

Developing Novel Services for the Railway Station Area through Experience-Driven Design

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Abstract. Supporting end-users' practical and emotional needs is an important goal in the design of novel smart services. We present a design research study with the experience-driven design approach to create concept ideas for smart city services. We present current challenges in the context of use and results of a two-phased user study of traveler experiences in the railway station area of the city of Tampere. Results show how experience-driven approach utilizing playful experience (PLEX) cards enables users to ideate experience-oriented concepts. As an outcome of the study, we describe one of the concepts selected for development, the *smart community info wall* concept. Our findings on the use of PLEX cards show that PLEX cards work with the amateur participants and support their idea generation. Furthermore, with the help of the PLEX cards, users were able to think on the subject more extensively and presented ideas on the experience-oriented categories.

Keywords: Smart city; urban space; citizens; travelers; ubiquitous services; experience-driven design; user experience.

1 Introduction

When people enter a city as visitors, they have conscious or unconscious expectations about the city and their visit. Arrival spots such as railway stations and airports have a significant role in building the first experience of a city. With emerging smart city infrastructures and services, various kinds of experiences can be provided to travelers. A key thing is to get citizens involved: bottom-up approaches linking citizens directly to technology and application development have been extremely popular and successful [16]. Many smart city projects have already taken a user-centered design approach to develop new services, which would make visiting cities more enjoyable. However, so far the most of the projects related to smart city services focused on

novel features and technological solutions rather than specific experiences that would make visiting experience richer.

In the coming years, the city of Tampere is going through a major restructuring of its city centrum. The intention is to improve transportation network, build new commercial and residential areas, and get currently underused areas into more active use. The railway station area is a focal point in these plans. The general objective is to make moving in the city centrum more fluent and have several areas more efficient, pleasant and entertaining. Both non-electronic and technologically augmented services are an essential part of making the area more pleasant. The railway station is one of the central nodes, “an area accessible by high order transit and mix—used development” [26] in vivid cities, as in Tampere city centrum area. Currently, there are some inherent challenges in the Tampere railway station area with which affect the traveler experience, these factors are identified in the work by Väänänen-Vainio-Mattila et al. [25], which this work expands. The focus of the study was on travelers who come to visit Tampere arriving by train. The main negative aspects that affect travelers’ experiences were the overall visual look and design of the station, lacking or unknown services, missing information displays and signs and uninviting environment during the waiting times.

In this paper, we explore these challenges in more detail and continue the work by presenting novel mobile and ubiquitous services for the railways station area and its vicinity. We utilize participatory experience-drive design (EDD) methodology in designing the new solutions and to identify the needs of users.

2 Related work

Smart city definitions include use of information technology to develop the services and livability of the city [5, 7, 8, 11, 12, 14, 19]. Smart city consists of three fundamental components: technology factors, institutional factors and human factors [11, 18]. “Smart” often refers to user perspective [18]. Fu considers “the city as the social network, living community and connected organism by the support of new information and communication technology” [7]. Furthermore, different places in the city offer different types of functionalities and interactions, and these, together with the physical and social context, provide a range of experiences to the people in the city. Smart cities have been studied across the globe for about a decade. Infrastructural components of smart city developments have included e.g. public displays [15, 17, 28, 29], city-wide open wireless networks, and embedded sensors for contextual data collection [21]. Examples of application domains are smart tourism, smart learning, natural resources, transportation, building information and government services [5, 8, 19]. Smart city design often creates a “digital double” – a virtual version - to places and spaces [4].

2.1 Experience-Driven Design

In experience-driven design (EDD) a particular experience is taken into a starting point for the design process and the design work uses the experiences as a source of

inspiration [6, 10]. This approach differs from traditional user-centered design in the sense that in addition to understanding user needs, the design is based on specific target experiences [23]. The experience-driven design has been used successfully in several design cases. Desmet and Schifferstein report 35 student design projects where the experience has been taken as a starting point for product designs [6].

Our approach to the development of mobile and ubiquitous services to the smart city environment is based on EDD [20]. Experience-driven design has been defined as [20]: 1) Taking human experiences as a starting point; “valuing the whole person behind the ‘user’” and focusing on the key design elements: context, interpretation, participation [30], 2) Using the targeted experience, and stories around them, as central concepts of the design vision [10].

2.2 PLEX Cards and Similar Methods

Playful Experience (PLEX) framework [1, 3] describes experiences that users typically experience when using a product. The framework consists of 22 categories, which describe both positive and negative (e.g. Cruelty or Frustration) experiences of product use [1]. The framework has been developed for design related activities i.e. for concept development. Lucero and Arrasvuori have created a set of cards to communicate the experience categories for designers in a concrete way [13]. In addition, there are two ideation techniques to help designers in the design task [13].

PLEX framework has been used in different experience-driven design cases in smart city context. Ventä-Olkkonen et al. used PLEX cards in the brainstorming session of public display for urban interaction [24]. Three PLEX categories (fellowship, submission, and competition) were selected together with different brainstorming methods. Pakanen et al. [22] used PLEX categories thrill, humor, and subversion to create ‘excitement’ meta-theme for their brainstorming session. The objective was to create exciting experiences to a bus stop, which are commonly experienced as unexciting. They ended up with ‘Virtual Garden’ which provides small tasks for people waiting a bus to arrive. Each task involved some aspects of tending a garden [22]. Olsson et al. [20] used PLEX categories to guide the design task for navigation and moving in winter time. The PLEX categories were grouped semantically to form meta-categories such as Adventure (Discovery, Exploration, and Captivation). Olsson et al. [20] concluded that PLEX categories served well as targets for the design because they are concrete and specific enough for guiding the design work. However, at the same time they leave enough space for innovation. Other similar methods are LocaLudo [28] and inspiration card workshops [9].

In this paper, we expand the use of PLEX cards to design of smart city concepts to the railway station area. We also use the PLEX card in participatory design in a novel approach that is described in the following section.

3 Method

When designing services for travelers in a city, it means that we need to understand the travelers’ needs [27] and expected experiences in the specific places they visit in

the city. First, the travelers in the area were identified by 31 short interviews, deepening the understanding with 10 in-depth interviews. The conducted user study was completed in two phases. First, 31 travelers of the railway station area were taken in to short interviews in the actual context. Secondly, 10 in-depth interviews were arranged with the users of the railway station area. These two phases utilize two research questions as a starting point:

RQ1: What are the current needs for experience-driven designs in the Tampere railway station area?

RQ2: How PLEX cards help in participatory experience-driven design with non-professionals?

3.1 Phase 1 - Initial User Study (N=31)

Short contextual interviews were conducted in the railway station to explore experiences that people desire to have in the station area and to investigate current problems in the area. The participants were recruited on the spot. Totally 31 people were interviewed in 5-10 minute long interviews. 26 of them were passing through the railway station on their way to somewhere, 3 were spending time there and 2 were escorting someone to a train. Participants were asked what kind of general experience the interviewees were expecting when visiting the railway station. Participants' experiences were divided into following categories: comfortable experience 53 %, efficiency 17 %, and 33 % wanted both efficiency and comfortable experiences similarly.

3.2 Phase 2 - In-depth interviews (N=10) and experience-driven design session

Ten in-depth interviews were conducted with the users and potential users of railway station area to understand the desirable experiences in more detail and to collect ideas and requirements for new smart services and solutions to the area.

Seven male and three female attended the interviews. Out of the ten participants half were currently living in a Tampere region and half were living in other parts of Finland. We made the selection of participants in order to gather more extensive views on the problems of the area and to gather ideas from more viewpoints.

During the in-depth interviews participatory design sessions were completed with the participants. PLEX cards were used as stimulators in the sessions. PLEX cards are traditionally used in design by selecting a subset of 3-5 experience cards to drive the design into experience-oriented approach. The approach was deliberately changed into a method where participants were allowed to see all PLEX cards and pick up the *most interesting* ones for the concept design and drop *irrelevant or uninteresting* cards. With that approach, objective was primarily to expand the use of PLEX cards as a design tool and secondly to collect information on the experiences participants select as the most relevant and irrelevant for the smart solution and experience design in the selected context.

4 Results

There are several possibilities how to influence the travelers' experiences. The study brought up a plethora of concept ideas to develop further in the railway station area. The ideas are presented in the following sections.

4.1 Identified Challenges and Development Areas of the Railway Station

In the first phase interviews we collected mostly the feedback on the current development areas of the railway station area. This section answers the first research question: What are the current needs for experience-driven designs in the Tampere railway station area? The more specific kinds of experiences and services the interviewees were expecting in the railway station area were mostly related to the themes collected to the Table 1.

Table 1. Themes identified in the interviews.

Theme and need	How many times was mentioned (N=31)
Comfortable waiting places, places to sit in peace	12
Quality restaurant or café to spend time in	8
More information and displays (trains, connections and the shops in the area)	8
Designing and developing the area into more enjoyable (things to do, cleanliness, overall atmosphere, security)	6
Entertainment for children, games and places to play	6
Special services (money exchange, book shop, ATM)	5

As results presented in table 1 shows, people wanted to have easily accessible information on what is happening in Tampere area, more info on the nearby stores and activities while waiting. Additionally, possibilities to add event information and content on their own to public displays were interesting.

In the second phase, users were also asked how they spend the waiting times in the area. Participants stated that when they are waiting for a train or during the train change there is time to perform other activities. Users wanted peaceful and relaxing places and spaces to the area in addition to the interesting experiences. Most optimize their time at the railway station area so that they arrive only couple minutes before the train leaves, but more traditional travelers arrive to the station 15-45 minutes before the departure. *“Currently I just try to catch the train, but it could also be a pleasant experience. Improved image of the station could bring other customers than travelers to the area also” (Participant 3).*

Currently there are some inherent challenges in the Tampere railway station area with which affect the traveler experience, identified in the work by Väänänen-Vainio-Mattila et al. [25].

- overall visual looks and design of the station
- lacking or unknown services; both non-electronic and electronic
- during the waiting times, there are no entertaining activities

- missing information displays and signs, and information of the current events: citizens are not able to share their advertisements and event information

Currently there are info screens and interactive screens in the railway station area, but they have not gained success. Their mentioned problems were too static information and mostly commercial content, which basically consist of advertisements of the nearby stores. In general, these issues lead to rather unenticing and even frustrating, or at least neutral and unmemorable experiences in this part of this essential place in Tampere city centrum.



Fig. 1. Left: Tampere Railway Station picture from the City Centrum direction showing the main façade. Middle: Waiting hall of the railway station has large wall areas, mainly populated by static advertisements. Right: Signage on the railway station mostly advertises the stores on the building.

4.2 Overview of the selected PLEX cards

In our interviews, users were instructed to firstly select the uninteresting or irrelevant PLEX cards that do not offer any ideas or are irrelevant in the smart services field or related to the railway station. After they had made the selection, they were instructed to select 3-5 most relevant and interesting PLEX cards. After the selection, the PLEX cards and related ideas were described. Selected PLEX cards are presented in Table 2 and out selected PLEX cards in Table 3.

Table 2. The relevant PLEX cards

PLEX card experiences that were selected as relevant and interesting	How many times the experience was selected (N=10)
Discovery	7
Relaxation	5
Humor, Fellowship	4
Fantasy	3
Exploration, Expression, Competition, Captivation	2
Challenge, Completion, Sensation, Submission, Eroticism, Subversion	1

Results (Table 2) show that Discovery, Relaxation, Humor, Fellowship and Fantasy were the most often selected target experience cards from the set. Following section describes the ideas that were originated from this selection.

Table 3. The irrelevant PLEX cards

PLEX card experiences that were selected as irrelevant	How many times the experience
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or not interesting	was selected (N=10)
Eroticism	8
Cruelty	7
Subversion, Suffering	5
Thrill	4
Competition	3
Control, Sensation, Submission	2
Captivation, Nurture, Exploration, Completion, Fantasy, Challenge	1

Most evidently, Eroticism, Cruelty, Subversion, and Suffering were not seen as relevant target experiences in the area. This makes sense, since the origin of PLEX cards is in game experience design and in games also negative experiences support the overall experience, which might not be the case in smart city design.

Analysis of the Concepts from the Studies. All the interview material was recorded and transcribed. Two researchers analyzed the material using electronic form of affinity diagram. The findings from the studies were divided in two main themes: 1) developing new experiences to the area 2) developing the services and current user experiences in the area. The first category was experience-oriented and included hedonic experiences, where the second was pragmatic and more efficiency and technology-oriented. In these main categories, six theme categories were identified and rough concepts were categorized in them as follows.

Table 4. Concept categories and the relevant PLEX cards

Idea category	Selected target experiences from the PLEX cards
<i>Developing new experiences to the area (Hedonic and experience-oriented ideas)</i>	
A: Developing railway station area into an inviting and relaxing experience	Humor, Fellowship
B: Community and crowdsourcing to the railway station area	Discovery, Fellowship, Exploration, Captivation, Submission, Competition
C: Gamification and experiences on the railway station area	Fantasy, Competition, Completion, Challenge, Humor, Captivation, Sensation, Exploration, Discovery
<i>Developing the services and current user experiences in the area (Pragmatic, task-, technology- and efficiency-oriented solutions)</i>	
D: Finding the services and stores	Exploration, Discovery
E: Smart traffic and traveling	Completion, Relaxation, Submission
F: Signage, Guidance and New Interactions	Exploration, Discovery, Fantasy, Completion

Table 4 shows the categorization of the participants' concept ideas and the related selections of the PLEX cards. Following chapter describes the six categories in detailed level and gives examples of the related participants' ideas.

Developing Railway Station area into an Inviting and Relaxing Experience. Users wanted to have relaxing experiences among the fast pace of travelling. Concept ideas spread from adding smart surfaces on the railway station walls to adding atmosphere

with audio or video. Participants introduced ideas of creating personal space to the travelers by developing the acoustics by using generated audio or by creating visual experiences by reflecting images or videos to the walls and roof of the station. Guidance and information possibilities of interactive screens were also utilized in concept ideas.

Community, Social Applications and Crowdsourcing to Railway Station Area. In the interviews, participants noted that railway station area has very little room for any kinds of announcements, advertisements or other public notes from the people. Citizens and travelers showed interest on producing the information on their own. All of the public information on the railway station area is produced by third party and currently there is very little wall space to the announcement or advertisements. Participants suggested using smart screens for implementing virtual boards, where people are allowed to add their own content. In addition, the participants ideated that users should be able to fetch content from the board.

Gamification and Experiences on Railway Station Area Participants considered railway station current design as goal-oriented and pragmatic. However, waiting times cannot be avoided when travelling, so hedonic experiences were wanted to the area. Users suggested that waiting times could be turned into activities by adding gamification. Participants stated that especially children are bored in the station, since they are not taken into account when designing the railway station area. The playful solutions could connect the local amusement park to the railway station area, e.g. by starting the virtual journey or route from the station. Novel interaction techniques were ideated also, e.g. reflecting different playing areas to the floor of the station, utilizing sensors to play with the smart surrounding, and utilizing user's own device as a game controller.

Finding Services and Stores. The interviews summarized that services in the railway station area are not well known, even among the people that visit the area on a daily basis. In the studies, three different groups were identified: 1) tourists and rare visitors of Tampere, 2) frequent travelers, who want to know about the special events in the surroundings, 3) everyday travelers, who are interested in the daily information.

Seeking the information has to be user-initiated. Pushing the information to the users was seen irritating. Users wanted information that is relevant at the certain moment, e.g. night time travelers want to know which services and stores in the area or nearby are open. Users are not willing to download application for each city they visit to, yet scalability and freshness of the information is highly important. People want to know what is happening here and now – current problem was that they are not visible in the station area.

Smart Traffic and Traveling. Interviewed people characterized smart traffic and smart traveling mainly as a possibility to plan the trip on the run and easily change the means of transportation without planning it beforehand. Optimizing the mean of transportation in relation to different parameters was also important. Participants wanted to buy the journey as a whole and only afterwards decide the most suitable means of transportation. Participants wanted real-time information of trains and other

transportation. Participants also stated when travelling, they want to “timeshift”, e.g. they have time while sitting in the train, but during stops at the station they are in a hurry, so they wanted to do things in advance. For example, they could order and pay food in the train and just pick it up in the station when they arrive. Similarly, finding the transportation from the station could be done in advance while sitting in the train. Currently the problem relates to the internet connection in a train.

Signage, Guidance and New Interactions. Understanding how people move and find their route on the public places and spaces is essential for designing the efficient signage and guidance to the areas. Participants suggested using new technologies such as fog screens, smart lighting systems. Utilizing sensors that detect pressure, movement, and using gestures to control smart environments and other novel ways of interaction were ideated. Smart lightning that offers navigation aid was ideated. Users mentioned idea of utilizing their own devices in cooperation with the smart surroundings multiple times. For example, leaving and picking up information from the public screens was one of the central themes in the sessions.

4.3 Findings of the PLEX cards as Stimulators

Following section answers research question 2: How PLEX cards help in participatory experience-driven design with non-professionals? In our study, using PLEX cards as a stimulus material produced extensive amount of small concept ideas to smart services, solutions and applications to the railway station area, as previous section described. Table 5 gives an overview of the amount of the ideas with and without PLEX cards in the sessions.

Table 5. Concept categories and the ideas generated with and without PLEX cards

Idea category	Ideas generated without stimulus (N=10)	Ideas generated with PLEX stimulus (N=10)	Ideas in total
Experiences to area	5	<u>19</u>	24
Gaming and Entertainment	5	<u>19</u>	24
Crowdsourcing and social applications	8	<u>14</u>	22
Services and events	<u>18</u>	11	29
Signage and guidance	<u>13</u>	8	21
Smart traffic	<u>15</u>	4	19
Total	59	75	134

As results show, users came up with 59 small ideas in the interview phase, where PLEX cards were not used and 75 small concept ideas in the idea generation part with PLEX cards. The difference of the idea amount is not significantly big, but the categories, in which participants generated ideas with and without stimulus shows interesting differences. Without the PLEX cards, users mostly gave ideas related to service, store and event information, signage and guidance and the smart traffic services. With the help of the PLEX cards users brought up more ideas on the experience-oriented categories.

4.4 Selecting the Best Concept Ideas in a Workshop with SME's

In the end of December, a workshop with SME's was arranged in the Tampere region in cooperation with Teknologian tutkimuskeskus VTT Oy (VTT) and City of Tampere in December 2014. The main goal of this workshop was to make connections with the companies interested in smart city development.

The rough concept ideas were presented to the participating SME's and their feedback collected. From the presented concepts, Smart Community Information Wall prototype was recognized as a potential concept for further development.

The prototype of Smart Community Information Wall is built as an extension to the existing gesture-controlled Information Wall installation [17]. Smart Community Information Wall allows users to move information between a large display and a personal mobile device using mid-air gestures and an NFC reader. The prototype was designed to be a novel but also practical way to receive relevant information (e.g. information about local events) on the go for later use. Information can be transferred into the mobile device by committing a simple pointing gesture in front of the display and touching the NFC reader with the mobile device. The prototype also allows users to add their own content on the wall via a simple mobile application. The development of the smart community information wall will continue in the project.

5 Conclusions and Discussion

In this work, we firstly identified the needs for experience-driven designs in the railway station area context. In the study we found a plethora of development points and challenges which can be met by smart and ubiquitous services. The main findings suggest that experiences were needed to improve the overall visual look and design of the station, lacking or unknown services, missing information displays and signs and uninviting environment during the waiting times. Small concept ideas related to these findings were generated in participatory design method.

Secondly, we studied how participatory experience-driven design with PLEX cards can be carried out with non-professionals. In our study, PLEX cards were understood easily and received well by the participants. With the help of the PLEX cards, participants generated totally 75 small concept ideas and 59 without the help of PLEX cards. PLEX cards clearly supported their idea generation. Letting participants select the relevant PLEX cards was proven to be an efficient way to stimulate ideas.

Our findings show clearly that participants mostly gave ideas on the pragmatic services without the aid of PLEX cards, with the help of the PLEX cards users were able to think on the subject more extensively and gave ideas on the experience-oriented categories. Use of PLEX cards can be therefore recommended in the participatory and experience-driven design cases also in the smart city service context. Further work on the use of PLEX cards as idea stimulators will be needed to understand how well they can be expanded to different contexts. From the generated ideas, smart community info wall was selected as the most prominent idea to develop further. The work continues with the research and development of the concept.

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