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Abstract. To enhance the desirability of public transportation, it is important to design for positive travel experience. The context of bus transportation has broad potential for utilization of novel, supplementary digital services beyond travel information. The aim of our research was to study bus passengers' needs and expectations for future digital services and to develop initial service concept ideas through co-design. To this end, three Idea generating workshops with 24 participants were arranged. Our findings reveal six service themes that can be used as a basis of designing future digital traveling services: 1) Information at a glance while traveling, 2) Entertainment and entertaining activities, 3) Services that support social interaction, 4) Multiple channels to provide travel information, 5) Extra services for better travel experience, and 6) Services that people already expect to have. The themes are discussed and further elaborated in this paper.

Keywords: Bus, public transportation, digital services, user needs, co-design

1 Introduction

In recent years, urban mobility has been considered as one of the most significant societal challenges for the future as the need for transportation will raise, resulting increase in emissions, noise and infrastructures [27, 31]. As cities, worldwide are forced to reduce emissions by, e.g. trying to reduce the usage of private cars, the role of public transportation and the related services are becoming a central design issue. As policy makers seek to encourage and support the widespread use of public transportation, its services need to be developed so that it is seen as a more desirable option for the wide audience [8, 10]. This can be achieved by understanding the passenger's travel behavior and the multifaceted issue of trip satisfaction [26]. To this end, individuals' travel behaviors have been targeted with informational education campaigns in order to raise awareness and change attitudes [24].

For the public transportation to gain larger popularity, the transport providers and planners should also consider the individuals' needs and expectations regarding short distance traveling activities and thus design for better travel experiences [2]. Enhancing the attractiveness of public transportation can happen, for example, through experience-driven design [17]. The importance of user experience for customer

satisfaction and loyalty have already been recognized by several organizations in different fields [32]. The context of public transportation has broad potential for the application of digital services and other supplementary services that can add value to the passengers' travel experience [2].

The goal of our research is to investigate how people experience the short distance bus transportation and what kind of digital traveling services would enhance their travel experience. By traveling services, we mean digital services that can support or enrich the bus ride and the associated activities before and after it. This study is a part of a larger research project called Living Lab Bus, in which one of the aims is to develop a platform for interactive services for electric buses. However, the service ideas developed in this study are not specific for electric buses only, and most of them can also be utilized in traditional buses.

This study aims to gain design-relevant insights on to how public transportation services should be developed in order to better serve the travelers' needs and expectations, and thus to improve the travel experience of buses. To gain deep understanding of the user perspective, the present study took a participatory approach. The research question is: *What kind of services support the passengers' needs and expectations in the bus context?*

We address the research question by gathering user needs and expectations by ideating with the potential users, novel digital services that could enhance their travel experience. New service concept ideation can be seen as an initial phase of co-design process, and thus the workshops were organized with a strong focus on participatory ideation activities. To this end, we conducted a series of three Idea generating workshops with altogether 24 participants. We applied a context-specific workshopping method to study situated activities in a specific environment, i.e. the bus. This paper contributes to the understanding of short distance bus travel experience from the perspective of user experience of digital services. The results of this paper contribute to the design knowledge of the future digital services for the bus context. This knowledge can be used as a basis for human-centered design for different categories of services that can enhance the desirability of bus transportation.

2 Related work

We present related work on travel experience and how supplementary digital services can enhance the users' experience of bus transportation.

2.1 Travel Experience

Public transportation is a unique representation of urban space where individuals come together with diverse socio-economic backgrounds at regular frequencies for extended periods of time [9]. Public transportation plays an important role in the way people move around in their everyday life [7]. Travel experience in the context of public transportation is a result of the holistic view of the transportation service [2], including

the different experience components: the customer's affective, cognitive, physical and social responses to the service [28].

Several studies [e.g. 10, 20], have found that public transportation users are generally the least satisfied compared to other modes of transportation, such as private car drivers and cyclists. Within different public transportation modes, the bus users were least satisfied [19]. The reasons for the low satisfaction rate is impacted by the attributes such as the transport mode's flexibility, "fun" factor and how well the mode matches with the traveler's lifestyle [4]. However, a qualitative interview study conducted by Hildén et al. [11] found that participants were generally pleased with the current travel experiences with the local busses in two major cities in Finland – Helsinki and Tampere. The study examined the trip satisfaction by comparing the experience of the local public transportation services to the participants' previous experiences of public transportation internationally.

The satisfaction rates of public transportation systems vary locally, and the reasons for that can be drawn from multiple factors. External factors such as the timetables, state of the vehicles, safety and the accessibility of public transportation have a strong impact on the satisfaction rates. A pyramid of customer needs formed by van Hagen and Bron [28] represents the train passengers needs and experiences in five levels (from bottom to top): trust, travel time door to door, mental effort, physical effort, and emotions. The model was used in the Netherlands Railways in shifting the focus of measure from efficiency to customer experience.

Passengers' traveling behavior, and thus also the experience of traveling, is changing simultaneously with the mix of transport modes and the offered services in them [27]. Furthermore, St-Louis et al. [26] state that trip satisfaction is affected not only by external trip factors but also internal factors. They state that travel behavior is influenced by spatial, socio-economic and personality components (ibid.). Foth et al. [8] have investigated the travel experience from three aspects of the journey – before, during and after the trip. This division can be drawn from the user experience design, where the experiences can be divided into different categories based to the stages of the product, service or system usage [22]. Even though user experience happens during the interaction with a product, service or a system – and thus has a beginning and end – there are still indirect experiences before the first encounter as well as after the usage (ibid.).

2.2 Supplementary Services for Better Travel Experience

Passengers in a vehicle are the ideal candidates to be entertained and informed about aspects related to the journey as well as e.g. the social aspects of the travel, such as the people sitting next to them [8]. When conducting short distance journeys passengers have great potential to interact with mobile services, unless they are traveling with a companion [8]. Hence, the context of public transportation has broad potential for the application of digital services such as location-based services through the use of, for example, travelers' mobile devices [9].

Dziekan and Kottenhoff [4] have studied the impact of real-time information displays on public transportation. They state that real-time travel information increases

the feeling of security, decreases the feeling of uncertainty, and makes the traveling easier, since it saves passengers' effort when making a journey. Providing real-time travel information results more efficient traveling when passengers' can plan their journeys leading to shorter traveling times [4]. It also leads to utilization of wait time when passengers' can use the time to carrying out tasks, such as shopping (ibid.). It also results other adjusting strategies, for example enhancing the comfort of the journey by choosing to wait for the next bus when the arriving bus is being crowded (ibid.).

Maclean and Dailey studied real-time bus information on mobile devices already in 2001 [16]. Later studies by Watkins et al. [30] and Ferris et al. [7] have studied the enhanced usability of public transportation by providing good traveller information systems to passengers. Both papers study a transportation information toolset *OneBusAway*. OneBusAway is designed to decrease the passengers' feeling of uncertainty of public transportation by providing real-time information for bus riders in the area of Seattle [7]. Tools that provide real-time arrival information to bus passengers improve the usability of public transportation and thus increase the passengers' travel experience.

Developing the efficiency of traveling does not always increase the passengers' travel experience. The access to real-time information of bus is just "a necessary first step which other ideas can build on and add further value" [8]. To enhance the travel experience Foth et al. [8] suggest that the systems of real-time passenger information could rather focus on how the different journey options can be planned, assessed, and distinguished on the aspects of fun instead of efficiency.

Foth et al. [8] studied the micro activities performed by passengers during commute and their impact to the bus travel experience. These micro activities include activities of social, entertainment, observational, travel, and routine. Similar studies have also been conducted showing that people spend their time at, for instance bus stops and onboard buses listening to music and using social media applications in addition to reading newspapers and books or simply relaxing [e.g. 6, 15]. Until today, it has been mostly left to the passengers to entertain themselves [8].

Enhancing the attractiveness of public transportation can happen for example through experience-driven design [17]. Experience-driven design takes selected experiences as design targets to inspire and guide design [1, 18]. By familiarizing oneself with the passengers' needs and current activities in the vehicle, new mobile and supplementary services can be developed that have the potential of adding value to the passengers' travel experience [2]. No longer is transportation only about moving from an origin to a destination but it is a way for the users to encounter different service channels; such as off-board services (services that are used outside of the vehicle), on-board entertainment or information before, during or after the bus trip [3]. Carreira et al. found that "Passengers also looked for other services, usually based on new technologies that could enhance their experience during the overall trip" (ibid). To be able to understand the demand in different travel settings, the service providers need to familiarize themselves with the travel experience and its forming factors [21].

3 The Study with Co-design Workshops

This study aimed to gather design-relevant insights to how public transportation services should be developed in order to better serve the passengers' needs and expectations, and thus to improve their travel experience in buses. The research focuses on gaining insights of the passengers' needs and expectations for digital traveling services, in order to understand how the travel experience could be enhanced by developing the existing services and by adding new, supplementary digital services to the public transportation. This was studied by co-designing service ideas together with frequent bus users and later analyzing the ideas generated in the co-design workshops.

3.1 Method

In order to better understand the bus passengers needs and expectations, and to ideate services, we conducted three co-design workshops. In co-design, users are invited to participate to the design activities together with design professionals in a continuous cooperative process that results in better solutions for daily life [23, 24]. In co-design, users are treated like experts, but since they often have very little experience on innovation it is important to provide materials that support the ideation activities [23]. The co-design materials, such as workshop tools can provide different entry points to the design problem as well as help the participants to build their own design language [14]. These co-design methods suit best for the early phases of the design process, e.g. for idea generation through brainstorming new ideas, or when rethinking existing solutions [14].

Figure 1. Examples of the Context Cards: on the left, the card of Confidence and feeling of being in control and on the right, the card of Luxurious and premium experience.

3.1.1 Stimulus Materials

Findings of a semi-structured interview study [11] with ten international students was carried out in order to gain insights of the current user experience of buses in Finland, as well as of the expectations to the electric bus. The interview findings were used as an input to the workshops in form of Context Cards (see Figure 1). A set of 15 inspiration cards was designed to help the participants with the ideation of the intangible traveling service ideas. Seven (#1-7) of the cards were derived from the findings of an interview study [11] and seven (#8-14) were chosen with small alteration from the 22 categories of Playful Experience (PLEX) framework. PLEX Cards were developed to communicate the Playful Experiences framework's 22 categories to people who aim at designing for playfulness [13]. PLEX Cards have been used to generate ideas with experience driven approach (ibid.). The 15th card was added from the Living Lab Bus project agenda. The cards were printed and cut into size 12x12cm. Each card consisted of 3-4 pictures and the card title. The Context Cards consisted of three theme sources:

Context-specific themes
1. Making the ecological values of electric bus visible
2. Informative communication
3. Entertaining activities
4. Atmosphere of relaxation
5. Subtle opportunities for social interaction
6. Luxurious and premium experience
7. Getting to know the personality of the driver

Themes from PLEX categories
8. Confidence and feeling of being in control
9. Fellowship - friendship and communality
10. Opportunity to be creative and express oneself
11. Stimulating senses
12. Exploration and discovery to learn something new
13. Captivation - forgetting one's surroundings
14. Competition - contest with oneself or an opponent

Theme from the [Blinded for review] project agenda
15. Utilizing the sensor data collected by the bus

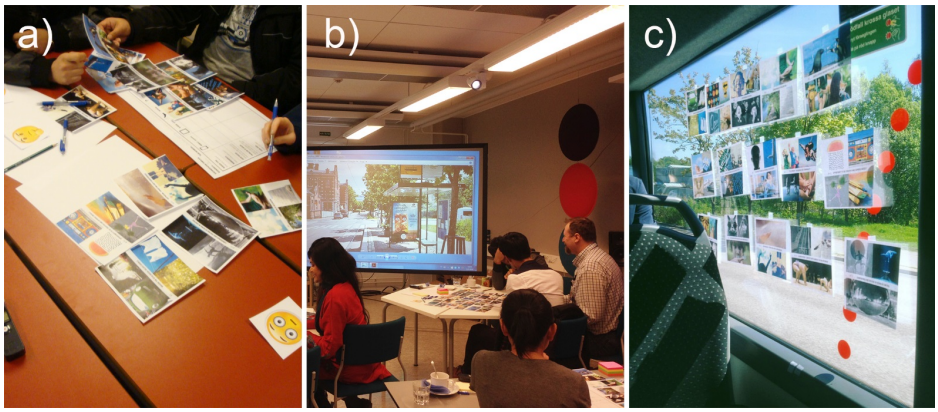

Figure 2. Pictures from each workshop context: imagined environment (picture a), stimulated environment (picture b) and real environment (picture c).

3.2 Idea Generating Workshops

This study consisted of a series of three co-design ideation workshops. The workshops took place in Tampere and Espoo (Finland) in the spring of 2016. In Tampere, the public transportation is focused on bus transportation, and the bus lines cover the city well. In Helsinki region – including the city of Espoo, the public transportation is multimodal, which means that the passengers have access to bus, commuter train, tram, metro, and a commuter ferry with one travel card. In both cities, the public transportation could be described as a functioning and well-planned system. Still there is a general need to develop the attractiveness of the public transportation system.

The workshop process and stimulus materials were identical in all three workshops. However, all of the three workshops were organized in a different environment with different levels of contextuality: 1) imagined environment, 2) a stimulated environment and 3) a real environment. These three workshop context types were selected in order to study the optimal level of workshop contextuality (results reported in a separated publication). The settings of the workshops were (see Figure 2):

1. A classroom at a university - ***Imagined environment*** (Workshop 1, WS1)
2. Technologically advanced lab in a research institute – ***Stimulated environment*** (Workshop 2, WS2)
3. Moving electric bus, Espoo, Finland – ***Real environment*** (Workshop 3, WS3)

3.2.1 Workshop Process

The agenda of the workshop sessions consisted of short presentation of the day's agenda, goals for the day and briefs for the tasks. We wanted to provide the participants with electric bus specific inspiration, and thus videos of the unique qualities of electric buses were shown to highlight the silent and smooth ride. An icebreaker exercise served as a starting point for the workshops. The participants were asked to share a good or a

bad experience when using public transportation and share this with others. This helped the participants to relax and set to the right mindset.

Five scenarios – situations that could take place in the context of bus transportation – were used to guide the main part of the workshop. Before the ideation we encouraged the participants to ideate wild and creative ideas. At this stage, it was not relevant to think about costs nor the technology available. The task was to come up with service ideas that could enhance their own travel experience in that specific situation. The scenarios were:

1. The bus was few minutes too early and you just missed it. Now you have to wait for the next one.
2. You are in the bus. The route is unfamiliar to you.
3. You are in the bus. The route is familiar to you so you can lay back and relax.
4. You get off at your destination stop after a busy day.
5. You have to change to another bus in a big transportation hub, like Kamppi in Helsinki.

Participants were divided into teams of 2-3 persons (three teams in each workshop, nine in total) for the ideation tasks. 15-20 minutes was spent for each scenario task after which the groups shared their ideas with others. The participants were asked to choose one to three Context Cards at a time to guide their ideation during the scenario exercises. They were also encouraged to use different cards within and for each scenario to get diverse ideas.

3.2.2 Participants

The workshops had 7-9 participants each. The workshop participants were mainly students and they represented diverse study programmes (e.g. HCI, Bioengineering, Business, Automation Engineering, Art and Design). Most participants of all workshops stated that their main reason for traveling was going to university (12 participants) or to work (4 participants), 12 said that they use public transportation to travel during their free time. Majority of the workshop participants used public transportation frequently: 12 participants stated that they use public transportation at least 4 days a week, and eight participants 2-3 days a week. Only four said that they use it once a week or more rarely. See Table 1 for the participant details.

Table 1. Participants of each workshop.

Attribute	Imagined environment (WS1)	Stimulated environment (WS2)	Real environment (WS3)
Number of participants	8	9	7
Average age (year of birth)	1990	1982	1987
Gender	4 F, 4 M	3 F, 6 M	3 F, 4 M
Participants' nationalities	Bangladesh, India, Iran, Pakistan, Spain, USA, Vietnam	Australia, Bangladesh, China, Finland, India, Russia, Vietnam	China, Finland, India, Indonesia, Russia, Taiwan

3.2.4 Data Collection and Analysis

The sessions were voice recorded and filmed. We transcribed the recordings and the documentation sheets in which the participants documented their ideas. The analysis was done by thematically grouping the ideas bottom up. To draw out common themes from the ideas we used affinity diagramming [12] in the analysis. Building the affinity diagram allowed us to understand the traveling service ideas thematically. As a result the transcriptions were divided to 181 individual traveling service ideas or digital service features. These 181 service ideas were generated in the workshops by different student teams, and thus they included a few same or similar ideas.

4 Findings

The purpose of this study was to gain design-relevant insights for the development of supplementary services for public transportation that can improve the bus travel experience. We wanted to understand the bus users' needs and expectations for such traveling services, and therefore utilized co-design workshops to gather service ideas from the workshop participants. This chapter presents findings – six service themes – that answer our research question: *What kind of services support the passengers' needs and expectations in the bus context?*

The study findings were grouped thematically bottom up into 46 subthemes and finally to six main themes (see Table 2). The traveling service ideas related to each service theme are presented in the following. The main service themes, derived from the ideas generated by the workshop participants were: *Information at a glance while traveling, Entertainment and entertaining activities, Services that support social interaction, Multiple channels to provide travel information, Extra services for better travel experience* and *Services that people already expect to have*. For the subthemes, participants' ideas are presented below in quotes.

Table 2. The found themes and subthemes of digital services for the bus context.

Theme	Subthemes
Information at a glance while traveling	Discovering interesting places in the surroundings
	Discovering interesting events
	Aiding the navigation to the stop of connecting line
	Easy access to journey related information
	Bus showing information outside about the line and destination
	Interactive windows
	Connecting the public screen with the mobile phone
Entertainment and entertaining activities	Active entertainment
	VR, AR windows
	Physical exercise suggestions at bus stops and when in the bus
	Art and visual entertainment
	Passive entertainment
	Bus stop specific entertainment
Services that support social interaction	Sharing social media with other passengers in the bus
	Games for people sitting next to each other
	Silent and loud areas for buses
	Suggesting “bus mates” from other passengers to travel with
	Interactive screens at bus stops to aid with communication
	Writing and sharing stories with fellow passengers
Multiple channels to provide travel information	Real time information of the bus location
	Alerts of the approaching stop
	Info about the next 2-3 stops
	Info about intersecting lines
	Bus driver giving information on the surrounding environment
	Re-planning your journey on the go
	Compensation for late buses
	Connecting transfer modes
	Information about bus consumption & green values
	Confirmation of being on the right bus stop
Extra services for better travel experience	Indication of available seats
	Vending machine at the bus stop
	Possibility to inform the driver to wait for you
	Luxury, premium and extra service
	Handling of the luggage
	Borrow, rent carts/carriages to carry luggage
	More comfortable seats at the stop/hubs
	Waiting area/lounge at the transportation hub
	Borrow umbrella and return it next time
	Instant channel for feedback
	Book/magazine/newspaper exchange
Services that people already expect to have	Physical place (other than the bus) to buy tickets in advance
	Better, adjustable seats in the bus
	Free Wi-Fi available
	Possibility to charge your phone
	Possibility to check balance and charge your travel card
	Temperature-controlled bus stop

4.1 Information at a Glance While Traveling

This theme includes service ideas dealing with the easy and effortless access of information during the travel. This theme consists of 30 ideas within seven subthemes. The subthemes found most relevant for our study were: *Easy access to journey related information* with ideas such as "Touch screen information points to the transportation hubs" and "More information screens installed into the bus"; *Discovering interesting places in the surroundings* with ideas such as "Mobile guide tour – possibility to match with someone local who could give you a tour around the nearby area" and "A map at the bus stop that would provide information about the neighborhood"; and *Connecting the public screen with the mobile phone* with ideas such as "Possibility to transfer the information from public screen to mobile phone".

Participants highlighted the importance of clear communication of, and easy access to information, whether being inside or outside the vehicle. For example, the participants stated a need to aid the navigation to the bus stop or gate of the connecting line. Participants also wanted the bus to show more information to outside, such as placing the bus number to every side of the bus so that it would be visible also when standing next to the bus. Participants had some ideas for new ways of communicating the information such as utilizing interactive windows as screens and enhancing the connection between the public screens and personal mobile phones. As one group stated, the modern technology could allow the phone to connect to the bus stop screen, which could advertise them specific things to do, i.e. try out new cafeteria around the corner.

Participants stated the need to get advertisement of the local neighborhood and events around the area. One of the ideas within the subtheme *Discovering interesting places in the surroundings* was about providing the passengers' easy recipes that could be in line with what is on sale in the local supermarket ("Meal inspiration – show all supermarket, restaurant and bar deals from the local area together with the opening hours"). Other ideas were about notifying the passengers about upcoming local events in the surrounding area. One team stated the need to bring surprising factors to everyday life and thus their idea focused on decorating the bus or bus stop with the seasonal events – like the Ice Hockey World Championships in May – with sound, lights, visualizations and smells.

4.2 Entertainment and Entertaining Activities

This theme includes service ideas dealing with a variety of entertainment modes within the bus transport journey from the bus stop to the actual bus. The theme consists of 29 ideas within six subthemes. The subthemes found most relevant for our study were: *Passive entertainment* with ideas such as "Onboard entertainment, such as music and games" and "Screen with randomized questions to learn something new"; *Active entertainment* with ideas such as "Drawing exercises at the back of the seats" and "Games to play with the other passengers in the bus"; *Bus stop specific entertainment* with ideas such as "Public screen with games and news" and "Playing the sound of birds singing to make you feel welcome to the bus stop"; and *Physical exercise suggestions at bus stops and when in the bus* with ideas like "Exercise instructions to

keep you warm at the bus stop" and "Application that would suggest easy exercises after sitting still for a certain period of time".

Participants generally stated the need to be entertained and having multiple options to choose from depending on your mood and energy levels. Several suggestions came for public touch screens that would provide entertainment and travel information inside the bus and at the bus stop. Participants were also willing to get free access to music while traveling by bus with ideas such as attached headphones, earphone jacks, and sound booths. Some ideas focused on utilization of modern technology, such as VR and AR. Ideas were generated where the VR experience could be either provided with VR glasses or with smart windows. This way people could entertain themselves by looking at different sceneries – different seasons, predictions of future life, informative guide tours of local attractions, etc.

4.3 Services that Support Social Interaction

This theme includes ideas related to the social aspects of traveling by bus. The theme consists of 13 ideas within six subthemes. This theme was the smallest one in the number of service ideas. Many people stated that they want to relax in the bus and therefore being social is not a priority.

The most relevant subthemes within this theme were: *Sharing social media with other passengers in the bus* with the ideas such as "Creating a social network of the passengers", *Games for people sitting next to each other* with ideas such as "Bus related team games for the two people sitting next to each other"; and *Interactive screens at bus stops to aid with communication,* with ideas such as "Creating a hashtag for each bus stop to enhance the community feeling" and "Guide request button that connects to the transportation provider's help desk that gives you answers in real time".

Participants had ideas of creating and sharing things with the other passengers within the bus. One idea was that one could write a story that the others could read and maybe even edit and this could be then published on the big screens in the bus. There were also many suggestions for a social network within the bus where you could communicate with others and, for instance, search for people with similar interests.

4.4 Multiple Channels to Provide Travel Information

Amongst the participants this was seen as the most important and easiest category to ideate around, based on the amount of ideas within the subthemes. This theme includes ideas related to the information regarding the journey. The theme consists of 46 service ideas within 10 subthemes. The subthemes found relevant were: *Real time information of the bus location* with ideas such as "A screen at the bus stop with a real time map with the vehicles' locations", "Journey planner that would function also without internet connection" and "A screen attached to the back of the front seat in front of you that would have your personalized journey"; *Alerts of the approaching stop* with ideas like "Voice alert or wake-up call" and "Vibrating bench when your stop is approaching"; *Bus driver giving information on the surrounding environment* with

ideas such as “The driver reminding people of their stops” and “The driver providing information of the surrounding area like a tourist guide”; and *Information about bus consumption and green values* with ideas like “The screens in the bus could show the benefits of using the ecofriendly modes of transport” and “Displaying the CO2 savings personally and by all passengers on board at that time”.

Even though real time journey planners already exist, it was still seen important to provide the information in various of ways, i.e. through public screens, voice alerts and mobile phone applications. Important features were also the ability to quickly re-plan your journey in case the plan A failed and also to get some compensation if the bus never shows up or is remarkably late from its schedule. Other ideas mentioned were i.e. about showcasing not only the approaching busses but also the ones that already went, so that you would know not to wait for it to come. One team stated a need to get confirmation that you have arrived to the correct bus stop. One team on the other hand, had an idea of using the same maps in all the applications so that it would be easier to understand and read them.

4.5 Extra Services for Better Travel Experience

This theme includes ideas regarding something that is considered being “extra”, which would enhance the travel experience. The participants brought up a need for services that link to, but are not directly part of the bus ride. The theme consists of 43 service ideas within 11 subthemes. This theme was seen as the second most important and easiest category to ideate around, based on the amount of ideas within the subthemes.

The subthemes found most relevant for our study were *Luxury, premium and extra service* with ideas such as “Home delivery, when you are too tired to walk home from the bus stop”, “Comfort seats that allow you to sleep” and “Lottery with different prices utilizing the travel card usage”; *Instant channel for feedback* with ideas such as “Give feedback for the driver” and “Rate the travel experience when you get off”; and *Vending machine at the bus stop* with ideas like “Refreshments, such as coffee and snacks” and “More exotic alternatives of food choices available”.

Participants also suggested a lounge type of place for the transportation hubs that would contribute to the overall travel experience by more comfortable and enjoyable waiting time. Teams suggested silent rooms with sleeping pods and rooms with different ambient or themes, such as forest or beach. In this lounge families could take care of their kids and also one would have free access to the toilet facilities. One suggestion was that you would need a travel card to access this space and thus it would not be available for everyone.

Teams generated also ideas related to the sharing economy. Suggestions came for i.e. borrowing carts or carriages for handing luggage, borrowing an umbrella and returning it the next time and a book or magazine exchange. Regarding the physical environment, the participants hoped to have i.e. more comfortable seats with neck support, so that it would be easier to sleep both in the bus and in the lounge area while waiting for the bus.

4.6 Services that People Already Expect to Have

This theme includes ideas dealing with the "must haves" or hygiene factors that the participants noted to be important. The theme consists of 20 ideas within six subthemes. The subthemes include *Physical place (other than the bus) to buy tickets in advance* with ideas such as "Buying your ticket advance should notify the driver that he should not leave earlier" and "A place to buy the tickets to shorten the queues"; *Possibility to check balance and charge your travel card* with ideas like "Make tomorrow a smoother day and charge your card while you wait for the bus" and "Information desks where you could buy tickets"; and *Temperature-controlled bus stops* with ideas like "Heating system at the bus stop that you pay for" and "Closed bus stops so that the heat stays inside".

Most popular needs and ideas were related to free Wi-Fi available for passengers in the bus and the possibility to charge one's phone. Also, some ideas were related to the physical qualities of the bus, for instance better and adjustable seats.

5 Discussion

The aim of our study was to understand how to enhance the bus travel experience by digital services. There are needs and expectations for new services that do not simply focus solely on the efficiency of the trip but rather, on the pleasurable experience of related activities, such as entertainment, social interaction and "extra" services that enhance the travel experience. Our study shares the motivation of Foth et al. [8] that holistic understanding of passengers' requirements is needed in order to develop services that can add value for the users and thus enhance their travel experience. Our study also validates some of the findings of Foth et al. (ibid.) regarding the passengers' needs and expectations for future traveling services. In specific, we agree with Foth et al. (ibid.) that traveling services, together with the supplementary services, could focus more on the entertaining aspects of the journey instead of solely on the efficiency of the trip.

In our study, we identified six service themes based on ideas that the workshop participants generated in the co-design sessions. Many of the individual service ideas have already been studied or even implemented and hence, the novelty of our study does not lie in the individual service ideas, but rather in the overall service theme categorization. Where the themes of *Information at a glance while traveling, Multiple channels for better traveling experience,* and *Services that people already expect to have* are somewhat axiomatic and predictable the other three themes hold more novelty. These themes have been addressed also by Dziekan and Kottenhoff [4], Watkins et al. [30] and Ferris et al. [7].

Even though commuting is often seen as private quality time [11], people still crave for social interaction and therefore we believe that the theme *Services that support social interaction* has high design-relevant potential for successful services. Supporting the social interaction can happen in forms of traditional face-to-face discussions or, for instance, via social media. In addition to direct interaction, the

participants generated ideas with indirect interaction, such as co-writing short stories or playing mobile games with others.

As Carreira et al. [2] state, in order for public transportation to gain larger popularity, the transport providers and planners should be considering the individual travelers' needs regarding short distance traveling activities. Thus, the services should be more personable focusing on individuals and their daily lives providing *Extra services for better travel experience*. To attract more people to choose public means of transportation over private cars, something that adds extra value to the commute should be available. The workshop participants generated service ideas that are familiar from other transportation fields, such as aviation industry. However, not all these ideas were for digital services. For instance, a lounge type of waiting area or better bus stops are simple, yet major improvements that have an impact on the quality of the wait time. People also wanted to feel that they have a voice and that their voice is heard, in case there is a need to give feedback. This need generated several ideas regarding digital feedback channels. This addition to the existing transportation service is something that would also benefit the service providers, when they would get real-time data of the problems occurring during peoples' traveling time.

Even though people are nowadays entertained by their mobile phones and the applications in them, there is still a need to be provided with entertainment via other channels too. *Entertainment and entertaining activities* theme included service ideas of both active and passive entertainment. Especially services for passive entertainment, such as showing content on displays in the bus and bus stops were needed. Currently these displays are filled with news and commercials, but the participants of this study expected more local information, such as information of surrounding area – parks and attractions, as well as advertisement of local events, shops and restaurants.

Based on the service themes described in this paper, we propose tentative *experience characteristics* for digital services in the bus context:

- ***Feeling of being in control*** relates, on one hand to the basic need for successful traveling, that is, the journey from A to B and how it can be kept manageable at all times. Supplementary services can add to the feeling of control by providing cues about the landmarks, schedules and the overall travel chain.
- ***Relaxation*** is another central experience for the bus context. Many people prefer to spend their traveling time relaxing, preferably alone. Bus ride is seen as private quality time for many people and hence, there should be ways to enhance "calm" experience instead of pushing everyone to be active and social.
- ***Connectedness*** is related to people's feeling of being part of a community and friends, for example via their mobile phones and social media. More indirect connectedness could also relate to sharing economy between bus passengers.
- ***Local experiences*** form another experience category that provides design opportunities for the bus ride. These experiences can take the form of infotainment – knowing the local environment, advertisements and local contacts to people.
- ***Being modern***, even if not an experience *per se*, refers especially to utilization of modern technology – such as shared public displays, VR, AR and smart

windows – when using new traveling services, both informative and entertaining services. Using modern solutions may evoke further related experiences such as curiosity and pride.

From the above experience characteristics, relaxation and connectedness are proposed also by Hilden et al. [11]. Additionally, they propose that emphasizing the ecological choice and feeling of luxury can be accounted for in the design of digital services in *electric* buses. Depending on goals of a specific service design effort for the bus context, these experience characteristics could be turned to *experience targets* according to the approach of Experience-Driven Design [18], which can increase user acceptance of the developed services.

The study was limited in the number of participants as well as number of workshops. Students as participants do naturally not represent all possible target groups. However, we consider students with international background as a good starting point for establishing understanding of service themes, since they are known as active users of public transportation, and an active and enlightened group of smartphone users. Another reason to focus on students at this stage was also the potential in them as application developers, which is one of the areas we will study in the future.

In our future work, we are planning to conduct co-design workshops with other stakeholder and user groups by taking the ideas generated in these workshops further. We will furthermore utilize the special characteristics of the electric bus, such as the quietness of the bus, novel types of displays, and various sensor-based data that can be collected during the bus ride. Another possibility for future work is to study the found service idea categories in relation to other models of passenger needs, for example the pyramid of customer needs by van Hagen and Bron [28]. The presented findings regarding bus service needs and ideas reveal themes that can be used in development of services. Our study also revealed themes that can be used to inform the interaction design of future traveling services in different phases of the journey: before, during and after the trip. We find this an interesting way to categorize service needs and ideas and thus, we will also explore these aspects in our future studies.

6 Conclusion

In this paper, we presented the findings of our study of bus passengers' needs and expectations for future digital services by developing initial service concept ideas through co-design. This was done by conducting three Idea generating workshops with 24 participants. The study findings revealed six service themes that can be used as a basis of the design of future digital traveling services: 1) Information at a glance while traveling, 2) Entertainment and entertaining activities, 3) Services that support social interaction, 4) Multiple channels to provide travel information, 5) Extra services for better travel experience, and 6) Services that people already expect to have. This knowledge can be used as a basis for human-centered design of digital services that can enhance the desirability of bus transportation.

This study was a part of a larger research project *Living Lab Bus*, in which one of the aims is to develop a platform for interactive services for electric buses. However,

the findings of the study were not specific for electric buses only and can be utilized also in traditional buses.

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