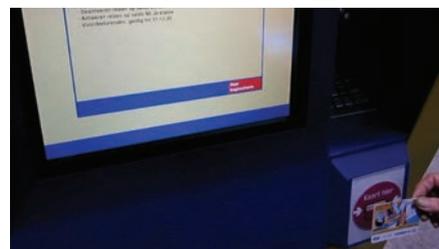
"Oh, oh, nog een keer, ging het nou goed?"

This situation shows, that the incomplete information (meant to be a supportive tool) leads to the fact that people are not aware that they left out one essential step. Travellers who did everything according to the provided information letter, will probably blame the organisation when encountering a problem.

Situation 2 - Peak hour

All passengers of a train has to check-out at Arriva and check-in at NS, which results in people standing in a long row. As it can be seen in the picture one man needs more time to check-out and check-in. Whereas the NS validator is providing the traveller with visual and audible information the validator of Arriva provides visual information only. This inconsistency causes the insecurity of this man, weather he really checked-out at Arriva or not.

The situation shows, how important it is that the check-in/out poles work consistently and provide all necessary information at first sight. Especially in peak hours it is essential to let travellers pass these validator as quickly as possible.

Situation 3 - Open transactions

The man in the picture seeks help at the NS information desk, since he noticed the credit stored on his OV-chipkaart was less than he thought it should be. As the woman from the service desk checks his transactions it becomes obvious that he has a lot of incomplete journeys, due to checking in at one operator and checking out at another one, without being aware of this. He believed that he was always checking in and out. She explains the system as follows:

"Als je de Albert Heijn tegen over hebt van de Jumbo, dan kunt u ook niet boodschappen doen bij de Albert Heijn en vervolgens bij de Jumbo afrekenen. Zo werk het hier ook, u moet altijd bij iedere vervoerder in en uit checken."

When the men asks, whether there is any possibility to get his money back and what he needs to do, the women answers:

"Om u geld terug te vragen, moet u bij de RET op de website terecht, bij NS moet u met de klantenservice bellen en hoe het bij Connexxion werkt weet ik eigenlijk ook niet."

> This situation shows that travellers do not recognize the differences of the check-in/out poles of different providers, or they are not aware of the fact that it is necessary to complete a journey by checking-out at the same travel operator as they have checked-in.

Situation 4 - Waiting for replacement

The current OV-chipkaart is not valid anymore. The woman behind the service desk explains that he has to send his old card together with a new pass photo to the NS. He will then receive a new card by post. The man wonders and asks:

"Maar als ik mijn huidige OV-chipkaart opstuur dan ben ik deze kwijt?! ... Maar hoe lang duurt het dan voordat ik hem terug heb? ... Twee weken? Nou dat vind ik wel een beetje lang, ik moet elke dag met de bus, hoe doe ik dat dan? ... Maar krijg ik dan wel korting op mijn busritjes?"

> In this situation there is no extra service offered to make the waiting period more pleasant for the traveller. He only experiences disadvantages like extra costs and the necessity to spent more time to buy a ticket every day instead of travelling by the OV-chipkaart. What makes this situation even more relevant is that users do not only encounter this situation when asking for a new card but also when buying their first card. Even though users might want to use the OV-chipkaart, they are confronted with extra difficulties they have to solve themselves. The PTOs do not provide any obligingness or support, which would for example include a temporary OV-chipkaart.

Situation 5 - Hold card

Most of the travellers hold their OV-chipkaart during the whole journey in their hand or place it somewhere in their sight to remind themselves of not forgetting to check-out when leaving the vehicle.

This visualizes how important it is that individual travellers actively take care of their situation, in order to prevent themselves from paying more then necessary. The system does not work supportive in this case.

Situation 6 - Luggage and gates

Gates support the user in not forgetting to check-in/out but also make it impossible for certain groups to enter. Whether someone is travelling with a bike, has a lot of luggage or has a baby in a stroller, the gates will not let those people pass. For the gate it seems as if two people try to enter the station, with only one person who has checked-in.

In this situation the bike of the women got stuck between the two doors, which finally made to the women walk away looking for another possibility to enter the station.

Part 2: Interviews

In order to share the most important insight we got from the interviews with Dutch people as well as with international visitors, we selected a couple of quotes, which are put into seven different rubrics. The quotes are given in the language we received them.

Advantages

"Daar zitten op zich wel voordelen aan, met het in en uitchecken, dat kost gewoon wat minder tijd." IV_SD_11

"Het gaat veel sneller." IV_M_24

"It is cheaper than buying a day ticket every time I take the bus. Normally it costs 5,50 euro now it is only 4,50 euro. That is still expensive but at least I save one euro every time." IV_HE_29

"Het is een prachtig systeem, nooit problemen gehad en goedkoop ook. Daar kun je de auto niet voor starten." IV_HE_32

"Gates vind ik veel beter dan palen, want dan weet je het tenminste zeker." IV_D_22

"Ik vind de OV-chipkaart heel makkelijk te gebruiken en het is fijn dat je dan geen geld mee moet nemen." IV_HE_31

"I think it is really astonishing to travel through the whole country with only one card. Its really comfortable and useful." IV_D_21

Disadvantages

"Ik vind het niet prettig dat je minimal 20 euro op je kaart moet zetten voor de trein". IV_RD_09

"Soms heb ik nog gewoon geld op mijn OV-chipkaart staan maar dan is het toch blokkeert en ik kan niet reizen." IV_M_23

"De OV-chipkaart is veel duurder dan een dagkaartje. Met de OV-chipkaart betaal je voor kilometers en als de bus een ronde om het busstation heen doet, dan betaal je gewoon voor de ronde. Het is echt veel duurder." IV_M_23

"Als je een keer vergeet uit te checken, dan is het geld meteen op, dat is heel erg. Ze moeten iets met moderne techniek of zo doen, want ik ben gewoon uitgestapt. Dat moeten ze gewoon weten. Als je uitstapt moet je ook automatisch uitgecheckt worden." IV_M_23

"Wat ik ook heel vervelend vind is dat de OV palen op ieder station op een ander plek staan. Als ze bij de ingang staan dan moeten ze gewoon zo staan dat je er echt langs moet gaan en anders moeten ze gewoon op het perron staan. Maar ik zal het erg prettig vinden als het op ieder station het zelfde was want nu ben je de hele tijd aan het zoeken." IV_D_22

"Ik heb zelf nog geen computer thuis en de hele maatschappij gaat ervan uit dat iedereen een computer heeft. Dus dat is wel moeilijk voor me." IV_HE_30

"Ik heb geen positieve gevoelens bij de OV-chipkaart." IV_HE_30

Besides it is really crazy that I need to have 20 euro on my blue card in order to travel. They say that those 20 euro do not count, but actually they do count for my budget. Especially for a student 20 euro is a lot of money." IV_D_21

"The biggest issue is that for foreigners it is really hard to get a personal OV-chipkaart." IV_D_21

Usage
"Normaal mag ik weinig gebruik van de kaart buiten de vrije dag." IV_RD_09

"Mijn studentenpas ging kapot omdat ik hem in mijn portemonnee had en toen kwam ik er achter dat er dus blijkbaar twee organisaties achter zitten: De 'OV-chipkaart' en de 'Studenten OV-chipkaart'. En de logos zijn allebei roze, alleen staat bij die ene dan nog 'studenten' ervoor of zo iets. Toen heb ik er een maand lang niets van gehoord omdat ik het pasje blijkbaar bij de verkeerde heb ingeleverd. Ik vind eigenlijk niet dat ik hoef te bedenken hoe hun organisati-estructuur in elkaar zit. Ik had dus een maand lang geen OV-chipkaart en moest gewoon losse kaartjes kopen. Was iets van 150 euro wat ik zelf moest betalen. Ik heb later ook niets terug gekregen omdat ik dan weer te laat was, of zoiets. Dat was best zuur. En dat allemaal omdat zij het pasje zo slecht hebben ontworpen." IV_SD_19

"Ik heb een OV-chipkaart maar ik koop het liefst papieren kaartjes, want ik ben bang dat ik weer vergeet om uit te checken. Voor mij zit er geen voordeel aan de OV-chipkaart, grootste nadeel voor mij is echt 'Denk er aan om niet vergeten uit te checken'." IV_M_23

"Ik ben nog nooit vergeten om uit te checken, want voordat ik moet uitstappen haal ik hem al bij de hand." IV_M_26

"I still have to get used to the check-in and check-out, but I guess it makes sense, so it's okay." IV_HE_29

"Als ik ergens ver weg naar toe ga, dan maak ik liever gebruik van een dagkaart, omdat het ge-makkelijker en goedkoper is." IV_HE_31

"Ik weet niet of het nu kan maar vroeger kon je op mijn station geen geld op je kaart zetten, dus dat doe ik nu gewoon in een boekenwinkel en dan helpen ze je er ook altijd mee dus dan gaat het gewoon goed." IV_RD_09

OV-chipkaart request
"Ik heb zo'n voordeelurenabonnement voor net afgestudeerden, die krijg je niet automatisch thuisgestuurd maar die moet je eerst gaan aanvragen. Dan moet je eerst zo'n mijn NS aan gaan maken. Het was allemaal best ingewikkeld want ik kwam er toen achter dat het los van elkaar staat, zeg maar NS en de OV-chipkaart. In je hoofd voelt het gewoon alsof het een ding is. Dus ik had maar zo'n NS account, maar toen kwam ik er later achter dat ik ook nog een OV-chipkaart account moest hebben. En daar moet ik dan aanzetten dat ik mijn reizen ook graag wil bijhouden maar daar kwam ik later pas achter, dus nu kan ik mijn reizen niet meer declareren. En die 'Mijn

OV-chipkaart' site moet je ook hebben om automatisch opladen aan te zetten, reizen op saldo heet dat dan volgens mij." IV_D_22

"Ik was in Italië op vakantie en daar ben ik mijn OV-chipkaart kwijtgeraakt. Toen wilde ik online een nieuwe aanvragen, maar ik had nog geen 'Mijn OV-chipkaart account' die je dus nodig hebt om dat te doen. Maar om zo'n account aan te maken moet je dus je chipkaart met de nummer daarop hebben, maar die was ik natuurlijk kwijt. Telefonisch kon het ook niet want je kunt alleen maar vanuit Nederland, België en Duitsland met ze bellen, en daarom moest ik wachten tot dat ik weer in Nederland was om een nieuwe kaart aan te kunnen vragen. Toen ik terug in Nederland was zat ik ongeveer een week zonder OV-chipkaart." IV_D_22

"I'm an exchange student studying at the University of Delft for six month. When I first arrived I was not aware of the existence of the OV-chipkaart. People I met here told me about the card. First I had to buy the blue card because I did not have a BSN number and no Dutch bank account as well. It took me about one month to arrange all of it, it was really complicated and all just to apply for a yellow OV-chipkaart. I really wanted to have a yellow one, because public transportation in the Netherlands is really expensive compared with the prices I know from Italy. But for me it is really difficult that it takes so long until I get the OV-chipkaart with my picture on it. I arrived on the 4th of October and I will get my card on the 20th of November. So meanwhile I cannot travel with reduction. Also I do not know, whether the card will actually pay off for me. It costs 50 euro a year but I'm staying only 6 month and when I finally get my card it's only four and a half month left." IV_D_21

Information

"Ik heb eigenlijk geen idee wat de gevolgen zijn als je met je studenten OV vergeet uit te checken." IV_D_22

"Ik kan niet met terugwerkende kracht mijn reisgegevens bekijken? Dat is onhandig, want het is toch gewoon mijn kaart!" IV_D_22

"Ik heb ook het idee dat de medewerkers van bijvoorbeeld de NS er gewoon heel weinig van weten." IV_D_22

"Ik heb een voordeelurenabonnement, alleen ik vertrouw hem nog niet. Ik betaal bij de NS het volle tarief ofwel ik eigenlijk een korting zou moeten hebben. Ik gebruik heb alleen in de bus en voor de NS heb ik hem nog niet geactiveerd. Maar dat was me ook nooit duidelijk. Nu maken

ze er wel reclame voor op televise, dus blijkbaar zijn er meer mensen met het zelfde probleem. Maar toen ik hem gekocht heb is me nooit verteld dat ik hem nog moet activeren." IV_HE_30

Improvements

"Klachten moeten gewoon meteen goed geïnterpreteerd worden, en je moet snel je geld terug kunnen krijgen als je daar recht op hebt, en dat niet eerst moet gaan aanvechten of weet ik veel, handtekeningen moet gaan verzamelen." IV_SD_20

"If I check in with my card, but not really being aware of doing so, how can I check the state of my card? I never really know if I'm checked in already, but then I don't know what to do, because if I check-in again my card will be checking-out probably. I was thinking if there was an app for my phone, which tells me the state of my card. And probably this app could check me out on distance as well, in case I forgot it and I'm already at home." IV_D_21

"Het heeft heel lang geduurd voordat ik zover was om een OV-chipkaart aan te schaffen, want ik vind het schandalig dat er 7,50 euro betaald moet worden voor iets waar je toe verplicht wordt. Maar goed ik heb het uiteindelijk toch moeten doen, want anders kom je gewoon nergens meer. Voor mij was het bijvoorbeeld wel een ander verhaal geweest als het een borg was geweest." IV_M_27

Other comments

"Die campagne, 'Hij zit al in je portemonnee, doe er wat mee' ik bedoel ik doe er toch al iets mee, ik reis er toch al mee, is er nog iets anders dan? Dat is natuurlijk wel een beetje vragen om moeilijkheden. Ik heb een NS pas, maar je hebt ook de OV-chipkaart, dus dat is ook best verwarrend. Want ik dacht eigenlijk dat de OV-chipkaart vanuit de NS kwam." IV_SD_18

Part 3: Questionnaire booklets; what do people say when they are at home

The questionnaire booklets add an extra level to the interviews since people had one week to fill them in. This makes them more aware of what they say and gives them the opportunity to think a bit further. It was decided to use this method since interviewing people in the context of travelling was often influenced by a short available time span. These booklets were used to ask about the users behaviour at each step of the customer journey.

It can be stated users are quite pleased with the OV-chipkaart in general. They say that the OV-chipkaart is 'makkelijk', 'vlot', and 'handig'. However some people also have the impression that travelling by the OV-chipkaart is more expensive than travelling by the former system the 'strippenkaart'.

Looking at the impact the OV-chipkaart has on the travel experience this is quite severe. Almost everybody reported that they constantly hold the card in their hand during travelling, because they are too afraid for forgetting to check-out. These quotes also show the impact of the OV-chipkaart on the travel experience: "Altijd in het achterhoofd."; "Niet geheel ontspannen reizen."; "Extra opletten bij samen reizen."; "Je zit niet relaxt."; "Beter opletten."

A lot of the participants forget to check-out at least once. However they assume that it costs too much time and effort to ask the money back and therefore do not even try to do so.

When encountering a problem, the traveller often feels alone and gets angry at for example the ticket machine, since there are hardly service employees to turn to and to ask for help. If the station is equipped with a service desk, which is open as well a lot of travellers rely on these people to help them solve their problem. Generally participants indicated that the system should be designed in such a way that it enables the individual traveller to solve his problem.

Summarizing it can be said, that the OV-chipkaart is a good system, which works quite well overall. However, when a problem occurs travellers are not able to resolve it themselves and they do not trust their individual ability to remember to check-out at the end of the journey. Taken as a whole those problems result into a slightly negative image of the OV-chipkaart, which is related to a lot of extra effort although the system works well. When interviewing travellers at the station, the negative feelings are much more present then when letting users think about the system for a longer period of time.

Appendix M Interview comments

Mainly negative comments:

IV_RD_05
He does not have an OV-chipkaart yet, plans to buy a personal one since (as he has heard from his friends) it offeres more advantages than the anonymous one.

IV_RD_07
He does not have an OV-chipkaart yet, because he does not know how it works. His friends and family are not using the OV-chipkaart either.

IV_RD_08
He is not spending a lot of thoughts on the OV-chipkaart, but he thinks that it is painful difficult to top up ones card with at least 20 euro to use the train.

IV_RD_09
She isn't using the OV-chipkaart for bus or metro, and she hardly uses the train beyond her free day tickets. For her the different colours of the validators are confusing. She would appreciate more top-up possibilities in smaller villages.

IV_SD_10
His experience is that the system is not working and is not accepting credit cards.

The only possibility for him is to go to a service desk.

IV_SD_11, IV_SD_12; IV_SD_13
She uses the OV-chipkaart for the bus and the regional train. She thinks that it is a disadvantage that there is no single check-in/check-out. She thinks that CICO at multiple operators is especially difficult for people travelling outside their usual area. In her opinion, top-up of the OV-chipkaart should be possible at every station and to her there is no logical connection between travelling and top-up at the supermarket.

IV_SD_14; IV_SD_15; IV_SD_16
Generally she is confident with the card, but her card got stolen and then she experienced a lot of problems: She had to pay for the bus (whereas normally she is allowed to take the bus for free), she had to pay the full price for the train ticket instead of 60%, it took a long time before the new card came and when the card arrived the 40% reduction was missing on her card.

She is tired of fighting for her rights, since it costs her a lot of effort to get the same kind of card, which is why she is not even trying to ask the money back she has paid additionally for using public transport.

She is disappointed of the customer service of the NS. "Je wordt van het kastje naar de muur gestuurd"

She had to check-in and out several times at the same station, in order to find the information she was looking for. This costs her two times 4 euro, but she got the money back from the RET and is therefore satisfied with their customer service.

IV_SD_17

He likes public transport in general, he has a 'voordeelurenabonnement' but does not think that he earns back his money, since he is not travelling a lot. He recently got a new card, which he received too late to activate his 'product'. With help of the service desk he finally managed to 'load his product'. When he first loaded money on the card he was really confused that he had to present the card twice, he had already put the card back, but managed to present the card to the reader just in time.

When he travelled for the first time with the OV-chipkaart his money ran out of his card, because he was not aware of the correct way of checking-in and out yet. After a lot of time and effort he succeeded to get his money refunded.

IV_SD_18; IV_SD_19; IV_SD_20

This traveller got confused by the current TV-spot of the NS "Hij zit al in je portemonee, doe er wat mee" since he always thought that the OV-chipkaart was published by the NS. He never knew that there are two organisations behind ('de OV-chipkaart' en 'de NS'). When he was still studying he had a problem with the organisational structure as well, since he handed his broken student OV-chipkaart in at the wrong organisation (OV-chipkaart instead of student OV-chipkaart). That caused him a lot of trouble, a long time of waiting and high costs he never got refunded. In his opinion it is not the responsibility of the traveller to understand how the organisations are linked to one another.

IV_D_21

This user is a visitor working for 6 month in the Netherlands. He had a lot of problems with figuring out, which kind of cards and products are available and mainly relied on the experience of other (Dutch) people. Generally he thinks travelling in the Netherlands is too expensive and he does not understand why the OV-chipkaart is only offering reductions at the off-peak hours and he thinks that 20 euro is a lot of money, that one has to pay to be able to take the train at all. According to him travelling should be affordable for everyone at any time.

IV_D_22

They are confused about terms such as 'op saldo reizen' 'automatisch opwarderen' 'mijnNS' 'Mijn OV-chipkaart' etc. They use the term in a wrong context and do not understand how the companies are related to one another. They were/are not aware of the fact that an account is required to get an overview of the journey in order to declare travel expenses.

They are complaining that the provided information is not sufficient to understand how to behave, what to do when something goes wrong, to whom to turn to and what the consequences of their own behaviour are.

IV_M_23

This woman prefers to buy a regular ticket, since she is afraid to forget to check-out. For her the biggest disadvantage of the OV-chipkaart is that is requires constant alertness in order to not forget to check-out. She also gets confused about the location and the placing of the validators.

IV_M_24

She thinks that the OV-chipkaart is too expensive. She also thinks that a km based system is not fair and sometimes her card is blocked even though she still has money on it. That is why she prefers to go by bike or to buy a day ticket. According to her, the transport operator should come up with a "smart technology", which automatically recognizes when the traveller is leaving the vehicle.

IV_M_27

She thinks that the second chamber is doing its best in order to make life as good and easy as possible for everybody in the Netherlands. She thinks the Netherlands offers so many things that it is a bit ridiculous to gossip about the OV-chipkaart, since there are much worse problems. It took her quite long to get her first OV-chipkaart, since she could not accept that the card (which everone is forced to have) costs 7,50 euro. According to her, travelling should not be an exclusive thing but must be available for everybody.

IV_M_28

A bus-chauffeur driving between Maastricht and Aachen told me that it was possible to buy an anonymous OV-chipkaart in Aachen. As I found out later it is not possible anymore, which means that people living in Aachen need to go to the Netherlands first to either buy or activate their card.

IV_HE_30

He does not yet trust the OV-chipkaart system, since he has to pay the full price on the train even though he should travel with reduction. Only recently he understood (from the TV-spot) that he has to activate his card, which he was never told. Also he thinks that the letters on the validators are so small and difficult to read on purpose, in order to avoid that people get an insight into their costs. He always keeps the card in his hand, while travelling to prevent himself from forgetting to check-out. He has no positive feelings about the card.

IV_EH_33

He uses his student OV-chipkaart almost every day. During the week (when he travels for free) he regularly forgets to check-out, but he never forgot to check-out during the weekend. He thinks the system works good; the only thing that could be improved is the time people have to wait for their (new) card.

IV_EH_34

He forgot to check-out once and got his money refunded. He is a bit annoyed by the defect validators and does not like the fact that he needs to have 20 euro on his card in order to be able to travel.

IV_WG_38

She has a student OV-chipkaart and mainly travels for free. She has a small amount of money on her card, but prefers to buy a ticket when she is not travelling for free.

IV_WG_39

His experiences with the OV-chipkaart are positive when travelling with one operator only, however when travelling with multiple operators it is easy to make a mistake. He also has negative experiences with the customer service of Syntus, since the response was slow and he did not receive the full price back.

IV_WG_41

She only uses the OV-chipkaart when she travels for free. In the weekend she buys a paper ticket, since she does not want to have so much money (20 euro + ticket price) on her card. She expects to take the train less often when it will not be possible anymore to buy paper tickets. She is afraid that her card could get stolen and she loses her money by that. Also she indicates that she needs the 20 euroand cannot constantly 'park' them on the card. She regularly encounters Syntus validators, which are out of order.

IV_WG_42; IV_WG_43; IV_WG_44

This woman has an OV-chipkaart, which she only needs for a busride every how or then and hardly uses it, because she does not like to go by bus at all. For her the negative feelings she has about travelling by bus are somehow connected to the OV-chipkaart. Her husband worked for the NS and therefore she can take the train for free.

Mainly positive comments:

IV_,RD_01

Not travelling often. Has good experiences with the OV-chipkaart and no problems.

IV_RD_02

Travels from Rijsen (Twente) to Endhoven twice a week, takes the bus and the national train. In general he thinks the OV-chipkaart works well. He thinks that the inconcistency of CICO poles and gates is confusing and he feels that the gates are not placed at the right place, since the facilities behind the gates are not available for people who are not travelling at the moment.

He prefers to load money on his card instead of buying paper tickets. He would like to take his bike without buying an extra ticket. He does not use the automatic top-up service because he doesn't want to have money stored on his card (while not using it) that he needs for something else instead.

IV_RD_03
This woman has two OV-chipkaarts, one allows her to travel for free by bus and metro in the region of Rotterdam, the other card she uses when travelling outside Rotterdam by bus or metro. When she takes the national rail she buys paper tickets. She doesn't know whether it is possible to use the OV-chipkaart for the train as well. She prefers the OV-chipkaart to the Strippenkaart: "Dan zit je niet altijd met die opgevouwen dingen en dat gekreukel.."

IV_RD_04
This woman has two OV-chipkaarts: A 'voordeelurenabonnement' and an OV-chipkaart which she uses for the bus in Amsterdam. She sometimes forgets to check-out in the bus for example when she does not get reminded by the tannoy announcement or when she is in a conversation. She never asked money back, in order to train herself not to forget to check-out the next time. She uses automatic top-up for both of her cards. At the beginning she needed to get used to the OV-chipkaart, but now she really likes the system. She has encountered validators which were not working ('buiten dienst') several times.

IV_RD_06
The card works well, he does not have any problems in using it. He loads manually 10 euro to 20 euro on the card, depending on where he is going to.

IV_M_25
He thinks that the OV-chipkaart is an improvement compared to the old paper tickets. However, he thinks that it is unfair that he cannot travel with reduction (with his ticket) during peak hours, since that is the time he usually takes the train when he goes home.

IV_M_26
She is travelling about three times a week on different routes. She is happy with the OV-chipkaart and everything goes well. In order to prevent herself from forgetting to check-out she holds the hand in her hand during the journey.

IV_HE_29
He is using the OV-chipkaart for about one month now. He uses it only on the bus because it is cheaper travelling by OV-chipkaart that travelling with a paper ticket. He still needs to get used to check-in and to check-out, but he thinks it makes sense and he does not experience any problems with the OV-chipkaart. Even though travelling by OV-chipkaart, according to him, it is still too expensive, this is why he uses the OV-chipkaart of his Dutch friends (who are travelling for free) every time possible.

IV_HE_31
She travels on a daily basis by bus, here she always uses the OV-chipkaart. She thinks it is an advantage that she does not have to bring small change every time she wants to travel and has

only positive experiences with the OV-chipkaart so far. She holds the card in her hands during the journey, to make sure to check-out, however she does not feel that this is affecting her travel experience. When she goes somewhere else (uncommon route, farer away) she uses a day ticket, since she thinks it is cheaper and more convenient.

IV_HE_32

He thinks it is a wonderful system. He never has any problems and he immediately got used to it. Also he thinks that the OV is cheap.

IV_AF_35

She thinks that the OV-chipkaart works well, in the beginning one has to arrange a lot of things but once one got used to it, using the card seems relatively simple. She still has to remind herself, that she has to check-out now as well. When she travels by bus she keeps the card in her hand during the journey. Every now and then she asked service employees to top-up her card, since she still needs to get used to 'all the machines'. She recently heard that there is also a possibility that this is done automatically and now she already has all the information on how to activate it, but didn't have time yet to do so.

IV_AF_36

She sometimes has problems with defective validators, for the rest she likes the system.

IV_WG_37

He uses his OV-chipkaart to go to university and back home. In the beginning he had problems with the OV-chipkaart because money was taken from his account when it should not have been taken. He mailed the NS to ask about it, but did not receive any money back. After a while the card was working, so he was happy about it and not concerned about the costs anymore. Now everything works well.

IV_WG_40

He is positive about the OV-chipkaart. It is easy and convenient to use. The only thing he comments upon is that it can be quite busy at the validators, which may lead to missing a train or connection.

IV_WG_45

He thinks the OV-chipkaart functions well as long as it is working. Once his card was defective and he had to wait four weeks before he got a new card. He tops-up his card at the Albert Heijn, but has no idea where to go when he is in another city and cannot find an Albert Heijn.

Appendix N Usability issues

Orientation
Lack of information overview
Information regarding the acquisition of an OV-chipkaart, travel products, usage and customer service is distributed by different organisations. Some people find it hard to determine which organisation is the one they should turn to in order to get information about the OV-chipkaart or to solve their problem. This results in people spending a lot of time to find the right information or giving up because (they expect) it takes too much time.

OV-chipkaart components
The OV-chipkaart itself is a 'card' onto which one can put 'travel products' that may or may not be used with a 'transport operator' in a 'concession'. Understanding the difference between these components and items in these component categories can be difficult for people. Most travellers want to get from place A to place B and have little patience for artificial concession boundaries, business reasons for season ticket limitations or technical obstacles preventing one from going about.

The mental model of 'travel products' on a 'card' and the effect of these products on the fare are especially confusing for people. Travel products and cards used to be the same and inseparable. Furthermore, the invisibility of travel products, and the distribution by some transport operators of cards that look like they only (are able to) contain one product , makes the distinction hard to explain and understand.

People try to simplify their ideas about the OV-chipkaart system and will come up with the wrong explanations for why things happen, based on the few interactions they think they understood.

Internet reliance
For a particular group of people, the expected access to the web and the ability to navigate complex websites is limiting their usage of the OV-chipkaart and thus public transport. Most transport operators have reduced the amount of service desks, the things that can be handled at these desks and instituted charges for people using service desks. Depending on other people to navigate public transport ticketing makes some people feel dumb and incapable, reducing their willingness to use public transport.

Purchasing
Inconsistent man-machine interaction
Man-machine interaction of OV-chipkaart hardware is different per machine and per operator: screen layout, information, terminology and available options seem to wildly differ without any apparent reason to the user.

Ticket vending machines offer a range of tickets and sometimes just a few. At some machines you can purchase an anonymous OV-chipkaart, at others you cannot. Some machines will allow you to load travel products you bought online, while others do not.

Payment methods

Available payment methods differ per machine, per location, per operator. The most common available method is PIN and second is coins. These are, for example, often unsuitable for tourists, who are more likely to possess a credit card or not-supported debit card.

Spread out purchase process

The process of buying, for example, a personal OV-chipkaart requires the user to find information about where to buy it, to visit the OV-chipkaart website, fill out the purchase form, upload a digital portrait picture, wait for delivery, charge the balance, and activate the national train travel product. These are many steps at different moments in time and at different locations before one can use the card.

Activation
Product activation

People now have to buy their 'travel product' at one location and 'activate' it at another place. This new and unfamiliar concept of split purchase and activation is often hard to understand what actions have to be taken at which places.

Cards are not activated for national trains by default

Any OV-chipkaart is ready for use in a bus, tram, metro or regional rail, but only cards purchased at the NS are directly ready for travelling with the national trains. Many people are unaware that they will have to activate their OV-chipkaart and will conclude that "it just does not work for the train".

Product pickup points

If you order a travel product online, you will need to 'load' it on your OV-chipkaart to activate it. Operators have installed product pickup devices around the country, but many people still do not encounter a pickup device in their regular routine. Furthermore, one has to remember the necessary steps if one encounters such a device. Most of these pickup devices have a less than optimal design and are hard to operate because of the display and interface quality.

Credit charging
High national train trip deposit

The deposit for trips with the national trains is 20 euro for anonymous cards, something many people consider a large amount of money to idly put on a card. Most people accept that it is needed, but do not necessarily understand why or appreciate.

Auto-charging requires a Dutch bank account

Automatically charging your card makes it a lot easier to use, because one does not need to keep track of the amount of money on the card (there is always enough) and people do not have to queue anymore to charge a card. Currently, the auto-charging requires a Dutch bank account, for which one needs a Dutch postal address and an official GBA registration in a Dutch city to receive a BSN. Something that precludes regular visitors from using this feature.

Unknown required trip deposit

At check-in, the validator takes a deposit of which the amount currently depends on the modality and operator. In the future, the size of the trip deposit might change from service line to line. This makes that the minimal amount of money that is needed to travel is unpredictable for the user, resulting in validators not accepting cards while travellers expected to be able to check-in.

Check-in
Validator

Validators from different transport operators provide varying feedback when travellers check-in or -out, sometimes confusing users about what the fare is and what the trip deposit is. Many validators also have hard to read screens, due to low contrast, bad typography, and the height and angle of the display. Some validators are noticeably slower than others, causing boarding queues and users are not sure whether the machine is working.

Card status

An OV-chipkaart does not show whether it is checked-in, if it is using a travel product or how much money is on the card. This invisibility makes people uncertain and reduces trust.

Train transfer

Transferring from one train operator to another train operator requires the traveller to check-out and check-in. While this is less of a problem on trams and busses because those use on-board validators, it is confusing people at stations. Forgetting to check-out and -in during a transfer, but only at the endpoints of a trip, will in the worst case result in two deposit deductions.

Error solving

Room for error solving is very limited when validators deny an OV-chipkaart. Usually the traveller really wants to take the next vehicle and solving the error takes time. Charging a card might not be possible if there is no machine around and a blocked card will require the purchase of a new one.

Check-out
Forgetting

People have to remember a lot of things while travelling and checking-out is just one of the many things on one's mind. Especially if the point of check-out is unenforced and away from the vehicle, the traveller has already moved-on in his thinking process beyond the end of the trip. The financial risk of not checking-out makes that people have to undertake action to fix these situations; something people consider to be cumbersome and difficult.

Time limits

Checking-out is only possible within a certain time frame, after which the system assumes you forgot. In some cases this assumption is wrong and hinders the traveller, who now needs to arrange a refund.

Flat fare

Some forms of public transport work with a flat fare, such as ferries and night busses, but the OV-chipkaart does not accommodate this yet. Travellers are required to check-in and -out, resulting in confusing situation where you have two validators besides each other, which you have to use to complete your payment before you board a ferry.

Customer service
Who to address

The many organisations involved with the OV-chipkaart have different responsibilities and capabilities. Determining which organisation to contact for customer service is difficult for travellers. For example, requesting a refund needs to be done at the right operator, while hardware problems with a card you bought at an operator are handled by TLS.

Checking expenditure

Keeping track of your travel costs is less accessible now than in the past. Having an online overview of your trips—if you know that is possible and have activated it—saves time, but is not necessarily easier for people to understand.

Slow card replacement

A broken card takes days, if not weeks to replace and usually requires sending it in by mail. In the meantime, travellers often have to cover their cost and hope for a refund afterwards. This decreases the trust in the system.

Distance based

Most of the customer service is only available by phone and this distance based customer service sometimes makes people feel trapped if the problem is hard to explain. The lack of in-person service leaves people feel left behind.

Operator specific rules

Different operators have different rules and routines for refunds and other customer service issues. Transferring knowledge a user gained during one interaction is often impossible.

Balance refund (for tourists)

Reclaiming the credit balance from an OV-chipkaart you will not be using anymore is possible at service desks for amounts under 30 euro. You will need to have a Dutch passport or identification document, making this option unusable for tourists who would benefit the most from this.

General barriers for entry

Pricing

Initial cost of the OV-chipkaart is higher, especially compared to the paper tickets, which had no initial cost. A family of four now has to buy six cards for 7,50 euro each and charge them with 20 euro each before they can take a train trip. This sets the family back 110 euro, a considerable investment.

Appendix O OV Loket complaints

The OV Loket provided us with a list of complaints they have received by users of the OV-chipkaart. The complaints of this list have been studied and a couple of those complaints are provided on the following pages in order to give a brief overview of the problems users are dealing with.

"Hierbij richt ik mij tot u, gezien pogingen om geholpen te worden bij de NS en de OV-chip tot niets hebben geleid. Het gaat om het volgende:

In december 2011 lieten wij ons verleiden door de reclame van de NS en besloten wij als gezin een voordeelurenabonnement te nemen. Twee volwassenen en twee kinderen. Een OV-chip-pas, reizen met 40 % korting en de kinderen gratis mee in de trein. In de eerste week van januari 2012 vielen de passen op de deurmat. Dat kwam goed uit want we hadden een aantal treinreizen gepland, waardoor we meteen konden profiteren van het voordeel.

Al snel bleek dat één van de passen niet werkte, namelijk die van ondergetekende. Dat betekende in de rij bij de informatiebalie om even later te horen dat de pas 'dood' was en de medewerker niets voor mij kon betekenen. Ik moest een andere pas aanvragen.

Toen ik een paar weken later de nieuwe pas ontving, ging ik hoopvol naar de NS automaat om 'de reservering op te halen.' Helaas, er stond niets klaar voor de nieuwe pas. Ik kon opnieuw niet reizen met korting. Ik kon überhaupt niet per trein met de OV-chipkaart reizen. Na wat heen en weer bellen met de NS en de OV- kaartmaatschappij, bleek dat het abonnement is gekoppeld aan de oude kaart. Aan de nieuwe kaart 'hangt' geen abonnement. 'U moet bij de NS zijn, was het commentaar van de OV-maatschappij. 'Nee hoor, u moet echt bij de OV-maatschappij zijn, was vervolgens het commentaar bij de NS. Uiteindelijk zei de persoon aan de telefoon toe dat ze zou zorgen dat het probleem verholpen zou worden en stuurde ondertussen een papiertje waarop stond dat ik gedurende een maand recht heb op de 40 % korting.

Wekelijks ging ik vervolgens proberen bij de automaat of ik de reservering al op kon halen... steeds weer 'stond er geen reservering klaar'. Keer op keer vertelde de vriendelijke dame of heer mij dat ze er druk mee bezig waren en uiteindelijk stelde één van hen voor om een 'van het kasje naar de muur procedure te starten'. Dat klonk kordaat en hoopgevend. Het was inmiddels april geworden en ik had nog steeds geen reservering die ik op kon halen. 'Het was een ICT-probleem' zei de vriendelijke telefonist. Het probleem lag nu op die afdeling en als we aan de beurt zouden zijn, zou de oplossing nabij zijn. Ook weer een kaartje voor een maand reizen met korting. Na een aantal weken van radiostilte, maar weer gaan bellen. Heeeel vervelend vindt iedereen het, heel naar en vervelend. Opnieuw een kaartje waarmee ik weer een maand met korting kan reizen. MAAR IK WIL HELEMAAL GEEN KAARTJE WAARMEE IK MET KORTING KAN REIZEN. Ik wil het gemak van in-en uitchecken met één OV-chipkaart, net als de andere leden van ons gezin. Ik wil 'handig, één kaart voor alles', waar de NS mee adverteert. Maar bovenal wil ik serieus genomen worden. Ik wil niet iedere maand weer aan de telefoon moeten hangen om te horen dat men er mee bezig is en dat het probleem nog bij de ICT-afdeling ligt.

Het is inmiddels september. De OV-chipkaart heeft mij alleen maar ergernis bezorgd en 50,00 euro gekost. Iets waar door de NS niets tegenover wordt gesteld.

Ik voorzie dat het na september ook oktober, november en december wordt. Dan is het abonnement zowieso afgelopen en sta ik helemaal met lege handen.

Ik hoop dat u iets voor mij kan betekenen. Ik loop alleen maar tegen muren aan en wordt niet geholpen.

Ik zie graag uw reactie tegemoet,"

1 Complaints concerning a system which is hard to access sometimes

"Ik woon niet in Nederland en kom na 23.00 uur aan op vliegveld Zestienhoven waar ik met de bus en vervolgens met de tram naar de plaats van bestemming moet.

De volgende ochtend moet ik dan weer met de tram naar Rotterdam Centraal Station voor het nemen van de trein.

Nu begrijp ik dat je geen losse kaartjes meer kunt kopen bij de chauffeur en dat via www.ov-chipkaart.nl/webwinkel een wegwerp OV-chipkaart voor eenmalig

gebruik te bestellen is, die dan op het ophaalpunt op het vliegveld op te halen is.

Echter het ophaalpunt is open tussen 07.00 en 23.00 uur terwijl ik na 23.00 aankom.

Hoe nu verder ????"

"Mijn dochter is schoolgaand op het voortgezet onderwijs te Middelharnis. Iedere maand bestel ik met het daarvoor bestemde formulier een maandabonnement van 72,00 euro.in Leeuwarden. (Dat is natuurlijk al zeer bewerkelijk en je moet ook nog eens rekening houden dat dit min. 2 weken van te voren wordt aangevraagd incl telkens een kopie van legitimatie en afschrift erbij!!) Mijn verbazing was groot toen ik van de klantenservice van Arriva hoorde dat per aankomende dec. 2012 het maandabonnement komt te vervallen. Nog groter was mijn verbazing toen ik hoorde dat de dichtstbijzijnde oplaadpunten voor de ovkaart Spijkenisse (58.7 km)??? en Tholen (39.5 km)??? zijn. Hoe is het in hemelsnaam mogelijk dat er nog steeds geen enkel oplaadpunt is in de woonplaats of bij school? Moet ik nu naar Spijkenisse of Tholen gaan fietsen? Of aan iemand vragen of diegene mij regelmatig met de auto brengt om enkel op te kunnen laden? Niet iedereen kan een pc of internet veroorloven. Dit is toch volslagen absurd! Ik heb geen internetbankieren en een minimum inkomen. Hoe moeilijk kun je het mensen maken om gebruik te maken van het openbaarvervoer in toch zo'n klein landje als Nederland? Schandalig! Zeer slecht geregeld! Er moeten meer oplaadpunten komen. B.v. in lokale supermarkten, banken, postkantoren, bij bushaltes of desnoods in het stadhuis. De klantenservice van Arriva heeft geadviseerd om deze klacht in te dienen bij het ministerie van vervoer. Waar en hoe kan

ik dat doen? Is er ook een gemeenschappelijk bezwaar of site zodat ik mij kan aansluiten bij gelijkgestemden. Er moeten toch meer mensen zijn die hier bezwaar tegen hebben of door in de problemen komen?"

"De strippenkaart kon je op iedere straathoek kopen. Een kennis van mij in Den Haag, die nota bene tegenover Albert Heijn woont, moet echter een half uur lopen naar het dichtstbijzijnde verkooppunt als ze straks voor buitenlands bezoek een ANONIEME kaart wil kopen.

Het aantal verkooppunten moet drastisch uitgebreid worden! En de verkoop van die anonieme kaarten moet net zo makkelijk worden gemaakt als met de strippenkaart. Daar kan toch moeilijk bezwaar tegen gemaakt worden."

"Beste mensen van de tweede kamerfractie,

Ik heb een vraag en het gaat over de NS. Ik hoop dat jullie daar iets mee kunnen doen.

Ik wil een jaarabbonnement bij de NS, een dal voordeel. Maar ik heb geen internetbankieren. En bij de ns-servicebalie kan ik hem niet kopen. Daar kan ik wel de dure maandabonnementen dal vrij en weekend vrij kopen, maar dit jaarabonnement niet. Het kan wel telefonisch, maar toen ik belde was er een storing. Bovendien duurt het dan 10 werkdagen voordat ik mijn abonnement kan gebruiken.

Dit vind ik echt super klantonvriendelijk en het raarste vind ik dat er bij de servicebalie maar een beperkt aantal abonnementen te koop is. Hierover heb ik een klacht ingediend bij de NS. Kunnen jullie er ook iets mee doen? Het is een gevolg van de invoering van de ov-chipkaart. Voorheen kon je gewoon een abonnement kopen bij de balie of in de automaat. Nu niet meer. Eerst: ov-chipkaart aanvragen. Dan: reizen op saldo activeren bij de ns. Dan: bellen voor een abonnement en dan 10 dagen wachten. Ik vind het te gek. Kan de ns hierop aangesproken worden vanuit het ministerie?"

"Mw belde om het volgende te melden;

Haar zoon wilde online een aanbieding van NS Dalvoordeeluren abonnement bestellen. Tijdens het bestekproces bleek dat men alleen via Ideal (internet bankieren) betaald kan worden. Moeder belde naar de Klantenservice. Er was geen andere betaalmogelijkheid dan via internet bankieren, Moeder moest het maar regelen via een kennis of een familielid. Automatisch incasso was geen probleem voor deze mevrouw, maar NS biedt geen oplossing. Dan maar geen klant zijn?"

2 Complaints about a bad customer service

"Ik wil bij jullie graag mijn beklag doen over de organisatie die de OV-Chipkaart uitgeeft.

Ik had een dalurenkortingkaart van de NS, en gebruikte die ook voor het reizen in ander openbaar vervoer. Tevens stond er mijn recht op om als 65+ er gratis te reizen in het openbaar vervoer van de RET in mijn woonplaats.

Op 26 september wilde ik de kaart, waar ruim   30 tegoed op stond, gebruiken, maar hij deed het niet. Er bleek een klein barstje in te zitten.

Bij het station haalde ik informatie en kreeg een formulier waarmee ik de kaart moest opsturen, hetgeen ik deed op 27 september. Maar helaas heb ik tot nu toe geen nieuwe kaart ontvangen.

Na 2 weken, dus afgelopen vrijdag 5 oktober, stuurde ik een mailtje, waarop ik onderstaand stompzinnig antwoord kreeg. Ik heb direct gebeld maar kan de ondertekenaar niet aan de telefoon krijgen, en de vervangster zegt dat het nog wel 3 weken kan duren, want dat zou zo in de voorwaarden staan.

Ik vind dit tenenkrommende slechte service en begrijp absoluut niet waarom een defecte kaart niet binnen 2 dagen vervangen kan worden. Men ontneemt mij eenvoudig voor langere tijd alle rechten die aan de kaart verbonden zijn, inclusief de toegang tot het saldo. Dit is typisch het gedrag van een monopolie organisatie en ik verzoek u dringend hiertegen actie te ondernemen.

Ruim 1 week geleden stuurde ik u mijn kaart op omdat die het niet meer deed vanwege een barstje. En nog steeds heb ik geen nieuw exemplaar ontvangen, zodat ik al ruim een week niet op normale wijze van het OV gebruik kan maken. Ik begrijp dat dat zo lang moet duren! Dat ziu toch binnen één werkdag gepiept moeten kunnen zijn? Schandelijk dat dat niet zo is!"

"De kaart werkte 24 januari niet meer zonder zichtbare beschadiging en na normaal gebruik. Na ruim vier weken kreeg ik een nieuwe kaart. Ik had ondertussen 272.00 euro kosten gemaakt. 12 juni kreeg ik te horen dat ik 18.78 retour ontvang. Dit is 14 weken nadat de kaart kapot is gegaan. De kwaliteit van de kaart is ontoereikend. Hij hoorde tot 2015 te werken. Ik heb geld geleend van mijn ouders om mijn tussentijdse kosten te kunnen betalen. Ik ben een student en heb geen 272.00 euro te besteden. Ov chipkaart klantenservice reageerd stoicijns en absoluut niet klant gericht. De kaarten zijn waardeloos en daar wil ik niet voor boeten. Ik heb diverse bewijzen en kopien in mijn bezit om e.e.a. te onderbouwen maar ik weet niet hoe ik die kan toevoegen aan deze klacht."

"Aanvraag nieuwe ov chipkaart heeft ongeveer twee maanden geduurd. Normale wachttijd is 3 weken. Vervolgens declaratie opgestuurd waarvan ik op de dag van vandaag nog niks van heb gezien. Dit duurt al ongeveer 4 maanden. Normale wachttijd is 6 weken. Bellen en mailen helpt niet, krijg elke keer hetzelfde antwoord.

"Vastgesteld op de balie te Amersfoort door medewerkster dat chip defect was buiten mijn schuld Formulier opgestuurd naar Postbus 365 te Amersfoort.Nog steeds geen vervangende kaart ontvangen. Moet van Soest-Zuid naar Arnhem met trein en bus. Mijn ouders kumnnen de reiskosten niet langer blijven voorschieten Wanneer komt de vervangend kaart? svp antwoord ben ten einde raad."

3 Complains about the inconvenience of the system

"Onlangs kreeg ik een nieuwe ov-chipkaart van de NS. Aangezien ik automatisch opladen op mijn oude kaart heb staan moet dit eerst op de nieuwe worden geactiveerd.

Daartoe logte ik in op m'n account bij ov-chipkaart, wat ik al verschillende keren heb gebruikt. Dit lukte niet omdat m'n gebruikersnaam en/of wachtwoord niet correct zouden zijn.

Procedure gebruikersnaam vergeten" gestart, kreeg gebruikersnaam via de mail toegestuurd en wat bleek het woord dat ik zelf had gebruikt was wel goed alleen het was zo maar omgezet naar hoofdletters, zonder dat ik daarvan in kennis was gesteld. Toen dacht ik te kunnen inloggen, maar nee nu was het wachtwoord blijkbaar niet goed en moest ik weer de "procedure wacht-woord vergeten" doorlopen, kreeg ook dat via de mail toegestuurd en dat moet je zoals bekend omzetten naar een zelf gekozen woord. Toen dacht ik eindelijk te kunnen inloggen, maar dat ging wederom niet door, want na het doorgeven van nieuwe gebruikersnaam en wachtwoord moest het ook nog aan de administratie doorgegeven worden. Je zouden denken dat gaat al-lemaal automatisch, nee het is nog gekker nu moet ik nog 24 uur wachten voor het in de admin-istratie is verwerkt voor ik kan inloggen. (Zouden ze daar nog met een kaartenbak werken?).

Verder vind ik het een belachelijke zaak dat je na 3x binnen 3 dagen verkeerd inloggen 24 uur niet kan inloggen; een "slip of the finger" heb je zo. Met een bankpasje is men nog soepeler."

"Mijn vrouw en ik wonen in Zwitserland en bezoeken regelmatig familie in Nederland. Wij zouden graag een OV-Chipkaart aanschaffen, hebben echter twee problemen.

1:Wij hebben geen Nederlandse bankrekening meer, wel een credit-kaart.

2: ik werk bij de Zwitserse Spoorwegen en heb daarom een 50% kortingskaart (FIP-kaart) voor buitenlandse spoorwegmaatschappijen (ook NS)

Is het mogelijk dat deze faktoren op de kaart geprogrammeerd worden? Indien niet, zijn er dan andere mogelijkheden om een kaartje te kopen? Hoe kunnen wij het OV gebruiken als de pa-pieren kaartjes afgeschaft worden?"

"Onze zoon maakt gebruik van OV rond Rotterdam. Hij maakt daarbij ook gebruik van de bu-sonderneming Arriva. Om daarvan gebruik te kunnen maken moeten er andere stappen onder-

nomen worden voor de aanschaf van een abonnement. Ik dacht dat OV alles eenvoudiger zou maken voor de klant. Maar nee. Arriva heeft zijn eigen voorwaarden en regeltjes. Is hier geen oplossing voor??"

"Onderstaande klacht heb ik gedeponeerd bij Syntus. De hele gang van zaken heeft me ongeveer 4 uur gekost.

Het komt hier op neer dat op het traject Dieren-Arnhem (en een aantal andere) geen abonnement gegeven wordt door Syntus. Een abonnement door Connexion (de opdrachtgever volgens Syntus) op de OV-kaart gezet kan of wil Syntus niet lezen. Zij eisen een zicht-abonnement, maar geven die dus niet af. Een uitdraai van de OV-kaart gegevens moet mijn zoon nu altijd bij zich hebben. Ik hoop dat u met deze melding iets kunt, met vriendelijke groet "

"Woonachtig in Dieren moet onze zoon vanaf 21-8 naar de middelbare school in Velp. Een busabonnement (bij Syntus Trajectkaart) is niet mogelijk omdat u lijn 43 rijdt in opdracht van Connexion. Dus een abonnement geregeld via de site van Connexion, en gekocht bij verkooppunt Primera in Dieren. Bij controle in de bus blijkt Syntus dit abonnement, bijgeschreven op de OV-kaart, niet te accepteren. Mijn zoon dient een zichtkaart te hebben. BRENG accepteert overigens de kaart wel.

In het kort komt het hier op neer dat Syntus geen abonnement verstrekt, en die op de OV-kaart staat niet accepteert. Na telefonisch contact werd mij het advies gegeven de accountgegevens van de OV-kaart uit te printen en deze print dient mijn zoon altijd bij zich te hebben als bewijs dat hij wel een abonnement heeft. Een primitieve gang van zaken.

Ik heb nu twee buschauffeurs gevraagd of ze mijn zoon inderdaad mee gaan nemen. Ze hebben aangegeven de gang van zaken niet te kennen, maar denken dat het wel goed is. Maar weten het niet zeker. Gisteren heb ik met chauffeurs gesproken die vertelden dat er vorig jaar scholieren niet meegenomen werden, omdat ze geen zichtabonnement hadden.

Blijkbaar heeft Syntus niet begrepen waar de OV-kaart voor in het leven is geroepen, namelijk één kaart voor iedereen en overal in Nederland. De burger is verplicht die kaart aan te vragen, maar Syntus ontwerpt zijn eigen regeltjes.

Ik ben hier nu al een kleine vier uur mee bezig geweest, alleen om een simpel busabonnement aan te vragen. Al met al een schandalige gang van zaken.

Een tweede punt is het volgende: ik moet voor deze klacht inloggen (ook al bizar) en naar aanleiding van het E-mail adres komt naar boven dat mijn zoon een account heeft bij u. De kaart is echter nog niet gebruikt. Blijkbaar is het voor u wel mogelijk om per direct de gegevens van de OV-kaart te krijgen, maar een abonnement op diezelfde kaart accepteert u niet."

4 Complaints due to a financial advantage

"Geachte NS zakelijk

Ik wil er sterk bij u aandringen de NS Business card te handhaven, naast de nieuwe NS Business card dal.

Graag uw reactie op onderstaande.

U noemt als reden voor de overgang naar NS Business card Dal: " mensen te bewegen buiten de spits te reizen"

Maar ook voor de incidentele/regelmatige dalurenklant zijn de nadelen zodanig, dat deze overgang als prijsverhoging en als klanten wegjager moet worden beschouwd. Uit de verschillen tussen de NS-Business Card en de NS-Business Card Dal (http://www.ns.nl/zakelijk/producten/ns-business-card/ns-business-card-dal) blijkt het volgende:

- 66% prijsverhoging.
- reizen bij alle andere vervoerders onmogelijk (ook niet door het vooraf boeken van een reis).
- aparte OV-chipkaart of een los kaartje voor reizen bij andere vervoerders.
- alleen OV bruikbaar bij de RET in bus, tram en metro in de regio Rijnmond.
- Saldo laden om te reizen in bus, tram of metro wordt onmogelijk gemaakt werkt uitsluitend op basis van in-en uitchecken. Niet boekbaar via internet of telefoon
- Niet overboekbaar naar 1e c.q. 2e klas (staat niet bij de veel gestelde vragen)

En als klap op de vuurpijl bij uw veel gestelde vragen:

Ik wil geen NS-Business Card Dal, want ik reis niet in de daluren. Kan ik een andere NS-Business Card kopen?

Nee, de NS-Business Card Dal vervangt de huidige NS-Business Card. Indien u echter nog een NS-Business Card heeft die nog niet is verlopen, kunt u daarmee reizen tot aan de vervaldatum.

Natuurlijk heeft de maatschappij u gedwongen tot privatisering en opsplitsing maar om zo weinig aandacht te besteden aan de nadelen hiervan, kan op weinig begrip van de OV reiziger rekenen.

Op 6 okt heb ik via internet een weekabonnement van 29.25 euro gekocht. Bij het ophalen van de bestelling ging iets mis. Contact gehad met klantenservice en die erkende het probleem en ik krijg binnen 30 dagen mijn geld retour. Op 13 okt heb ik voor BEIDE kaarten een maandabonnement gekocht via internet à 95.80 euro en op 1 kaart ook 10,- euro extra. Bij het ophalen van de bestellingen ging het wederom mis. Klantenservice gebeld en erkende weer probleem. Krijg binnen 30 dagen geld terug. Echter...ik zit in de bijstand en heb nu 230.85 euro (tijdelijk) weggegooid. Mijn kinderen moeten morgen wel weer met de bus naar school maar ik heb ABSULUUT GEEN GELD meer. Bovendien, als ik wéér via internet bestel, ben ik bang dat

het wederom mis gaat. Ik heb alleen geen keus om de bestelling anders te doen omdat ik verantwoording bij de sociale dienst moet afleggen. Als ik via de automaat een abonnement erop zet, heb ik onvoldoende bewijs.

Kunnen jullie mij a.u.b. helpen om MET SPOED weer mijn geld terug te krijgen?

Het betreft de kaarten (JB: kaart- en adres-gegevens zie onder en boven) Mijn gegevens zijn (JB: zie opmerking).

Hoop dat jullie mij a.u.b. kunnen helpen want ik zit nu echt met de handen in het haar. Ik moet nu geld gaan lenen om mijn kinderen naar school te laten gaan en dat vind ik echt héél erg."

"Beste ik heb al 3 keer problemen gehad. Tijdje terug heb ik gemaild omdat ik 10 euro van mijn rekening liet afschrijven om vervolgens mijn Ov. Chip hiermee op te laden. Ik kon mijn reisproduct niet ophalen, dus weg tien euro. Dat zouden ze terug storten, tot op heden niet ontvangen !!!"

"Ik heb een klacht over de ov-chipkaart. Op 28 augustus heb ik een maand-abonnement gekocht bij een automaat. Het bedrag is afgeschreven van mijn bankrekening en bij de inlog-gegevens van mijn zoon staat ook dat hij een abonnement heeft. Mijn zoon heeft 3 dagen kunnen reizen, en op een gegeven moment belde hij me op of ik hem kon ophalen omdat de buschauffeur hem weigerde omdat er niets op zijn kaart stond. Ik heb verscheidene malen gebeld met ov-chipkaart, maar telkens kreeg ik te horen dat ik de bestelling bij een oplaadpunt moest ophalen. Dat heb ik geprobeerd, maar dat lukt niet. Daarna heb ik een klacht ingediend bij ov-chipkaart, en ook eentje bij Connexxion (vervoerder). Telefonisch zeiden ze bij Connexxion dat als ik mijn bankafschrift zou mailen ik het geld teruggestort zou krijgen. Ik zit er nog steeds op te wachten. In de laatste mail die ik kreeg stond dat ik een anonieme chipkaart heb en dat daar geen abonnementen op gezet kunnen worden, maar het is helemaal geen anonieme kaart en waarom kon mijn zoon wel de eerste dagen reizen? Ik word van het kastje naar de muur gestuurd, en ik wacht al zo lang zonder resultaat. Ik krijg mijn geld niet terug, mijn mailtjes worden niet beantwoord en ik betaal iedere schooldag buskaartjes uit mijn zak wat mij veel meer kost dan een abonnement. Kunnen jullie mij helpen?Op 9 oktober 2012 een bestelling gedaan voor een 2 sterren abonnement. Vandaag nog niet kunnen ophalen, omdat het product nog niet is klaargezet. Op de website staat echter dat ik het product na 1 minuut kan ophalen. Nu kan ik 1 dag minder reizen op het product dat ik heb besteld."

"Na nogmaals gebeld te hebben met trans link systems kreeg ik het antwoord dat mijn bestelling bij hun niet goed is verwerkt. Zij annuleren mijn bestelling en ik krijg mijn geld binnen 30 dagen retour. Dit is nu al de tweede keer dat ik een bestelling niet kan ophalen. 1e keer was er een onbekende fout opgetreden en nu is de afhandeling intern niet goed gegaan. De betalingen zijn altijd wel in orde. Door hun toedoen kan ik nu wederom 30 dagen niet over EUR 74,- beschikken.

Ik vind dit een waardeloos systeem."

Appendix P Participants London

Interview	Location	Date	File name
Interview	King's Cross station	16/10/2012	L - interview 001
Interview	King's Cross station	16/10/2012	L - interview 002
Interview	King's Cross station	16/10/2012	L - interview 003
Interview	King's Cross station	16/10/2012	L - interview 004
Interview	King's Cross station	16/10/2012	L - interview 005
Interview	King's Cross station	16/10/2012	L - interview 006
Interview	King's Cross station	16/10/2012	L - interview 007
Interview	King's Cross station	16/10/2012	L - interview 008
Interview	King's Cross station	16/10/2012	L - interview 009
Interview	King's Cross station	16/10/2012	L - interview 010
Interview	Victoria station	16/10/2012	L - interview 011
Interview	Victoria station	16/10/2012	L - interview 012
Interview	Victoria station	16/10/2012	L - interview 013
Interview	Victoria station	16/10/2012	L - interview 014
Interview	Victoria station	16/10/2012	L - interview 015
Interview	Victoria station	16/10/2012	L - interview 016
Interview	Victoria station	16/10/2012	L - interview 017
Interview	Victoria station	16/10/2012	L - interview 018
Interview	Victoria station	16/10/2012	L - interview 019
Interview	Victoria station	16/10/2012	L - interview 020
Interview	Victoria station	16/10/2012	L - interview 021
Interview	Victoria station	16/10/2012	L - interview 022
Interview	Victoria station	16/10/2012	L - interview 023
Interview	Victoria station	16/10/2012	L - interview 024
Interview	Victoria station	16/10/2012	L - interview 025

Observation	Location	Date	File name
Observation	Victoria station	14/10/2012	L - observation 001 - 20121014-160950.MOV
Observation	Victoria station	14/10/2012	L - observation 002 - 20121014-163240.MP4
Observation	Victoria station	14/10/2012	L - observation 003 - 20121014-163656.MP4
Observation	Victoria station	14/10/2012	L - observation 004 - 20121014-163912.MP4
Observation	Victoria station	14/10/2012	L - observation 005 - 20121014-164330.MP4
Observation	Victoria station	14/10/2012	L - observation 006 - 20121014-164340.MP4
Observation	Victoria station	14/10/2012	L - observation 007 - 20121014-170940.MP4
Observation	Victoria station	14/10/2012	L - observation 008 - 20121014-204416.MP4

Observation	Victoria station	15/10/2012	L - observation 009 - 20121015-082618.MOV
Observation	Victoria station	15/10/2012	L - observation 010 - 20121015-082627.MOV
Observation	Victoria station	15/10/2012	L - observation 011 - 20121015-082755.MOV
Observation	Victoria station	15/10/2012	L - observation 012 - 20121015-082930.MOV
Observation	Victoria station	15/10/2012	L - observation 013 - 20121015-083057.MOV
Observation	Victoria station	15/10/2012	L - observation 014 - 20121015-083304.MOV
Observation	Victoria station	15/10/2012	L - observation 015 - 20121015-083358.MOV
Observation	Victoria station	15/10/2012	L - observation 016 - 20121015-083711.MOV
Observation	Victoria station	15/10/2012	L - observation 017 - 20121015-083722.MOV
Observation	Victoria station	15/10/2012	L - observation 018 - 20121015-084002.MOV
Observation	Victoria station	15/10/2012	L - observation 019 - 20121015-084038.MOV
Observation	Victoria station	15/10/2012	L - observation 020 - 20121015-084126.MOV
Observation	Victoria station	15/10/2012	L - observation 021 - 20121015-084212.MOV
Observation	Victoria station	15/10/2012	L - observation 022 - 20121015-084412.MOV
Observation	Victoria station	15/10/2012	L - observation 023 - 20121015-084425.MOV
Observation	Victoria station	15/10/2012	L - observation 024 - 20121015-084626.MOV
Observation	Victoria station	15/10/2012	L - observation 025 - 20121015-084748.MOV
Observation	Victoria station	15/10/2012	L - observation 026 - 20121015-085006.MOV
Observation	Victoria station	15/10/2012	L - observation 027 - 20121015-085107.MOV
Observation	Victoria station	15/10/2012	L - observation 028 - 20121015-085122.MOV
Observation	Victoria station	15/10/2012	L - observation 029 - 20121015-085205.MOV
Observation	Victoria station	15/10/2012	L - observation 030 - 20121015-085329.MOV
Observation	Victoria station	15/10/2012	L - observation 031 - 20121015-085342.MOV
Observation	Victoria station	15/10/2012	L - observation 032 - 20121015-085546.MOV
Observation	Victoria station	15/10/2012	L - observation 033 - 20121015-085554.MOV
Observation	Victoria station	15/10/2012	L - observation 034 - 20121015-085718.MOV
Observation	Victoria station	15/10/2012	L - observation 035 - 20121015-092518.MP4
Observation	Victoria station	15/10/2012	L - observation 036 - 20121015-092542.MP4
Observation	Victoria station	15/10/2012	L - observation 037 - 20121015-092616.MP4
Observation	Victoria station	15/10/2012	L - observation 038 - 20121015-092734.MP4
Observation	Victoria station	15/10/2012	L - observation 039 - 20121015-092950.MP4
Observation	Victoria station	15/10/2012	L - observation 040 - 20121015-093100.MP4
Observation	Victoria station	15/10/2012	L - observation 041 - 20121015-093240.MP4
Observation	Victoria station	15/10/2012	L - observation 042 - 20121015-093412.MP4
Observation	Victoria station	15/10/2012	L - observation 043 - 20121015-093458.MP4
Observation	Victoria station	15/10/2012	L - observation 044 - 20121015-093630.MP4
Observation	Victoria station	15/10/2012	L - observation 045 - 20121015-093738.MP4
Observation	Victoria station	15/10/2012	L - observation 046 - 20121015-093922.MP4
Observation	Victoria station	15/10/2012	L - observation 047 - 20121015-094214.MP4
Observation	Victoria station	15/10/2012	L - observation 048 - 20121015-094304.MP4
Observation	Victoria station	15/10/2012	L - observation 049 - 20121015-094354.MP4
Observation	Victoria station	15/10/2012	L - observation 050 - 20121015-094428.MP4
Observation	Victoria station	15/10/2012	L - observation 051 - 20121015-094742.MP4
Observation	Victoria station	15/10/2012	L - observation 052 - 20121015-095738.MP4
Observation	Shop	15/10/2012	L - observation 053 - 20121015-102426.MP4
Observation	Shop	15/10/2012	L - observation 054 - 20121015-102522.MP4
Observation	Wimbledon	15/10/2012	L - observation 055 - 20121015-104418.MOV

Observation	Wimbledon	15/10/2012	L - observation 056 - 20121015-105238.MOV
Observation	Wimbledon	15/10/2012	L - observation 057 - 20121015-105358.MOV
Observation	Wimbledon	15/10/2012	L - observation 058 - 20121015-110808.MOV
Observation	Wimbledon	15/10/2012	L - observation 059 - 20121015-112030.MOV
Observation	Wimbledon	15/10/2012	L - observation 060 - 20121015-112104.MOV
Observation	Wimbledon	15/10/2012	L - observation 061 - 20121015-112132.MOV
Observation	Wimbledon	15/10/2012	L - observation 062 - 20121015-112544.MOV
Observation	Wimbledon	15/10/2012	L - observation 063 - 20121015-113138.MOV
Observation	Wimbledon	15/10/2012	L - observation 064 - 20121015-113232.MOV
Observation	Wimbledon	15/10/2012	L - observation 065 - 20121015-113258.MOV
Observation	Wimbledon	15/10/2012	L - observation 066 - 20121015-114130.MOV
Observation	Wimbledon	15/10/2012	L - observation 067 - 20121015-115022.MOV
Observation	Wimbledon	15/10/2012	L - observation 068 - 20121015-115040.MOV
Observation	Wimbledon	15/10/2012	L - observation 069 - 20121015-115632.MP4
Observation	Wimbledon	15/10/2012	L - observation 070 - 20121015-121212.MP4
Observation	Wimbledon	15/10/2012	L - observation 071 - 20121015-121756.MP4
Observation	Wimbledon	15/10/2012	L - observation 072 - 20121015-123246.MP4
Observation	Wimbledon	15/10/2012	L - observation 073 - 20121015-123432.MP4
Observation	Wimbledon	15/10/2012	L - observation 074 - 20121015-123600.MOV
Observation	Wimbledon	15/10/2012	L - observation 075 - 20121015-123912.MP4
Observation	Wimbledon	15/10/2012	L - observation 076 - 20121015-124332.MP4
Observation	Wimbledon	15/10/2012	L - observation 077 - 20121015-124438.MP4
Observation	Wimbledon	15/10/2012	L - observation 078 - 20121015-124658.MP4
Observation	Wimbledon	15/10/2012	L - observation 079 - 20121015-124944.MP4
Observation	Wimbledon	15/10/2012	L - observation 080 - 20121015-125246.MP4
Observation	Wimbledon	15/10/2012	L - observation 081 - 20121015-125530.MP4
Observation	Wimbledon	15/10/2012	L - observation 082 - 20121015-125756.MP4
Observation	King's Cross station	15/10/2012	L - observation 083 - 20121015-134356.MP4
Observation	King's Cross station	16/10/2012	L - observation 084 - 20121016-091434.MOV
Observation	King's Cross station	16/10/2012	L - observation 085 - 20121016-091448.MOV
Observation	King's Cross station	16/10/2012	L - observation 086 - 20121016-093958.MOV
Observation	King's Cross station	16/10/2012	L - observation 087 - 20121016-094017.MOV
Observation	King's Cross station	16/10/2012	L - observation 088 - 20121016-094036.MOV
Observation	King's Cross station	16/10/2012	L - observation 089 - 20121016-094206.MOV
Observation	King's Cross station	16/10/2012	L - observation 090 - 20121016-094258.MOV
Observation	King's Cross station	16/10/2012	L - observation 091 - 20121016-094525.MOV
Observation	King's Cross station	16/10/2012	L - observation 092 - 20121016-094734.MOV
Observation	King's Cross station	16/10/2012	L - observation 093 - 20121016-094900.MOV
Observation	King's Cross station	16/10/2012	L - observation 094 - 20121016-095104.MOV
Observation	King's Cross station	16/10/2012	L - observation 095 - 20121016-095911.MOV
Observation	King's Cross station	16/10/2012	L - observation 096 - 20121016-100110.MOV
Observation	King's Cross station	16/10/2012	L - observation 097 - 20121016-100215.MOV
Observation	King's Cross station	16/10/2012	L - observation 098 - 20121016-100231.MOV
Observation	King's Cross station	16/10/2012	L - observation 099 - 20121016-100322.MOV
Observation	King's Cross station	16/10/2012	L - observation 100 - 20121016-100410.MOV
Observation	King's Cross station	16/10/2012	L - observation 101 - 20121016-100510.MOV
Observation	King's Cross station	16/10/2012	L - observation 102 - 20121016-100628.MOV

Observation	King's Cross station	16/10/2012	L - observation 103 - 20121016-100917.MOV
Observation	King's Cross station	16/10/2012	L - observation 104 - 20121016-101250.MOV
Observation	King's Cross station	16/10/2012	L - observation 105 - 20121016-101335.MOV
Observation	King's Cross station	16/10/2012	L - observation 106 - 20121016-101345.MOV
Observation	King's Cross station	16/10/2012	L - observation 107 - 20121016-101403.MOV
Observation	King's Cross station	16/10/2012	L - observation 108 - 20121016-102232.MOV
Observation	King's Cross station	16/10/2012	L - observation 109 - 20121016-102325.MOV
Observation	King's Cross station	16/10/2012	L - observation 110 - 20121016-102552.MOV
Observation	King's Cross station	16/10/2012	L - observation 111 - 20121016-110048.MP4
Observation	King's Cross station	16/10/2012	L - observation 112 - 20121016-110114.MP4
Observation	King's Cross station	16/10/2012	L - observation 113 - 20121016-110324.MP4
Observation	King's Cross station	16/10/2012	L - observation 114 - 20121016-110534.MP4
Observation	King's Cross station	16/10/2012	L - observation 115 - 20121016-111914.MOV
Observation	King's Cross station	16/10/2012	L - observation 116 - 20121016-112522.MP4
Observation	Train	16/10/2012	L - observation 117 - 20121016-124154.MOV
Observation	Train	16/10/2012	L - observation 118 - 20121016-124234.MOV
Observation	Victoria station	16/10/2012	L - observation 119 - 20121016-145436.MP4

Appendix Q London interview summaries

Interview 1

He is very happy with the Oyster card. He never had any problems with using it. He uses it everyday for the overground trains and uses the automatic top-up service, since that is even more convenient.

Interview 2

He has an Oyster card but is not using it very often, because he considers public transportation as too expensive. If he has enough money to buy a subscription he does so, otherwise he just uses pay as you go. As he is a student he receives special discount, which he applied for online.

Interview 3

She is not from London, but since she comes every couple of months to London she has an Oyster card. The main advantage is that it is cheaper. Besides she thinks it is easier to use the Oyster card than using paper tickets instead. She tops- up her card either at a convenience store, at the ticket machine or at the service desk.

Interview 4

She has an Oyster card, which she uses in combination with a weekly pass. Buying a weekly pass once a week is easier for her than topping-up her card more frequently. She uses the Oyster card to go to work mainly. She buys her weekly pass at the ticket machine at the station.

Interview 5

He lives in London and uses his Oyster card frequently. He uses all modes of transportation and uses pay as you go. He prefers this, above season tickets. Season tickets feel like spending money that might not be necessary. He tops-up his card at a shop or online.

Interview 6

She uses the Oyster card on a daily basis in order to visit clients. She does not have a subscription but uses pay-as-you-go instead. This is due to the fact that it is easier to claim her business expenses back. She tops-up her card at the ticket machine. She thinks the Oyster card is very convenient. Occasionally she experiences gates not opening but since there is always service personal available it is not a problem that bothers her.

Interview 7

She is not from London and is not visiting London very often, however she has an Oyster card, which she uses on the tube and busses. She uses pay as you go and tops-up her card at the machine with 10 pounds each time. She does not want to have too much money on her card, in case she might lose the Oyster card. She likes about the Oyster card that it is more sustainable than paper tickets. She would prefer a detailed transaction overview, with the exact costs for each journey. That would make it easier to claim back business expenses.

Interview 8

She is not from London and only uses the Oyster card occasionally. She tops-up her card at the convenience store and only uses it on the train, since she has a special card for the bus. She likes the system; it works well and is very easy according to her.

Interview 9

She thinks the main advantage of the Oyster card is that it is very easy and it saves time. She tops-up her card at the ticket machine. She would probably use automatic top-up since that is even more convenient, but she is afraid of losing her card, which is the reason why she is not using this service. Besides she does not like the fact that automatic top up means that 'everybody' would be able to see where she is going. The only negative thing about the Oyster card is that it is so convenient that TfL could easily raise prices without anybody noticing it.

Interview 10

He thinks the main advantage of the Oyster card that it saves time. He does not understand why the Oyster card is only working in London and not all over the UK. He uses the automatic top-up service, which makes it even more convenient. He is not really afraid of losing his Oyster card.

Interview 11

She uses the Oyster card about twice a week and mainly uses it at the tube and overgroud. She uses the automatic top up service. She would like the service of the Oster card to be extended across the boundaries of London. Whenever she travels outside of London, it is more confusing, more expensive and requires a lot of papers, which is quite annoying to her.

Interview 12

He is hardly visiting London anymore, which is why he is not using the Oyster card anymore. However he thinks it is a very easy and convenient system, and he never had any negative experiences with it.

Interview 13

She is from outside London, but since she is almost every weekend in London she has an Oyster card. She likes the fact that she does not have to buy tickets every time and only has to top-up her card. Each time she loads 10 pounds on her card, which is sufficient for about 2 days. She uses it for the busses and the tube. Besides the Oyster card she also has a national rail card. There she gets a special discount, which sometimes makes it cheaper than travelling by Oyster. To her a disadvantage is that some stations do not have gates and it is easy to forget to check-out at those stations.

Interview 14

He has a weekly ticket for the bus, which he buys at the local shops and tops-up his card whenever he needs to go by tube. He is satisfied with the Oyster card because it makes travelling cheaper and it saves him from bringing cash all the time. Besides he likes the zone-based fare system, to him it is really fair. Whenever he forgets his Oyster card he recognizes how much added value the Oyster card has to him.

Interview 15

She is a visitor from the Netherlands and uses the Oyster card. She like the Oyster card a lot, she think it works very easy and quick. She never had any negative experiences with the OV-chipkaart so far. Comparing the OV-chipkaart to the Oyster card, she thinks both systems are very easy, however checking-out is a bit more difficult in the Netherlands than it is in London.

Interview 16

For him the main advantage of the Oyster card is that he does not have to carry cash anymore. He live just outside London and comes to London regularly. He tops-up his card at the ticket machine with 50 pound each time. He never experienced any problems with the card.

Interview 17

She does not have an Oyster card. She is living outside London and only occasionally travels to London. In London she has a freedom pass, which she got from the City of London. She likes the system of the Oyster card.

Interview 18

He has an Oyster pay-as-you-go card, which he uses about two times a week. He tops-up his card manually in order to keep better track of his travel expenses. The daily capping is the biggest advantage to him, however he thinks the public transportation is too expensive in London.

Interview 19

She mainly travels at the underground. She is from outside London and tops-up her card each time she comes to London with five pounds. She likes that travelling with the Oyster card is cheaper compared to paper tickets. She once lost her unregistered card, with a value of twenty-five pounds on in and could not get her money back.

Interview 20

She mainly uses her Oyster card at the underground and tops it up at the machine with ten pounds each time. She never had any negative experiences with the Oyster card.

Interview 21

She makes us of the Oyster card on a daily basis. She tops-up her card each day with about five pounds. She likes the matter of fact that travelling by Oyster is more convenient, easier, cheaper, that it works all over London and at any time of the day. She never had negative experiences with the card.

Interview 22

She lives outside London and uses the Oyster card at the tube whenever she comes to London. She thinks it is very cheap and so far she had only positive experiences. She tops-up the card whenever needed at the ticket machine.

Interview 23

She works for TfL as a service employee at Victoria station. According to her the biggest advantage of the Oyster card is its availability and that it's easy to travel with. She is not using the Oyster card much herself, and therefore does not use the automatic top up service. She thinks the biggest disadvantage of the system is that sometimes the gates are open, which

causes people not to check-in and causes problems when people leaving the underground. She is aware of the fact that the error messages at the validators are not clear to users and indicates that it causes a lot of problems as well.

Interview 24

He likes that the Oyster card is much cheaper and that it better than buying single journey tickets each time. He also likes about his registered Oyster card that he can keep track of where he has been.

Interview 25

She uses her Oyster card regularly and likes that she can top it up at so many places, that she does not have to buy paper tickets. She uses her Oyster card almost every day and mainly at the bus and at the train. She thinks it is a very convenient system.

Appendix R Participants Hong Kong

Interview	Location	Date	File name
Interview	Hung Hom station	25/10/2012	HK - interview 001
Interview	Hung Hom station	25/10/2012	HK - interview 002
Interview	Hung Hom station	25/10/2012	HK - interview 003
Interview	Hung Hom station	25/10/2012	HK - interview 004
Interview	Hung Hom station	25/10/2012	HK - interview 005
Interview	HK Polytecnic	25/10/2012	HK - interview 006
Interview	HK Polytecnic	25/10/2012	HK - interview 007
Interview	HK Polytecnic	25/10/2012	HK - interview 008
Interview	HK Polytecnic	25/10/2012	HK - interview 009
Interview	HK Polytecnic	25/10/2012	HK - interview 010
Interview	HK Polytecnic	25/10/2012	HK - interview 011
Interview	HK Polytecnic	25/10/2012	HK - interview 012
Interview	HK Polytecnic	25/10/2012	HK - interview 013
Interview	HK Polytecnic	25/10/2012	HK - interview 014
Interview	HK Polytecnic	25/10/2012	HK - interview 015
Interview	HK Polytecnic	25/10/2012	HK - interview 016
Interview	HK Polytecnic	25/10/2012	HK - interview 017
Interview	HK Polytecnic	25/10/2012	HK - interview 018
Interview	HK Polytecnic	25/10/2012	HK - interview 019
Interview	HK Polytecnic	25/10/2012	HK - interview 020
Interview	HK Polytecnic	25/10/2012	HK - interview 021
Interview	HK Polytecnic	25/10/2012	HK - interview 022
Interview	HK Polytecnic	25/10/2012	HK - interview 023
Interview	HK Polytecnic	25/10/2012	HK - interview 024
Interview	HK Polytecnic	25/10/2012	HK - interview 025
Interview	Central station	25/10/2012	HK - interview 026
Interview	Central station	25/10/2012	HK - interview 027
Interview	Central station	25/10/2012	HK - interview 028
Interview	Central station	25/10/2012	HK - interview 029
Interview	Central station	25/10/2012	HK - interview 030
Interview	Central station	25/10/2012	HK - interview 031
Interview	Central station	25/10/2012	HK - interview 032
Interview	Central station	25/10/2012	HK - interview 033

Observation	Type	Date	File name
Observation	CICO	19/10/2012	HK - observation 004 - 20121019-084746.MOV
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Observation	CICO	20/10/2012	HK - observation 015 - 20121020-062019.MOV
Observation	CICO	20/10/2012	HK - observation 016 - 20121020-062219.MOV
Observation	CICO	20/10/2012	HK - observation 018 - 20121020-062928.MOV
Observation	CICO	20/10/2012	HK - observation 019 - 20121020-063100.MOV
Observation	CICO	20/10/2012	HK - observation 023 - 20121020-065804.MOV
Observation	CICO	20/10/2012	HK - observation 024 - 20121020-065948.MOV
Observation	CICO	20/10/2012	HK - observation 031 - 20121020-072047.MOV
Observation	CICO	20/10/2012	HK - observation 033 - 20121020-072729.MOV
Observation	CICO	20/10/2012	HK - observation 035 - 20121020-073749.MOV
Observation	CICO	20/10/2012	HK - observation 038 - 20121020-081141.MOV
Observation	CICO	20/10/2012	HK - observation 039 - 20121020-114344.MOV
Observation	CICO	20/10/2012	HK - observation 040 - 20121020-114432.MOV
Observation	CICO	20/10/2012	HK - observation 041 - 20121020-115126.MOV
Observation	CICO	20/10/2012	HK - observation 054 - 20121020-121553.MOV
Observation	CICO	20/10/2012	HK - observation 055 - 20121020-121648.MOV
Observation	CICO	20/10/2012	HK - observation 056 - 20121020-121802.MOV
Observation	CICO	20/10/2012	HK - observation 057 - 20121020-122258.MOV
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Observation	CICO	20/10/2012	HK - observation 059 - 20121020-122547.MOV
Observation	CICO	20/10/2012	HK - observation 060 - 20121020-122651.MOV
Observation	CICO	20/10/2012	HK - observation 061 - 20121020-123011.MOV
Observation	CICO	20/10/2012	HK - observation 069 - 20121020-123927.MOV
Observation	CICO	20/10/2012	HK - observation 070 - 20121020-124254.MOV
Observation	CICO	20/10/2012	HK - observation 071 - 20121020-124338.MOV
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Observation	CICO	20/10/2012	HK - observation 118 - 20121020-135034.MP4
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Observation	CICO	21/10/2012	HK - observation 137 - 20121021-123310.MOV
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Observation	CICO	21/10/2012	HK - observation 150 - 20121021-130354.MP4

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Observation	CICO	25/10/2012	HK - observation 201 - 20121025-081922.MP4
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Observation	CICO	25/10/2012	HK - observation 217 - 20121025-084147.MOV
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Observation	Fare Saver	21/10/2012	HK - observation 161 - 20121021-140217.MOV
Observation	Fare Saver	21/10/2012	HK - observation 162 - 20121021-140648.MOV
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Observation	Machines	20/10/2012	HK - observation 013 - 20121020-061703.MOV
Observation	Machines	20/10/2012	HK - observation 017 - 20121020-062536.MOV
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Observation	Machines	23/10/2012	HK - observation 177 - 20121023-214052.MOV
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Observation	Rush hour	25/10/2012	HK - observation 215 - 20121025-083805.MOV
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Observation	Rush hour	25/10/2012	HK - observation 219 - 20121025-084250.MP4
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Observation	Rush hour	25/10/2012	HK - observation 247 - 20121025-090623.MOV
Observation	Rush hour	25/10/2012	HK - observation 251 - 20121025-091008.MOV
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Observation	Service	20/10/2012	HK - observation 030 - 20121020-071930.MOV
Observation	Service	20/10/2012	HK - observation 032 - 20121020-072510.MOV
Observation	Service	20/10/2012	HK - observation 037 - 20121020-075956.MOV
Observation	Service	20/10/2012	HK - observation 052 - 20121020-121310.MOV
Observation	Service	20/10/2012	HK - observation 078 - 20121020-124944.MP4
Observation	Service	20/10/2012	HK - observation 079 - 20121020-125102.MP4
Observation	Service	20/10/2012	HK - observation 080 - 20121020-125214.MP4
Observation	Service	20/10/2012	HK - observation 081 - 20121020-125252.MP4
Observation	Service	20/10/2012	HK - observation 082 - 20121020-125254.MOV
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Observation	Service	20/10/2012	HK - observation 085 - 20121020-125754.MP4

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Observation	Service	20/10/2012	HK - observation 099 - 20121020-132518.MOV
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Observation	Service	20/10/2012	HK - observation 120 - 20121020-140334.MP4
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Observation	Service	23/10/2012	HK - observation 173 - 20121023-213550.MOV
Observation	Service	23/10/2012	HK - observation 174 - 20121023-213652.MOV
Observation	Service	24/10/2012	HK - observation 178 - 20121024-094217.MOV
Observation	Service	25/10/2012	HK - observation 193 - 20121025-080802.MP4
Observation	Service	25/10/2012	HK - observation 235 - 20121025-085739.MOV
Observation	Service	25/10/2012	HK - observation 249 - 20121025-090702.MOV
Observation	Service	25/10/2012	HK - observation 250 - 20121025-090720.MOV
Observation	Service	25/10/2012	HK - observation 253 - 20121025-093302.MOV
Observation	Service	25/10/2012	HK - observation 257 - 20121025-100131.MOV
Observation	Service	25/10/2012	HK - observation 258 - 20121025-100255.MOV
Observation	Service	28/12/2012	HK-20121028-153559.MOV
Observation	Shop	19/10/2012	HK - observation 005 - 20121019-115600.MP4
Observation	Shop	19/10/2012	HK - observation 006 - 20121019-115632.MP4
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Observation	Shop	20/10/2012	HK - observation 063 - 20121020-123322.MP4
Observation	Shop	20/10/2012	HK - observation 066 - 20121020-123440.MP4
Observation	Shop	20/10/2012	HK - observation 067 - 20121020-123516.MP4
Observation	Shop	20/10/2012	HK - observation 068 - 20121020-123552.MP4
Observation	Shop	22/10/2012	HK - observation 163 - 20121022-134644.MOV
Observation	Shop	22/10/2012	HK - observation 164 - 20121022-134727.MOV
Observation	Shop	22/10/2012	HK - observation 166 - 20121022-154630.MOV
Observation	Shop	22/10/2012	HK - observation 167 - 20121022-154957.MOV
Observation	Shop	22/10/2012	HK - observation 168 - 20121022-165138.MOV
Observation	Shop	22/10/2012	HK - observation 169 - 20121022-165834.MOV
Observation	Shop	26/10/2012	HK - observation 268 - 20121026-105436.MOV
Observation	Shop	26/10/2012	HK - observation 269 - 20121026-105506.MOV
Observation	Shop	26/10/2012	HK - observation 270 - 20121026-105552.MOV
Observation	Shop	26/10/2012	HK - observation 271 - 20121026-105815.MOV
Observation	Shop	26/10/2012	HK - observation 272 - 20121026-105856.MOV
Observation	Shop	26/10/2012	HK - observation 273 - 20121026-105905.MOV
Observation	Shop	26/10/2012	HK - observation 274 - 20121026-105925.MOV
Observation	Shop	26/10/2012	HK - observation 275 - 20121026-110007.MOV
Observation	Shop	26/10/2012	HK - observation 277 - 20121026-115808.MOV
Observation	Shop	27/10/2012	HK - observation 278 - 20121027-094009.MOV
Observation	Shop	23/10/2012	HK-20121023-111928.MOV
Observation	Shop	27/10/2012	HK-20121027-094016.MOV

Appendix S Hong Kong interview summaries

Interview 1
He uses the Octopus card for travelling, buying things at the 7-eleven and to pay for bills. Every time he tops-up his card he loads HK$500 on it, still he runs out of money very quickly. He considers the Octopus card as an essential item in his life.

Interview 2
He uses the Octopus card wherever it is possible. She is not paying bills with the card. She uses the automatic top-up function, each time her card gets loaded with HK$500. She has never experienced any problems with the card.

Interview 3
She uses the card mainly for travelling and sometimes at convenience stores as well. Each time she tops-up her card she loads HK$1000 on it, which is sufficient for about one month. She has never experienced any problems with the card.

Interview 4
She uses the card for the bus, the MTR, and at convenience stores. She would like to use the Octopus card at all taxis as well (currently it is only possible at a few taxis) and at restaurants. She always tops-up her card manually at the machine with HK$100.

Interview 5
He uses the Octopus card for travelling, at fast food restaurants, convenience stores and the 7-eleven. Either he tops-up his card at the machine or at the service desk at the MTR station. A couple of times he experienced that his card was blocked (due to an incomplete journey) and prohibited him to enter the station. In order to fix this he needed to contact the service desk. Also sometimes an incorrect amount of money is taken from his card.

Interview 6
He has a personal student card, which offers him a discount and uses it wherever possible about 10 times a week. He loads never more than HK$100 on his card, because he is afraid of losing it. He got his first Octopus card when he entered primary school. He prefers paying by Octopus card instead of paying cash. He has never encountered a problem situation and very much appreciates the convenience of the Octopus card.

Interview 7
He has a personal student card and uses it for the MTR and for 7-eleven. He prefers to top-up his card at the service desk with HK$200 each time. He once lost his card and then had to apply for a new one. He likes the Octopus card because it is very convenient.

Interview 8
She uses her Octopus card mainly for public transport, only sometimes she uses it at the 7-eleven. She usually tops-up her card with HK$100 and does that at the 7-eleven. She is afraid of losing her card and therefore does not want to top-up her card with a higher value.

Interview 9

She comes from Mainland China and just recently got her first Octopus card. She thinks that the Octopus card is very convenient and she uses it a lot for travelling, 7-eleven and would like to be able to pay at more fast food restaurants with the Octopus card as well. She is very much afraid of losing her card and therefore tops-up her card with HK$200 only, each time.

Interview 10

He is an exchange student from the states and has a personal student card, which offers him 50% discount on the MTR. In order to get this card he had to fill in a form, let it be stamped by the university and hand it in at the service desk. After a couple of days he can either pick it up or the card will be send home. In the meantime he received a temporary card. He really likes the Octopus card and uses it a lot, since it is so convenient.

Interview 11

She uses the Octopus card since it got introduced and likes the system very much. To her the biggest advantage is the convenience of the card. She uses it at many places and also thinks that there are sufficient places in Hong Kong where she is able to pay by Octopus card. She always takes her Octopus card with her.

Interview 12

He is using a temporary Octopus card at the moment, he has not experienced any problems so far, appreciates the convenience of it and tops-up his card with HK$300 each time at the machine at the MTR station.

Interview 13

He uses the card since primary school and got very much used to it. He cannot imagine a life without the card. He thinks that the card is very convenient and he uses it everywhere it is possible.

Interview 14

He uses the Octopus for about 10 years now. He thinks that it is really convenient. When he tops-up his card he does so at the machine and loads between HK$100 and HK$200 on his card, depending on how much money he has with him. He travels at least ten times a week, and since every eleventh trip is for free, he goes to the service desk once a week in order to get his free ride. The only thing that disturbs him sometimes is that the signal of the card is not necessarily strong enough (when his card is in his bag) to check-out.

Interview 15

She has an Octopus card for about one year now. She mainly uses it at the MTR and really likes the convenience of it. She would like the Octopus card function as credit card, to withdraw money, to have a negative balance on it and to buy more expensive items as well. She is not aware of the different product forms of the Octopus card.

Interview 16

She uses the Octopus card at the 7-eleven and for public transport. When she tops-up her card she is doing it at the 7-eleven and loads up to HK$200 on her card each time. She sometimes

encounters the problem that she cannot check-in or check-out. In this case she goes to the service desk, where it will be fixed immediately.

Interview 17
She mainly uses her Octopus card for the public transport, only sometimes she uses it at the 7-eleven as well. She tops-up her card once a month with HK$500. She thinks the Octopus card is convenient for travelling, for the rest she prefers cash. It happened to her twice that she could not leave the station because the gate denied her card. The service desk fixed this problem for her.

Interview 18
She got her first Octopus card at the age of three; she is used to the card and appreciates its convenience. She prefers paying by Octopus card since that saves her from taking cash with her. She mainly uses the card for the MTR and for the 7-eleven. She tops-up her card at the 7-eleven as well with a credit of HK$100. She thinks that there are not sufficient places to top-up the card, yet.

Interview 19
He uses the Octopus card for public transport mainly. Sometimes he buys snacks at the 7-eleven as well using his card. He loads HK$50 to HK§100 on his card each time he tops-up his credit. He thinks the Octopus card is very convenient. Sometimes the gate rejects his card, and then he goes to the service desk where they immediately fix the problem for him.

Interview 20
He uses the Octopus card since 15 years. Currently he makes use of a personalized student card. He mainly uses the Octopus card for public transport and only sometimes for other purposes. He tops-up his card with HK$100 each time. He thinks the Octopus card is the most advanced system in the world. He has experienced the Oyster card (London), which he thinks works slower and the Suica card (Tokio), which does not have as many applications as the Octopus card. He thinks the main advantage of the Octopus card is its convenience. He experienced that keeping too many electronic cards in the wallet sometimes disturb the signal at the gate. He is not using the automatically top-up service because he thinks that it is very dangerous once he loses its card.

Interview 21
She uses the card for transportation and for buying at convenience stores. She tops-up her card with HK$100 each time. She does not want to have more money on her card, because she is afraid of losing the card. Sometimes she cannot access the station because her Octopus card is not working.

Interview 22
He uses the Octopus card for public transport and convenience stores. He thinks the main advantages of the card are its convenience and the cheaper travelling. He once lost his card and since it was not registered he was not able to block his card. After this experience he prefers not to put too much money on the card.

Interview 23

He uses the Octopus card almost every day and therefore tops-up his card with HK$500 each week. He likes that the card is accepted at so many places. He would like to extend the applications of the card, for example to pay with it on the internet.

Interview 24

He uses a personal student card and a regular Octopus card. The first card gets automatically topped up, whereas he uses the second one for other daily life purposes. What he does not like about the personalized card is that all his personal data is stored somewhere. He would like to use the Octopus card at restaurants as well. Furthermore he would like to use the Octopus card for purchasing more expensive items as well.

Interview 25

He uses the Octopus card since he was a child. He tops-up his card with about HK$500 each time. He thinks that the transactions are not visible and transparent enough. He would appreciate a monthly letter in which all his transactions are listed. Sometimes it is hard for him to keep track of his expenses.

Interview 26

He uses a temporally Octopus card currently, which he uses for public transport and convenience stores. Each time he loads his card he tops it up with HK$200. He likes the Octopus card, because he does not have to take cash all the time.

Interview 27

He uses the same Octopus card since 15 years, which is still working well. He uses the card mainly for transportation and sometimes to pay at the 7-eleven or at the supermarket. He tops-up his card either at the 7-eleven or at the service desk. Only if the service desk is very crowded he uses the add value machine. So far, he thinks the Octopus card works well, but he would appreciate if more stores would support the Octopus card as well. He feels that it would be dangerous to connect his card to his bank account in case of losing the card.

Interview 28

He uses the Octopus card mainly for travelling and sometimes for the 7-eleven. This is also where he tops-up his card with HK$300 each time. He has never experienced any problems with the Octopus card.

Interview 29

She uses the Octopus card for public transport and at convenience stores. She uses the service of automatic top-up. For her this increases the convenience even more. She would like to use the Octopus card as restaurants as well.

Interview 30

He uses the card since fourteen years and uses it wherever possible. He tops-up his card with HK$50 each time at the 7-eleven. He thinks topping up at the 7-eleven is the quickest and most convenient way to do so. He is regularly losing the Octopus card, which is the reason why he is not loading too much money on his card.

Interview 31

At the light rail network, people have to check in and check out at poles and are not going through gates. We were wondering, whether users do forget to do so. From all the interviews we took on this specific topic the answer always was: "No I never forget to check out."

Appendix T Oyster and Octopus at a glance

The Oyster card at a glance

Purchase:

- Buying at service desk and special machines, costs are 5 pounds,

- No minimum amount of money is required to use public transport as long as the status of the card is positive

- Cards are not connected to a bank account, still the user gets all advantages of the card as if it was, the user can choose to connect the card in order to enable auto top-up

Transportation experience:

- People report faster travelling, less queuing, and more convenience

- Some cards are not accepted, people need to get new cards from personnel to be able to check out

- Tap in machines are very quick, allow product loading at the same time as tapping in

- Flat fee in buses

Introduction strategy:

- Cheaper travelling for everybody with the Oyster card

Service:

- Service personnel everywhere at the gates

- Top-up can be done at convenience stores all over London

- Oyster informs people about busy times, tries to stimulate walking at busy times

- City bike is not a service of the Oyster card

- Oyster cards can be handed in at service desks to get money refunded, money can only be refunded to the credit card it was bought with (no criminals)

- Error messages such as 'error 36' are not clear to the user

- Back office is foresighted (constructions at the railways) and reflective (refunding)

Types of cards:

- Concessionary cards for children and elderly

- Pay as you go cards

- Monthly passes for special routes, loaded on regular Oyster card

- Strong branding and recognition of the card, only 4 special edition cards

Reductions:

- Daily capping à moves to weekly capping

- Refund (or no charging) if one forgets to check out only one time within 28 days, refund is given at tap-in

Developments:

- Busy with abandoning the Oyster card and replace it by bankcards

The Octopus card at a glance

Purchase:

- Buying at every service desk, costs are HK $ 50 (deposit), user gets money back when returning the card to Octopus

- 'No costs' for the user but Octopus /MTR can use that money for speculations/ investments (acts like a bank)

- Cards are not connected to a bank account

- Special 'cards' for more convenience reasons such as key chains or watches can be purchased (no deposit, but purchase price), still those items are not personalized

Post-transportation experience:

- Fare saver makes it more attractive to take the metro; top-up easily done at 7-eleven

- people reported the feeling of 'no need' to bring cash since the Octopus card is sufficient often

Transportation experience:

- Octopus knows three systems: closed system (gate – gate) at the heavy rail network; gate-gate system makes it impossible to forget to tap-in/tap-out, different

types/designs of gates, all work the same and the tap-in/tap-out surface is located at the same position;

- semi closed system (airport express) allows tourists/visitors to get into town without having an Octopus card before arrival. Octopus card is sold at the airport, next to the airport express; includes getting in and out of town plus 3 days of free travelling, afterwards the card can be used as a regular Octopus card as well, this tourist card is applicable for all payment systems the regular Octopus card is suitable for;

- Open system (pole – pole) at the light rail network; tap-in/tap-out pole have different colours and are placed within walking route of traveller when getting in/out of the train

- No minimum amount of money required to use public transport as long as the status of the card is positive

- When tapping in/out is forgotten, no money will be charged but the gate will be blocked for the next trip, user needs to go to the service desk to fix it

- Flat fare system in busses (mini and regular)

Non-transportation-experience:

- Octopus card can be used for all kind of travelling, such as parking (outside and inside)

- Can be used for paying at other locations, such as 7-eleven, vending machines, or parking decks

Card types:

- Anonymous card in different forms for pay as you go

- Anonymous card in different forms with monthly subscription and pay as you go

- Private card in different forms with monthly subscription and pay as you go

- Concessionary cards for children and elderly

Travel products:

- Pay as you go (on every card)

- Four different routes for monthly subscription

Luring people into the metro:

- Fare saver system, placed at 24 places in Hong Kong that people pass frequently, aims at making them travel by metro instead of by bus, fare saver offers a HK $ 2 reduction for the next journey

- bonus points system, after getting 10 bonus points the next journey is for free, travellers have to pick up this card at the service desk

Service:

- Every station has at least one service desk, it can be entered from both the paid and the not paid zone of the station, while during rush hour extra personnel is positioned at the station to help or to fix tap-in/out machines and to indicate with signs when the train is too full to ensure no delays, metro goes every 1-2 minutes at rush hour

- Top-up can be done at the service desk (even though if not wished so by Octopus), at the top-up machines and at each 7-eleven

- auto-top-up is possible too (card needs to be registered) but not done by many people (7-eleven is very convenient already and in case of loss only the current debit will be lost)

- top-up each time most likely to be between HK $ 100 – 500

- Octopus card is used as 'a purse'

Criticism:

- Would be good to use the Octopus at all places for all kinds of purchases, would be great to use the Octopus card for larger amounts of money

- Not transparent enough where the money goes to, user can only see last 10 transactions

Future developments:

- Staying informed of new technologies, currently those are not reliable/practicable enough