

Playful AR

Playfulness and augmented reality in a route planning application

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Abstract

This thesis explores implementing playfulness into a route planning application using augmented reality. While AR in itself has been around since the 1960s, the use of it on smartphones is a quite new territory. The potential for AR as an everyday tool grows with the development of technology, and the use of the cameras in smartphones. Because of its newness there are still issues with the user experience and different opinions on how to best utilise it. The preliminary idea for this design concept was of a route planning application with AR, which helps the user map themselves in 3D space. Looking at past and present applications, many of them are games or have a lighthearted way of using AR. Implementing playfulness in design can make the user experience more pleasurable for the user. Adding playfulness as a means of introducing users to a new way of navigating, not only new applications and technology, but in the real world as well. The combining of the AR app and playfulness was achieved in this thesis with the help of the Playful Experience Framework (PLEX). A video prototype was made based on the design concept derived from the PLEX cards. The video prototype was then used in interviews where the design concept was explained. The aim of the interviews was to gauge the overall reaction to this type of application and answer questions such as: who would use it, how would they use it, and how they found the playful experience? The reception of playful aspect of the application played a part in analysing the responses in order to see how to proceed with the concept and whether it was a viable idea or not. The overall opinion of the design concept was positive with many wanting to test it out, which would be the next step in development after new iteration is complete, fixing the issues found in the current one.

Keywords augmented reality, AR, playfulness, plex framework, user experience, UX, mobile, application

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Denna avhandling utforskar implementationen av lekfullhet i en ruttplaneringsapplikation med hjälp av förstärkt verklighet (augmented reality / AR). Medan AR i sig har funnits sedan 1960-talet är användningen av det i smartmobiler ett helt nytt område. Potentialen för AR som ett vardagsverktyg växer i takt med utvecklingen av teknik och användningen av kamerorna i smartmobiler. Eftersom AR är en ny användarupplevelse, finns det fortfarande problem med den och åsikterna om hur den bäst ska utnyttjas varierar. Den preliminära idén för avhandlingens koncept var en ruttplaneringsapplikation med AR som hjälper användaren orientera sig själv i en 3D-värld. Många nu existerande AR-applikationer är spel eller utnyttjar AR på ett lekfullt sätt vilket kan göra användarupplevelsen mer njutbar för användaren. Lekfullhet kan användas som ett sätt att introducera användare till ett nytt sätt att navigera, inte bara nya applikationer och teknik, utan också i den verkliga världen. I denna avhandling förverkligades kombinationen av ar-appen och lekfullhet med hjälp av ett så kallat "Playful Experience Framework" (PLEX). En videoprototyp gjordes baserat på PLEX kortens koncept. Videoprototypen användes sedan i intervjuer där designkonceptet förklarades. Syftet med intervjuerna var att mäta den övergripande reaktionen på denna typ av applikation och svara på frågor som: vem skulle använda den, hur skulle de använda den, och hur den lekfulla upplevelsen upplevdes. För att se hur man skulle kunna fortsätta med konceptet och huruvida det var en genomförbar idé eller inte, var mottagandet av den lekfulla aspekten av applikationen speciellt viktig i analysen av svaren. Det allmänna mottagandet av konceptet var positivt och många sade sig vilja testa prototypen, vilket skulle vara nästa steg i utvecklingen efter det att en ny iteration är färdig, med korrigeringar av de problem som identifierats i den nuvarande versionen.

Nyckelord förstärkt verklighet, augmented reality, AR, lekfullhet, plex, användarupplevelse, UX, mobil, applikation

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1. Introduction

1.1 Motivation and aim of study

The scope of what is possible is constantly evolving with the development of technology. New technology, both in the sphere of software and hardware, have changed considerably during the last couple of years, not to mention during the recent decades. Not only have the products become better, e.g. faster processing capabilities or longer lasting battery life, but how the user interacts with them. Especially the integration with everyday life has altered significantly. It is not only brand new concepts which have seen an increase, but older technological concepts that grows and with this gain new life. Futuristic ideas, which were sometimes seen as only able to exist in science fiction, might become products used by hundreds of thousands of people. The tablet¹ is one of these types of items which went from visionary to later becoming an everyday object by everyone from toddlers to pensioners.

AR has long been one of these concepts which was ahead of its time, too technologically demanding to become a household item used by everyone, and while AR has gained traction in the last few years, it is still very much in its growing phase when it comes to how to best utilize and design it. The latest trend within AR development is using it in combination with smartphones, taking advantage of the cameras which are included with almost all smartphones nowadays. This has launched the newest surge in development of AR.

Designing the user experience of a mobile application using still developing technology can be difficult, no “universal truths” or clear guidelines have been established. Working in the field of user experience and user interface design, the ever evolving way of thinking about and interacting with design intrigues me. From these unanswered questions on the best way utilize it came an idea of using AR in a navigation and route planning application to improve some of the issues which arrive when going from a 2D representation of the world to what you see around you. The design concept this thesis will explore around is an addition to a standard navigation application instead of building a whole new navigational app. There are already many good navigation/route planning apps on the market. This addition would specifically targeting public transportation stops and the transfers in between them, helping the user find which stop is the correct one for their destination with

1. YouTube. (2010). clip1: Apple iPad in the 1969 classic: 2001 A SPACE ODYSSEY. [online] Available at: <https://www.youtube.com/watch?v=JQ8pQVDyaLo> [Accessed 1 Mar. 2019].

augmented reality.

The thesis consists of two parts, a written part and a design concept, see appendix 2. The first explores related works and the methodology while the latter puts it to practice. The design concept goes through the different stages of the process, using the PLEX cards, creating mockups and a video prototype. Interviews concerning the design concept is later held and analysed to confirm or deny the research questions and how it is received.

An additional motivation is to see if playfulness could help make user experiences, in this thesis topics case an augmented reality application's user experience, more pleasant and increase the value of it. Implementing playfulness the core idea to something final with the help of the PLEX framework, as well as exploring the PLEX framework as a tool works, how it feels to use and seeing if it is effective.

The aim at the end of the thesis is to have a first mockup version as well as a video explaining the design concept based on the results of using the PLEX framework, and to be able to conduct user research based on these. The feedback from potential user will then help with analysing the research questions and will likewise help navigate the progression of the application.

1.2 Research questions

The thesis is about exploring with implementing playfulness into an AR design concept for a route planning and navigation application for smartphones using PLEX cards, and receiving feedback on the user's experience. To see the first reaction of the application, but also answering the questions:

- Who would use it?
- How would they use it?
- Does adding playfulness add value to the experience?

The answers, overall feedback and research will in turn clarify which direction to proceed with the design concept.

1.3 Theoretical frameworks

The main framework used in this thesis, and is used as a tool to integrate playfulness into design. The description written by Lucero et al. is:

"The Playful Experiences (PLEX) framework is a categorization of

playful experiences based on previous theoretical work on pleasurable experiences, game experiences, emotions, elements of play, and the reasons why people play. [...] We believe that the PLEX framework further advances our inquiry through providing a more fine-grained understanding of pleasurable user experiences.” (Lucero et al., 2014, p. 37, 38-39)

This framework along with other projects, studies and theories on play cited in the book *Plei-Plei!* (Fernaes et al., 2012) gives a well rounded insight into designing for playfulness. Many of the works featured in the book are related to technology, with a particular interest in mobile technology. The book is from 2012 and some of the projects seem to be even older, so there is a variation in how “advanced” the technology used is.

While no official framework was used for the qualitative research, “Interviewing Users” by Steve Portigal (2013) was used as a base on how to best conduct the interviews. The questions used in the interviews were based on the research questions.

1.4 Definitions

AR - This is a commonly used abbreviation of augmented reality and used throughout the thesis.

Beat Saber - A new VR (virtual reality) game in which the player has to slice flying cubes with light sabers to the beat of songs.

Dance Dance Revolution - An old arcade game still popular today. The objective is for the player to step on specific arrows on the floor at a certain time corresponding to the ones on the screen. This is to the beat of different songs.

Mixed Reality - or MR, is “visual displays, a particular subset of Virtual Reality (VR) related technologies that involve the merging of real and virtual worlds somewhere along the “virtuality continuum” which connects completely real environments to completely virtual ones. Probably the best known of these is Augmented Reality (AR), which refers to all cases in which the display of an otherwise real environment is augmented by means of virtual (computer graphics) objects.” (Milgram and Kishino, 1994)

PLEX - Abbreviation of the Playful Experience framework.

1.5 Background

Mixing the real world, also known as physical reality, with the digital one has been around since the 60s, and has become more prominent during the last couple of years thanks to the improvement in technology. Even readily available technology such as smartphones have the capability to perform some sort of fusion of these realities. (van Krevelen et al., 2010, p.1-2) One version of combining these, and the one which will be explored in this thesis, is called augmented reality. In the article "A Survey of Augmented Reality Technologies, Applications and Limitations" by van Krevelen and Poelman, they define augmented reality (AR) as:

"AR supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world. " (van Krevelen et al., 2010, p. 1)

AR has become more common with popular applications like Pokemon Go² and Snapchat³. Pokemon Go, a mobile game that uses the smartphone's camera to show catchable Pokemon, cartoon animal-monsters, in your vicinity by overlaying the creatures and application UI on top of the camera. The messaging app Snapchat on the other hand has filters which alters the user or the environment. Some of the most popular of these filters are ones which changes the user's face by adding element or warping features. Interestingly both of these applications use the AR functionality not as the main purpose but as a fun addition to the application. The AR functionality is not even a mandatory part of using these applications, but something the user can choose to use.

2. Pokemon website [online] Available at: <https://www.pokemon.com/us/pokemon-video-games/pokemon-go/> [Accessed 23 Mar. 2019].

3. Snapchat website. [online] Available at: <https://whatis.snapchat.com/> [Accessed 23 Mar. 2019].



Figure 1 & 2 (screenshots from the game Pokemon Go taken in March 2019)

Like most fads or latest buzzwords just adding “new” features like AR can give an application some initial boost in popularity, but will lose its users if it is unpleasant to use. This leads to the main part of this thesis, design the user experience and interaction. Because of the new way of using AR in smartphone applications there are no tried and true and established guidelines for designing for it. Of course there are some which come from the limitations of AR overall e.g. the user getting tired arms because they are looking at everything around them.

2. Theoretical and methodological context

2.1 The Playful Experience Framework

The Playful Experience framework, or also known as PLEX, was first created by Korhonen, Montola, and Arrasvuori (2009), and further developed by Arrasvuori, Boberg, and Korhonen (2010). The design of the cards and their evaluation was made by Andrés Lucero, Evangelos Karapanos, Juha Arrasvuori and Hannu Korhonen. The version used in this thesis, in the form of cards, are meant to help the user think of different ways to implement one or more of the 22 different categories of playful experiences while brainstorming. They can also be used to analyze which type of playful experience a product or service has, e.g. game or app. The PLEX frameworks categories include:

Captivation	Forgetting one's surroundings	Fellowship	Friendship, communality, or intimacy
Challenge	Testing abilities in a demanding task	Humor	Fun, joy, amusement, jokes, gags
Competition	Contest with oneself or an opponent	Nurture	Taking care of oneself or others
Completion	Finishing a major task, closure	Relaxation	Relief from bodily or mental work
Control	Dominating, commanding, regulating	Sensation	Excitement by stimulating senses
Cruelty	Causing mental or physical pain	Simulation	An imitation of everyday life
Discovery	Finding something new or unknown	Submission	Being part of a larger structure
Eroticism	A sexually arousing experience	Subversion	Breaking social rules and norms
Exploration	Investigating an object or situation	Suffering	Experience of loss, frustration, anger
Expression	Manifesting oneself creatively	Sympathy	Sharing emotional feelings
Fantasy	An imagined experience	Thrill	Excitement derived from risk, danger

Figure 3 (Experiences and descriptions from Table 1. The Playful Experiences (PLEX) framework, Lucero et al., 2014, p.38)

The 22 different categories of playful experience were coined after analyzing

interviews with people playing 3 video games of different genres, and their experience with playfulness. The reason they chose video games are because of their history with invoking play and overall interaction design. The article also highlights Roger Caillois' definitions of play and games and builds upon it to two categories playfulness (*paidia*) and gamification (*ludus*). Gamification is described as "use of game-design elements, including points, levels, achievements, leaderboards, and (intrinsic) rewards, in non-game contexts to motivate and increase user activity and retention" while playfulness "as something not serious, with neither a clear goal nor real-world consequences". (Lucero et al., 2014, p.36-37)

There are two rule cards included in the PLEX card pack ⁴ with different techniques in how to use them. The first one is called "PLEX Brainstorming - for many ideas, fast", which guides the users into pairs with a randomly picked card in between them. The pair then take a couple more cards from the pile and motivate their analysis of which of those cards fits as an extension of the main card the best. This process is encouraged to be repeated. The other technique "PLEX Scenario - for more elaborate ideas" also has a pair dynamic but instead plays the cards your in a linear fashion. They draw three cards which acts as the beginning, continuation and end, and create a scenario of user experiences with them. They can also change the order or choose three out of seven.

A limitation mentioned in the article is it's "biased toward positive experiences, with only three of its categories—namely cruelty, subversion, and suffering—exploring negative aspects of playfulness." (Lucero et al., 2014, p.39). Having the positive with the negative gives the user or player a more well rounded experience as well as feels more like a significant experience.

2.2 Related work with PLEX

Studies regarding the use of the PLEX framework in designing services can be seen in Mekky and Lucero's article *An Exploration of Designing for Playfulness in a Business Context*. They used the PLEX framework together with the Scandinavian design agency Kontaktpunkt to test using the framework during different stages of designing services on two different concepts. The points in the process they focused on were the *idea generation*, *conceptualization*, and *evaluation*. (Mekky et al., 2016)

2.2.1 Idea generation

The group in the study used both of the methods described in the PLEX card guide,

4. Lucero, A., Arrasvuori, J. (2010). PLEX: Playful experience cards / PLEX Cards.pdf, Available at: <http://www.funkydesignspaces.com/plex/> [Accessed: 9.3.2019].

i.e. brainstorming and scenarios to generate ideas for remaking a web portal for Region of Southern Denmark's health services and products. (Mekky et al., p.3137-3138)

The conclusion of the experiment was that the participants thought it was a source of inspiration in generating ideas and led to a structured and fruitful brainstorming session. While it helped in the task at hand i.e. generation ideas, they already had restrictions and thought that it would have been "more efficient and have had a larger impact if it had been carried out at the early stages of the project". (Mekky et al., p.3138) The authors also mention that the project was somewhat difficult to find the appropriate fit of experiences in the PLEX card deck. Overall it seemed like a good tool but maybe not just with playfulness in mind.

2.2.2 Conceptualization

In the second study another group used the PLEX cards to determine which of the 22 different playful experience work best with the project outline received by the client. They used the 8 selected categories to design the concept and make decisions regarding it, which lead them to create prototypes and find unexpected and new experiences. The study found that using the PLEX cards helped in the aim of implementing playfulness and making concrete decisions from the outline. They also found that it fit into an established work routine. Using the PLEX framework in this way and at the beginning of the project, with a brief to start with made the project not only more client friendly budget and timewise, but lead to more freedom in designing it. Mention many times by Mekky et al. is the effect it had on decisions. Because the design decisions were based on research the people at Kontaktpunkt and their client had an easier time discussing them and felt more confident with making said decisions. (Mekky et al., p. 3139)

2.2.3 Evaluation

The evaluation process was to analyse the playfulness of a prototype by Kontaktpunkt and discover which of the 22 categories users felt suited it. The study was conducted in four parts: letting the participant become acquainted with the PLEX cards, using the product while commenting on their own actions and motivations, choosing the cards and rating them on a Likert scale and finally an interview on their experience using the cards. According to the article "The participants seemed to have a general positive feeling" (Mekky et al., p. 3140), finding them easy to use and helpful. Mekky et al. mentions that the design of the cards themselves might have affected which cards the study participant chose. As mentioned before, Lucero et al. also used the plex cards to analyse playfulness

in "*Playful or Gameful?*". They mention one of the shortcomings they found was rigidity of using the cards and suggested breaking each of the categories down further to explain them better to the user before using them. (Lucero et al., p. 38) After the study was conducted, like with most user testing, they knew how to proceed with the prototype and if the decisions panned out. (Mekky et al., p.3140-3141)

2.3 Related work in Playfulness

All the projects mentioned in the previous section concerning the related works using the PLEX cards and their implementation are also works which has playfulness at the center of the project. The articles focused mostly on the usage of the PLEX cards, with the playful aspect being secondary. The cards are also featured in the book *Plei-Plei!* (2012) by Fernaeus et al. as one of the many projects with playfulness at its core. Fernaeus et al. describe not only what playfulness is, but how to invoke it with a focus on the conjunction with technology. This is done with theoretical papers with descriptions of connecting prototypes, studies or experiences. The reason behind these prototypes are defined by B. Brown (Fernaeus et al., 2012, p. 11)

"We are interested in not just building those devices but in giving them out and seeing what happens with them when they are in different hands - whoever we can find to enjoy or to reject them"

According to Brown the definition of play is "continually changing" (Fernaeus et al., 2012, p. 11), which is further highlighted by the book by the diverse experiments which are made to apply playfulness. The theme of change is also noted by the evolution of technology used in the studies.

J. Holopainen writes about reversal theory in his essay titled *Exploring Play* (Fernaeus et al., 2012, p.14-15). How the proposed types of psychological states of this theory, telic and paratelic, one serious and goal oriented while the other playful and action oriented, and how these can easily change from one to the other depending on the amount of arousal and pleasantness and safeness of the experience itself. Holopainen depicts a scene where while walking to the store, a serious task, he saw piles of leaves, and after checking no one saw and he jumped around in them. He goes from telic to paratelic after accessing his surroundings to be safe (in a social sense). Similar to that, but with disruption as the key component instead of exploration is the *Balancing Playfulness* workshops. It described its purpose as exploring: "playfulness is on a continuum balanced by safety and disruption." The distributions the test subjects were exposed to were obstacles, e.g.

blindfolding them, in the different tasks that they were challenged to do. (Fernaesus et al., 2012, pp. 60-61) Both examples depict a fine line connecting feeling playful and feeling safe.

Cristian Norlin plainly states that playfulness is a “key factor” for the design processes “outcome [...] to be relevant and interesting” in his article about “Why playfulness matter to design practice”. (Fernaesus et al., 2012, p.44). Iteration within design processes is explored as a commonality which many of them use. Along with working in smaller stages and testing them separately comes natural involvement with user research; testing the end-users of a product or service and getting feedback. Norlin argues that the iterative design process help with trying out many ideas without being tied down by any of them, and that way people are more comfortable to try out new, out-of-the-box things. Though Norlin also mentions that iteration helps in making designs, it is not something which increases the creativity or innovation of design nor its processes. To be able to create new and innovative designs, according to Norlin, one needs to be able to be playful, it’s then when unique designs emerge. (p.44-45) The key experience, specified by Norlin, in innovative design is exploratory play. Exploratory play is helped by iteration reducing commitment to specific ideas and allowing the designers to challenge well known ideals or ways of designing. He also suggest that a playful environment is important to process as well. (pp. 47-48) Norlin’s core point is further emphasised by quotes from different people, like Kelley, Brown and Beaton on the importance of playfulness when it come to innovation. (Fernaesus et al., 2012, pp.47-49) In a similar fashion to Norlin’s article Knapp, Zeratsky and Kowitz write about solving things efficiently in their best selling book “*SPRINT: How to Solve Big Problems and Test New Ideas in Just Five Days*”. The best selling book about agile design processes made by Google Ventures employees is well known within design and development circles and has been itself been iterated for the most consistent result. In the Sprint the authors writes that it’s important to “solve the surface first”. (Knapp, Zeratsky and Kowitz., 2016, p.28) If the bigger idea is not going to work then the putting all focus on the smaller details will just waste time, not only on a fast prototyping schedule like the focus of the book (lasting only the aforementioned five days) but in all projects.

“How do you design for the joy of movement?” by Ylva Fernaeus (Fernaesus et al., 2012, p. 122-129) is an article which explores movement and joyful experiences and the attention which they have received during the latest year due to advancements in technology. She divides the article into 5 different themed examples of designing for physical movements and play. Within these 5 categories Fernaeus mentioned

many of the projects featured in the book to further demonstrate objective. The first of the five is about how interlinked experiences, in this case joy, are with your body. Human bodies have many senses (exact amount varies on definition) and all of them shape the experiences we have. Humans enjoy movement in different forms, and actively seek out things like sports. Both big and small movements have been exist, such as somaesthetic movements, and the size of the movement doesn't subtract from the joy which can be experienced. Fernaeus mentions different movement based technology which focuses on getting the user to move e.g. the kinect. This type of technology doesn't move itself, but with the growing popularity of portable devices opens up new possibilities. The projects and studies mentions in this section were ones designed to "encourage play through bodily movement" (Fernaeus et al., 2012, p.123). One example she uses is a study which observed how kids play with phones. The children still incorporated each other and traditional play with their phone used as extensions, and don't sit by themselves with their gaze lock firmly on their screens. Fernaeus notes separately that this is not only important when designing bodily experiences for children but for all. Theme two focuses on touch and physical objects and their relationship with joy and play, along with how to incorporate this into design. It explores the personalization and customization which come happen with devices (e.g. mobile phone cases) and how that relates to playing with toys. Peoples experience of playing is not only concerning the software of a device but the article brings up what consequences the hardware and its texture have on the experience. The third section is about digital feedback and especially hardware data is mentioned, e.g. accelerometers, radio signals and Bluetooth. New ways of collecting unseen data about one's surroundings. What is being sensed and how to use the information meaningfully. One key finding with mixing the digital medium and physical manipulation was that disruptions or failures of digital devices creates frustrated experience, even when it was first believed to be a small inconvenience. Fernaeus specifies that the research and exploration within this theme is new and thus put a focus on learning more about them so they may be used in future project successfully. Section four has a similar subject as section two on customization but focus on social experiences and performance. This research also brings up customizing personal items such as mobile phones although illustrates the way you accessorize your phone says something about the owner, or more correctly the owner wants to portray something about their style or thoughts with their phone accessories. This is one of Fernaeus's examples of that "designing for a human body normally implies designing for a social situation." (Fernaeus et al., 2012, p. 128) The fifth and final section highlights that there is also physical pleasures in leisure activities. Not all movements have to be high intensive sports to illicit a playful and pleasant experience. This type of experience is according to

Fernaesus often unplanned.

2.4 Related work in AR

Using AR in for navigational purposes is not something new, it was famously used by NASA X-38 in the 90s. (Delgado et al., 1999) Different types have popped up now and again, but it didn't become as popular or as a commercialized idea before smartphones became a norm. Nokia, for instance, came out with a map application called "City Lens" for their smartphone in 2012, in which they used AR as a way to see information about the users surrounding, e.g. shops, with added information about them like reviews. (Webster, 2012) More recently, in May 2018 there has been a big push from Google in mobile AR, not only in navigation but in other types of applications and the development communities as well. According to Roettgers in his article on the 2018 Google I/O convention they want to "augment everything, and turn your phone camera into a tool to browse the world." (Roettgers, 2018)

Not only has AR been used when navigating in aerial spaces or on land, but at sea as well. Marine electronics company Raymarine, using their own navigation system software and hardware which comes with a camera which the user attaches to the boat, called "ClearCruise AR"⁵. This program shows the boat's surroundings through the camera in addition to real-time information to help with navigation in the water. (Stein, 2018) This can be very helpful when moving through a busy harbor or just in unfamiliar places. There are many things which can not be seen below the surface: rocks, shallow waters, sunken ships, etc.

Wearable technology, or wearables, are the newest big futuristic technology trend and both the Microsoft Hololens and Google Glass are included in this category. While both are considered mixed reality, AR counts as part of it. They are essentially two different takes on AR glasses, one with a small screen of information from your phone in the wearers field of vision, and the other the small computer is in the headset instead of using the phone. The Hololens has more functionality, for example tracking its surrounding for connecting its 3D space and a functioning operating system. (ThioJoeTech, 2016) This is one direction of AR development which is still suffering considerably from the limitation of present technology.

New technology, in this thesis' case AR, in games is nothing new. As mentioned in the introduction, Pokemon GO is one of the few which have succeeded in combining a mobile game with AR. Pokemon GO launched in 2016 with the basic

5. Raymarine website. [online] Available at: <http://www.raymarine.com/clearcruise/> [Accessed: 9.3.2019]

functionality of the current application, the user could move around in the real world hunting pokémon which spawned in a locked locations and if the user was close enough they can see the pokémon and get a chance to catch it. There were also Pokéstops which the user could visit to receive more in-game items, these stops were often at cultural sites. Since then they have added gyms, battles and raids and more. Their AR functionality has stayed much the same through the different iterations of it. (Pokémon.com, 2018) According to a study made by Faccio and McConnell (2018) they estimate the cost of Pokémon go related crashes is about 5.2 - 25.5 million dollars during the first couple of months after the game came out. Not only driving while playing is dangerous, but walking around in the real world while focusing on your phone lead to people walking in traficated lanes without looking.

As mentioned by Montola et al. in the book Pervasive Games:

“Many pervasive games experiment with augmented reality, as such an interface could be a perfect way of adding game content to the physical-world” (Montola et al., 2009, p.13)

Even if there are differences with games and playfulness, as discussed in the chapter on the playful experience framework, they still both part of play.

Snapchat, Instagram, many makeup or face tuning apps are also using the camera function in smartphones to provide an AR experience. By using the camera not only for taking pictures but to also add live filters for a fun and playful experience. The filters are mostly focused on changing or adding objects to human faces and are often used when taking selfies. The other way of using AR in a smartphone is to point it not at yourself but at the world, some of the most known ones which use this are furniture shop ones like “IKEA place” or “Houzz”. The user can with the help of their phone see a simulation of how a piece of furniture would look like in their home. (Xue, 2017)

2.5 User research

One qualitative form of user research is conducting interviews from either potential or current users.

“Interviewing - which means conduction contextual research and analyzing it to reveal a deep understanding of people that informs design and business problems.” (Portigal, 2013, p.3)

4 key steps in user research or interviewing according to Portigal are: observing

people and the context they find themselves in, their behaviour and motivations behind them, understanding the gathered data and finally to use the information and knowledge gathered to move forward. (2013, p.3)

According to Portugal, there should be multiple interviews conducted throughout the design process of a product or service. He mentions that the analysed data, collected from specifically from interviewing users can lead to not only find new potential ideas and viewpoints, but to help understand the future success or failure of your product/service. The decision to hold interviews at this stage of the thesis' design concept is to, as Portugal puts it; "refine the design hypotheses". (2013, p.5-6) To be able to analyse the content of the design concept of the application and answer the research questions posed in the thesis, these need to be some sort of evaluation. Interviewing potential users and to hear their first impressions and opinions about the concept. This will also help in deciding the future path which to take with the application. In this thesis there will only be one user research session, but going forward, having more with a clickable prototype would be another useful one to have in this design process.

Knapp, Zeratsky and Kowitz states that 5 people to interview is the "magic number", after a study conducted on by Jacob Nielsen et al. in the 1990s. In this study, research consistently found most issues in just five interview. After conducting five, the interviewers will have found 85% of their problems and instead of interviewing another five or more for the remaining issues Nielsen recommends conducting new tests after correcting the ones already found. (Knapp, Zeratsky and Kowitz., 2016, pp.197-198)

3. Content

3.1 The initial concept idea

As mentioned in the introduction, the starting point of this design concept is an exploratory navigation app which uses AR to help the user find the correct public transportation stop before or during their journey. One of the features would be to for the user to be able to look at bus stops' timetables with just pointing their smartphone at the bus stop and seeing all the information you need, e.g. which busses stop there, and when they leave. Also having some sort of navigation to lead you to the right place was the other because personal experience with having trouble finding the right place because of unfamiliar routes, traffic, new buildings or just the change in season. The AR is an optional feature to a standard navigation application. Forcing the user to use AR all of the time is not only taxing for the user, because it often requires the user to hold their arm and phone up for an extended period of time, but for the smartphone as well. Battery drainage is a common side effect of using the camera, real-time location updates, not to mention other necessary processing to make an application like this run smoothly. While advancements in technology has helped with e.g. battery life, the interaction design still need to keep these types of limitations in mind.

The optional aspect also concerns the playfulness, the point is not to force a person to play but design something which may trigger or invite it. Playfulness might to add value to an everyday experience, such as when maneuvering oneself from point A to point B, especially when using AR. Designing playfulness, or as Montola et al. suggested:

“The designer does not design play but the structures, rules and artifacts that helps bring it about.” (Montola et al., 2009, p.xx)

3.2 PLEX scenarios

The first use of the PLEX cards was with the Scenario technique, because of the description of it being “for more elaborate ideas”. (Lucero and Arrasvuori, 2010) Having a concept to start from, the focus would be on making the interactions more playful and thereby creating a more meaningful experience. The cards themselves were well designed, having both the two pictures and descriptive text helped to open up the category title. The advantage of the three card scenario technique is that it forces one to think about the design from different angles and even when if

you know that the scenario isn't what you are looking for. Completing it makes for a great exercise as well as eliminates options and discovering them, making the idea more focused. Similarly, the disadvantage of having only three cards is that sometimes they just don't work with your concept and trying to find a way to force them to fit is time consuming and unnecessary. The scenario technique where the user picks 7 PLEX cards and chooses 3 of them, worked better with finding relevant cards to use. While deciding on the three remaining experiences, the user not only has to figure out which one works the best for the app concept but how well they work with the other cards in the scenario. Testing the cards as a single user was also interesting, as the other literature e.g. Mekky et al. (2016) had a group of people involved in the design process.

Playful concepts for the whole navigation application came more easily than just the AR experience. This may be because of ingrained patterns of thinking on previous experiences with designing user experiences. Another reason might be of the added limitations of designing for a smaller part than for the whole. Some of the categories came naturally with AR, like simulation which is part of the definition of AR. Other categories were a poor fit, e.g. captivation might not be ideal in terms of how AR is optimally used, if you want something with a short use span. Furthermore there were other factors than just requiring the app to be open for a long time to use which were undesirable from a design perspective, such as cluttering the screen so that the user can't easily find the important information they are looking for.

3.2.1 Scenario 1

Cards drawn: thrill, submission and nurture.

The scenario from this combination of cards gave at first a quite general scenario in which the user would use the application. Thrill could symbolise the feeling people get when in a new city. Getting lost while exploring and having to submit, "ask" for help, through the application. Using the application because the user cares for their time, and helping you to your destination on time is the main purpose of the application.

The first scenario might have been a bit general because of the fact that it was the first. Learning how the PLEX cards worked was a bit confusing, especially on how specific to make the scenario. The descriptive text and pictures helped in thinking of the category in different angles and giving the category a wider range.

3.2.2 Scenario 2

Cards drawn: cruelty, expression and subversion.

Being unmotivated, in a creative rut, feeling unwell or exhausted can all be a for of cruelty in which the user begins their journey. Exercise has been proven to help with these forms of cruelty. Combining exercise with expression, the application would suggest a walk past street art or park instead of the shortest route. Making your own route based on special locations in map. The subversion of not taking the shortest route and keeping to the same old routine as you usually.

Another version of the same cards were instead of focusing on exercise have the expression be a part of the user's experience. The user can choose to perform some sort of dance steps shown by the AR. Exercise may happen along the way, if the user get's enthusiastic and depending on the suggested moves and not of distance walked.

Trying to fit the three categories into a narrative with is similar to having strict specifications for a project, only to one step further. This new way of thinking of design rarely happens under normal work circumstances. Cruelty was hard category to think of, because often when designing the UX, you want to make the experience as pleasant as possible. In game design on the other hand, it is well known that the player needs to feel sad or frustrated to then enjoy the happier parts to the fullest. (thatgamecompany, 2013)

3.2.3 Scenario 3

Cards drawn: discovery, fantasy and relaxation.

While walking using the application, the user discover something new, fantastical creatures living among us seen through AR. This new sighting engages the users imagination and curiosity. Adults find their inner child which makes them feel nostalgic and relaxed.

The difference in age in this scenario is more pronounced than in the others. Relying on nostalgia, is a common marketing strategy, but is unpredictable at times. It can also make your target group more narrow, removing age groups are experiencing it for the first time today.

3.2.4 Scenario 4

Out of seven cards drawn, suffering, sensation and completion were chosen.

The user, hurrying to their bus, suffers because they missed it. They open the navigation application to see when and where the next possible one is. The AR options visual effects of adding new items to the everyday surroundings excites the user. Finding the next best option for them, the user follows the directions given by the application. The sense of completion is felt when they sit in the new bus on their way towards their destination.

In this scenario the sensory additions of AR would be a reason for playfulness.

3.2.5 Scenario 5

Out of seven cards drawn, control, exploration and simulation were chosen.

The user sits inside wondering when they should leave for the bus to minimise the time spent waiting outside. Taking control of the situation by opening the navigation application and choosing to use the AR function to help them explore their surroundings. By using the application they see the bus stops' schedules and know at what time they should leave to catch the correct bus. The imitation of everyday life with the sought after additional information produces simulation the final category of the scenario.

The PLEX framework gave several different scenarios in a concentrated period of time. While it took some time to getting acquainted with using them, for instance in how specific one was supposed to be, it helped overall in thinking of the applications from various angles. Focusing on the AR as a specific feature to enhance was hard, possibly because it was a smaller part, or practiced ways of working and thinking in the past taking over. I found overall that some of the categories of the seven drawn match better and more naturally with the AR element, such as exploration and simulation. It worked quite intuitively and as a tool used alone.

3.3 Designing wireframes

From the five scenarios the one which stuck out as the best fit to the original concept and its limitations was the second scenario. The second narrative arc was of giving an option for the user to express themselves, especially their playful and maybe even childish side, on their route to their destination, e.g. a bus stop. Having

the AR feature instead of showing a straight line show dance-like steps. The dance steps evolved through brainstorming to other similar type of playful movements which fit the criteria of the application. For instance hopscotch squares, and avoid crossing or touching the line while walking, often seen done by children to make their journey more like a game and more interesting. The user would still see the direction where to go but have the option to do something out of the ordinary for most, which in turn might bring an extra playful aspect to an everyday moment. There are rhythm games which have this type of mechanism of guiding the player to do particular movements, e.g. Dance Dance Revolution and beat saber. Unlike Dance Dance Revolution, where the player is guided to steps on arrow pads at particular moments to the beat of songs, this application idea neither punished the user or has a certain timeframe for the movement to happen. The experience which the second scenario is trying to create is similar to the experience described by J. Holopainen in Exploring Play (Fernaesus et al., 2012, p.14-15). Experiencing the same sense of sudden playfulness and feeling comfortable or safe enough to act on it. The playful act itself will feel different from person to person because everyone has their own comfort zone and actions which would be more enjoyable than others depending on their background. Some people, for example, love to dance while others are adamant to never to even sway to music. In the article "How do you design for the joy of movement?" by Ylva Fernaeus it reads "Designing for a human body normally implies designing for a social situation" (Fernaesus et al., 2012, p. 128) which is true in this design concept. This is a concern of designing movement based playfulness which will happen in a potentially social setting.

There seems to be mainly two modes of behaviour that stand out: those who have a complete route with a starting point and an endpoint, more used if going a new route or if there are changes with the mode of transportation. The second mode is those who only have a starting point, the user's current location, know where they are going and which transportation are an option for them, mostly choosing one based on the time or distance to the stop. For the users using the application in the first mode, with both a start point and an end point, the user interface will automatically highlight the correct transportation as well as the trail in AR. On the other hand the second mode, with familiar simple routes, will give the option to see the trail direction if the user wishes to see them, by clicking on a button. This is to keep the screen as clutter free as possible and only showing the necessary information. If it is a familiar route they will probably only check the timetables instead of using the AR directions.

Properties needed for the application to function at navigating with local

transportation is the users', destinations' and local transports' location information. Also time estimations, journey information and timetable information is necessary to make the application informative and practical to use. Based on all of this information wireframes depicting the user experience were made. Going from a normal map view (Figure 4) to AR by clicking on a button, having it loading the AR view (figure 5).

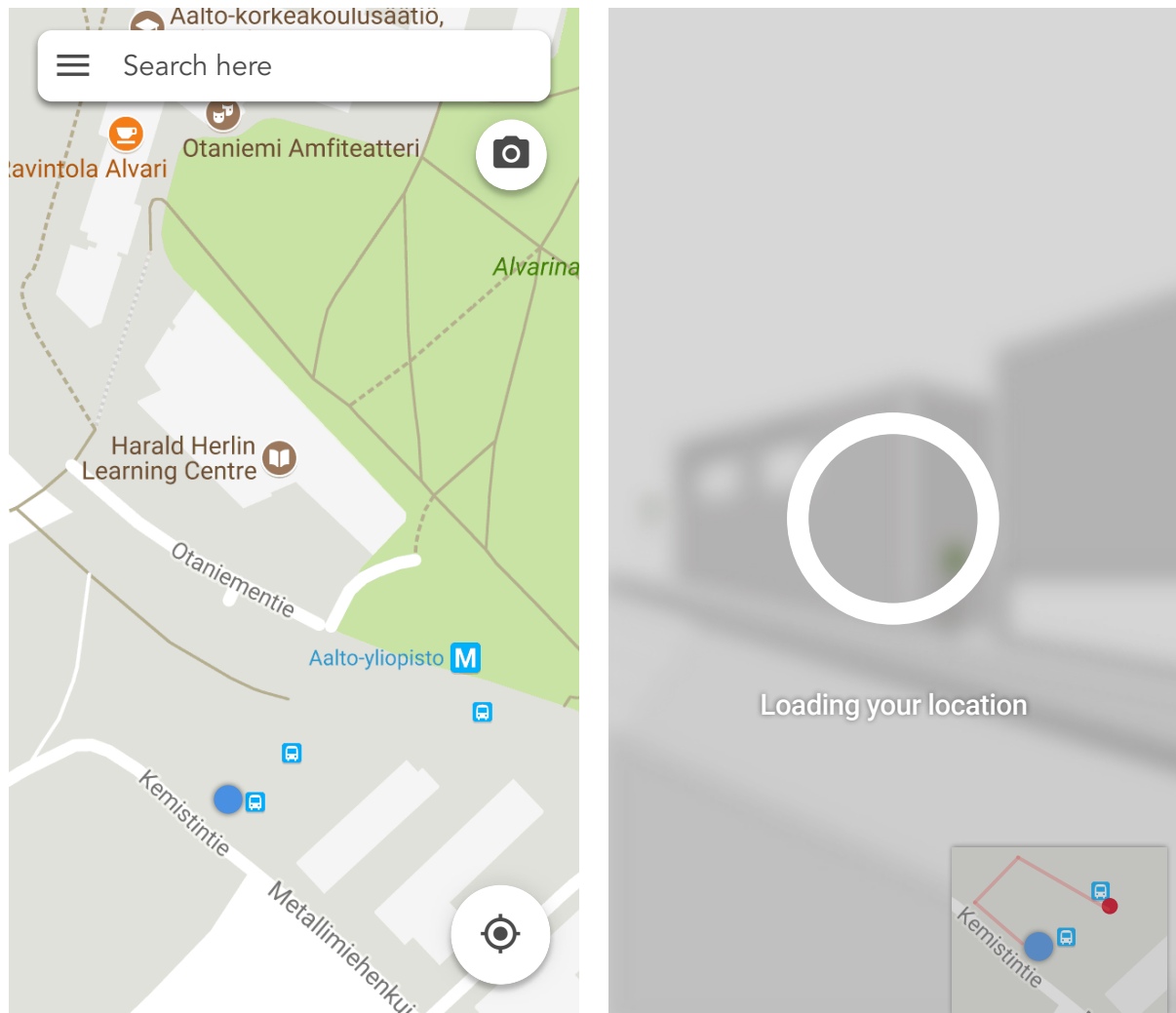


Figure 4 and 5. (Mockups of navigation app with normal app view and the transition screen map and AR view.)

From here on the user can see all of the closest public transportation stops near them, by the small indicators (seen in Figure 6 and 7). Clicking on one opens it so you can see more information about the stop. Figure 6 and 7 show the difference of behaviour modes one and two. One with the bus number highlighted and the AR directions on and the other without.

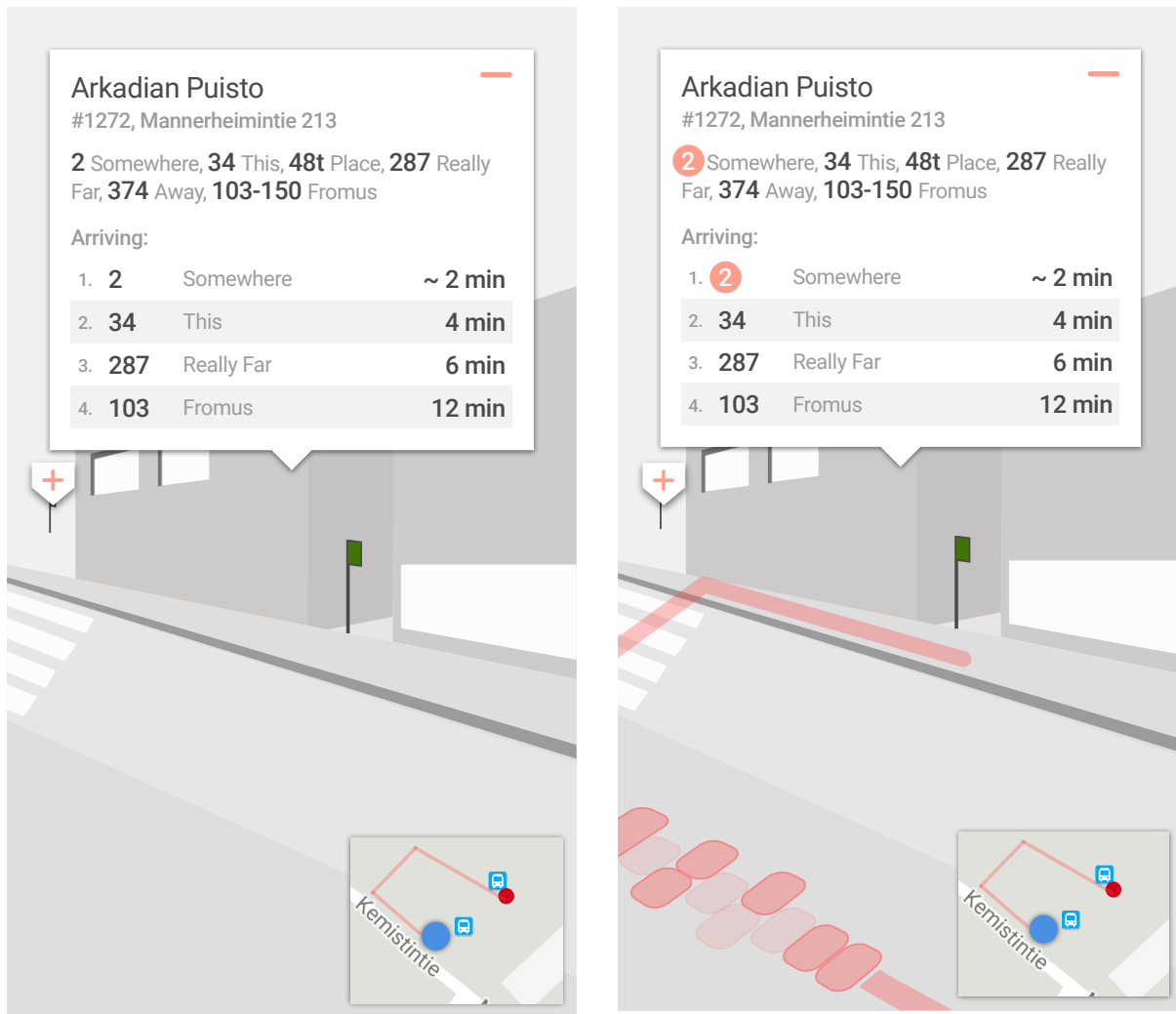


Figure 6 and 7. (Mockups of AR view with and without chosen route)

While these wireframes explain the initial idea of the application it is missing the element of being live. To communicate how this would work in an actual application in the simplest and resource wise lightest way, is to make a video. The video will help simulate using the camera with AR to prevent misunderstandings when presenting the design concept to others.

3.4 Result

AR in the design concept uses the camera as its core functions, and while it can be conveyed through 2D images, have actual moving images to simulate using it works better to give a better understanding of how the application functions. In their book "Designing with video" Ylirisku and Buur go through how to use video in user-centered design in different ways during the whole process with case studies, not only in the concept stage. Video, according to them can help with describing and exploring new designs as well as relating to them. (2007)

Receiving an preliminary impressions of the design concept both with and without the playfulness added with the PLEX cards in mind is important. Being able to see if the playful feature is something people would not only use but would actively encourage further engagement with the application. It could also be on the other end of the spectrum, and prevent the user from ever wanting to use it ever again.

See appendix 2 for video.

3.4.1 Interviews

There were 6 participants which were interviewed separately and each interview session lasted around 15 minutes. They were held in a room to avoid distractions from the surroundings. The interviews consisted of a short oral introduction, watching the video and asking questions, some about the interviewee; their background and usages of apps as well to make them more at ease, and then their opinions on the design concept. The summary as well as the questions was dictated to the participant during the interview. The audio of the interviews were recorded and transcribed to a separate text (appendix 1). There were only two people present during the interview, the person conducting the interview and the participant. The reason for the interview is to try to narrow the target group and because the way the interview subjects were chosen as a convenience sample, all age groups may not be represented. The preliminary target group for the interviews is 18-50, quite large but after feedback hopefully an idea of a more precise, narrower range is possible.

Summary introduction text for the interview:

"An addition to a navigation app which uses AR, or augmented reality, to help the user find the correct public transportation stop before or during their journey. You may find a cheeky surprise guide you to your destination; dance steps or hopscotch. Navigate in a mixed reality space where you see your surroundings with additional information, to help you on your way."

Interview questions:

1. A bit of background on you:
 - a. Could you tell me your occupation?
 - b. Age and gender?
 - c. Nationality?
2. What are some of the apps on your phone you use the most?
3. How tech savvy are you, scale 1-5 (5 very knowledgeable)? Why?

4. Do you use navigation apps? If yes, when/what for?
5. What is your first impression of the app concept I showed you?
6. Do you perceive an overall need for this type of AR application?
7. Would you use this app?
8. What would you use it for?
9. How do you feel about the hopscotch/ jumping part in the video? Would you use it?
10. Was there anything surprising or unexpected about this app?
11. What's most appealing about this app?
12. What could be done to improve this app?
13. Anything you would like to add? Thanks for your time.

Participant 1; 31, Finnish, unemployed, was not new to AR and had used it on a mobile phone before, but avoided it because the clumsiness of the experience with it turned on. She uses 2 different navigation applications depending on how and where she is going. The overall impression was that she like that it seemed fast and handy for quick decision making. The playful aspect was stated as fun, but needs to be optional because of people might stare. She mentioned it would be nice to have the app prompts the user to look up at interesting things around you when you walk past, because people look down on their phone a lot already. Mentions of futuristic tech being fascinating to her and she would like to be able to try it out.

Participant 2; 32, Finnish, software developer, he mostly uses news and music applications and as far as navigation apps so, he is using ReittiGPS, which he bought back in the day of iphone 3GS. He mentioned multiple times the experience as why he uses certain apps over others as well as one of the challenges with AR applications in his opinion as a software developer. He also sees navigation AR as "obvious usage of AR technology" (appendix 1, p. 42) and is surprised that it isn't already available, but muses that it's probably held back because of the hardware. The most frustrating part with using his phone now is using the keyboard and input fields and would like to have something that makes that element even more convenient in everyday life. He like the playful aspect of having something "funny or unexpected happen" (appendix 1, p. 43). Hopscotch he maybe wouldn't try out, especially in public, but maybe something else like avoid walking on lines as he has as an example.

Participant 3; 27, American, freelance illustrator, uses a variety of different apps on her smartphone, the thing she mentions that she doesn't use if for is mobile game apps. Liked the AR and hopscotch, but wasn't sure if the app was for her, as she is

already so used to Google Maps. She mentioned it seemed useful to people who are travelling in unfamiliar locations, and added that maybe there could be some type of information on monuments and such about them, to cater more to the tourist. She also talked about gamify the playful part, with things like collectables. She was one of two people who immediately said they would try the hopscotch out and wouldn't be embarrassed.

Participant 4; 39, Finnish, communication manager, uses mostly social media and new sites and her main app for navigation is Google Maps. She liked the concept and would use it, but feels like it would make her even more of a "lazy navigator" (appendix 1, p. 47), that what Google Maps has done, as she stated that she uses a paper map while navigation the sea. She was the other interviewee who wouldn't be embarrassed to be playful in public and would absolutely jump along to the hopscotch. In P4's opinion, children could benefit from this app, as they "don't have that strong sense of direction" (appendix 1, p. 47). As an additional feature to improve the application she mentioned having some sort other feedback than visual (e.g sound or haptic) to warn the user if they are going the wrong direction.

Participant 5; 21, Finnish, student, uses mainly communication applications, including social media ones. He doesn't use a navigation application very often, but when he does, he uses Apple Maps and Google Maps to find exact locations or when driving. He thought it was really interesting concept, because he had never seen something similar before and was also curious on how it would work technically. At first he said that he wouldn't use it but try it out. When he got an answer about the 2D map view said that it made it "quite appealing". (appendix 1, p. 48) He states that it seems easy to use and because of that would be good for children. He also mentions it would be good for tourists and people in unfamiliar cities. He said that the playful aspect looked like "it made the journey a bit more fun. [...] I would definitely try it out. I think it would be fun actually." (appendix 1, p. 48) P5 also commented that people already look down on their phones considerably often and not that their surroundings.

Participant 6, 67, British, principal lecturer, uses a variety of mobile applications, but for navigation he uses Reittiopas and Nysse, when he needs to be somewhere at a specific time or travelling in unfamiliar regions. At first he didn't see if it's a significant problem because existing apps do it well in a 2D map, but later during the interview says that it would give at least him peace of mind to have extra confirmation that you are going the correct way in a place with many possibilities. The only compelling AR he remembers seeing is in navigation, though talking about

indoor navigation in hospitals. He also states that this quick reassurance is what is the most appealing thing about the application, and If he would use it he would use it for this. P6 was non-committal about the playful aspect, and didn't see himself using it because when he uses navigation applications he is in a hurry and doesn't want to be distracted. He said that the "basic project makes sense" (appendix 1, p. 51) and that it works as he would expect it to, just to add maybe more "hooks" (appendix 1, p. 51) from the AR app to the real world by notification.

To see to the document used for the interviews and additionally the video shown, see appendix 1 and appendix 2.

4. Discussion

As Portigal writes in his book that holding interviews is a way to gather user information, which in turn helps with development. He also mentions that the insights which you gain “not only informs design but also inspires it”. (Portigal, 2013, p.3-4) The interviews were conducted with a handful of subjects of varied gender, age and cultural background and occupation. The “magic number” of participants according to Knapp, Zeratsky and Kowitz is 5, but to get an even number of women and men, 6 participants were chosen. Both Norlin and Knapp et al. recommend agile or iterative development. While Knapp et al.’s design process always end in user testing and is one of the key elements of their famous way of working. Norlin mentions it more as an informative but optional part of a design process.

The target group started out as people of all genders and a wide age range, similar to people who use navigation applications. They also have to own a smartphone, because of the type of application concept design this thesis explores, as potential users they need to own the device it would be on. This was because of the varied age range of people who use navigation application and to gauge reactions to the playful addition as well as the AR. One hypothesis before conducting the interviews was that there might be more positive feedback from younger people, because of the playfulness aspect and because they tend to easily become immersed in play, learn how to use new technology faster (AR) and be seen as not as set in their ways. But on the other hand there is a time in young adulthood when others perceptions of the image you portray is very important, and you might be more suspendable to peer pressure, which consecutively might lead there to be not as well perceived by them because of unwanted attention. Fernaeus talks about this in her article on designing for joy of movement on how performance and the social aspect that need to be considered when designing with the body in mind. (Fernaeus et al., 2012, p.126-128) From the interview the people that were to most distant application was the youngest and the oldest participant. The overall feedback gathered from the interview was positive. Four out of six people asked when it’s coming out and five expressed that they would like to try it. Though the general positive reaction to it all in some form or other mentioned seeing how it compared to other navigation apps they are already using to see if it could be a replacement or not. And while they saw a need for it none expressed to have a personal need for it, more of a “like” or nice-to-have. Two people mentioned that it could be useful if you are a tourist and don’t know the city well, one of the especially mentioned that if the signs are in another

language like Japanese, it would be helpful. This sort of application could be used in maps/apps for events like festivals or indoors, like P6 described with the hospitals or in museums to navigate through the exhibits. Then the playful experience could relate to the surroundings in a different way. Something mentioned by two of the participants is that the application would be useful for children because they might have a harder time to transfer the 2D map information into the 3D world and it seems easy and fun to use. Four people, on the other hand mentioned that seems, in some sort of way, easy to understand. The next user testing opportunity should also include children to see if this would be true.

Three of the interview subjects were in the IT-field. The lowest self score of tech savviness was 3/3,5 said by P4. P2 on the other hand didn't give a number, but said that he is "fairly knowledgeable" with computer science and mobile devices, which would probably come up to a 4 or 5 and with the additional information that he is a software developer, would probably end up with a higher number on the scale. All of the participants seemed confident in handling technology, e.g. P1 mentioned that they always find the information they need either by their own or online and P5 mentioned they are always able to fix technical issues when doing projects in school. This understanding of technology might be what made them both grasp the concept quickly and also why it seemed easy to use even if they haven't tried a live prototype and might also be the reason for the mostly positive feedback. People less tech savvy or not in the tech business might have a different reaction. None of the people interviewed mentioned having used an application with navigational AR on it before, while some have seen or heard of examples in the past none seemed to be currently using one.

The type of experience that Holopainen (Fernaes et al., 2012, p.14-15) writes about on the shift between telic and paratelic states when he jumped in the piles of leaves is similar to how the playful part, hopscotch, dance moves, etc., in the app is supposed to work. Going from serious and task oriented, with a destination in mind, to playful and action oriented, jumping hopscotch, when back again. Even if none of the interviewees tried jumping themselves, five of six said that it looked fun. Two participants said they would try depending on where they were in context of people staring while two others were very enthusiastic and unembarrassed about participating in the playful part of the app. Participant 1 stated that they would use the application if this was optional. As Holopainen mentions, some felt that in that type of situation their safety was compromised. Figuring out which playful experiences work the best within the app, furthermore conducting user testing on which of experiences, e.g. hopscotch, to determine which ones to keep. Both the

dance steps and hopscotch could be generated data, so it's a bit different every time, but too not feel too random or difficult there would need to be some rules to not make it truly random. The playfulness was quite well received looked enjoyable to most, so it would seem that it has potential to add value to the application experience. This can not be tested to its full extent until more and longer test with a live prototype with real data is tested, but seeing this seems to be the right direction with some user feedback helps the project move forward.

As mentioned in an earlier chapter, the concept design of this thesis would focus on the visual design and playful user experience and not e.g. sound design or haptic feedback. Sound could add another dimension to this application and haptic feedback is not explored past normal use. Fernaeus writes about different types of project with somaesthetics, or bodily aesthetics in mind first instead of the visual. While the visual will be the main feature of AR, doesn't mean that the other senses can be engaged as well to create a more well rounded experience. She also comments on the joy of leisure movement, which walking is and the playful experience in the application would most probably be categorized as it as well. These bodily movements have as much possibility to bring enjoyment and playfulness as the more active ones. In the article Fernaeus writes that leisure movement is often spontaneous, which fits with the design concept well and build upon it. (Fernaeus et al., 2012, p. 123-129). Two of the interviewees commented on a want for additional feedback, while only one of them, P4, specified "beeping and vibrating", the other, P6, talked overall about hooks between the AR application and the real world: having notifications which tell you that you are there and links the bus stop number together. Designing the sound and haptic design would be the next step in this project.

Another problem found out through the interviews was the timing with the playful aspect of the application. Half of the people interviewed voiced that the playful aspect could be a distraction if you are in a hurry. It is an optional feature, the user doesn't need to act upon it, but if it's still considered distracting or cluttering on the screen this could be fixed with only adding the playful aspect within parameters of when the user has ample time to reach their destination. If a user is using the AR guiding line as more of a quick check, holding it up for only a few seconds to see the right direction before pocketing the phone, then the placement of the playful experience will be more significant than if someone is using the app for the whole journey. Furthermore having the playful experience perpetually at the start would make it less of a stumbled upon event, even if you know what can happen you don't know when.

P1 and P5 both brought up that people are already often looking down at their phones. Although this would work well with the application, having the user see part of the world through the screen might lead to traffic accident, which was an issue with the Pokemon Go application (Faccio and McConnell, 2018). Pokemon Go only shows the AR when the user tries to catch a pokemon and the user stands still, not while they are looking for them in on the map provided by the game. Having some notification or reminder might help with this, but it's difficult to know how significant this would help, as well as how significant the phone would block your view or take your attention from your surroundings without testing a version of the app in real use. Especially if children are using the app, like P4 and P5 referred to as being a potential target group, showing these reminders to look around might be beneficial if not necessary. Conducting user tests with not only children but adults as well would be part of the next step with going forward with this project in the future, after the thesis.

Having both the traditional map to get back to the classic map as well as see yourself on it could help with the transition to using the AR map, something familiar and a way to give it more context into the real world. P5 was more convinced that he would use the application with this feature, not just either or. The reality of having a small window through which you look at world, as P2 mentioned, is a possible issue. AR application on smartphones usually use their camera in two different ways, either to look at your surroundings, like this design concept, or of focusing on the user, e.g. Instagram and Snapchat.

4.1 Limitations

The first limitation is in the device itself, with focusing on AR on smartphones and not other mobile devices. This is because of how smartphones are used in day to day interactions and the availability of them. As mentioned previously the concept is about an addition to a navigation app, with a focus on the AR experience not the whole navigation app itself. This focus is not only because there are already plenty well made navigation application, but so that the design concept could easily be added as a feature to already existing ones. Getting people to replace the application they currently use is challenging, even if it has some flaws. Many of the interview participants used multiple navigation apps to compensate for demands not being met.

While games have become more mainstream and accessible, and gamification has become popular as well as a buzzword⁶ within multiple fields, the focus will

6. Google Trends. (2019). gamification - Explore - Google Trends. [online] Available at: <https://trends>.

be on playfulness. Playfulness has a more organic way of integrating into designs furthermore gamification often requires consistent participation, which both has its good and bad sides.

The first version of the design concept and the version made in this thesis will have a focus on interaction and visual designs, because of the very visual nature of augmented reality. Exploring the potential of sound design in an AR application is another thesis topic in itself.

The product for the user research in this thesis is only going to be a visual and auditory representation, and non-interactive version to test. Prototyping comes in different forms, and while you could code a simple version, it's still good to get some data first in a more time and money efficient way, to gauge if the project is going the right direction. Qualitative research, in the form of individual interviews have its own pros and cons. They are usually less structured than quantitative research options. Also a smaller group of interviewees possible in qualitative than in quantitative research. Because what's being measured in this thesis are the impressions and motivations and not specific data, qualitative is the best way to accomplish this.

5. Conclusion

Switching to a new app after using one for a long time would be hard, as highlighted by the interviews. Navigation apps on the market are mostly well made, even though most of the interview participants used more than one, which indicates a need for improvement in them. This is why the design concept is thought of as an addition to an existing map application. The interview subjects had an overall positive reaction to the app, many said it was interesting and that they would want to try it. The AR seemed to intrigue some of them and the playful experience also received a few excited exclamations. The feedback received hints to a higher probability of the playfulness having an effect of adding value to the experience of the application. All in all the design concept explored in this thesis has potential.

Changing known issues, for instance the timing of the playful experience, adding haptic feedback (which will be easier with a live prototype) and creating a visual design style more than they wireframe exterior which it currently has, would be the first move in the next course of action. The workable prototype will probably unearth unthought of problems and highlight known and some redesign is most likely a must. Technology wise seeing how well AR works for on the smartphone even with fake data would be interesting. Testing with real data would be the better option to see how well it would work as a product, especially critical is the location accuracy and the application speed which must both be high. As Fernaeus remarks the feedback of digital feedback is crucial for the app to work well and for the user to not get frustrated. (Fernaeus et al., 2012, p. 126-128) One of the reasons why people in the interview would use it was because of it seeming handy and disturbing that ease of use would discourage people to continue using it.

After the most noticeable issue have been fixed another round of user testing to gauge the reception of this version and find missed problems. The next round of interviewees would be within the same age group as the last one with the exception of interview a couple of children as well. Two people in the interview observed children as a potential user group and as they were not part of the first interview, having this feedback will help in deciding the future stages of the project.

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Nintendo , Pokemon Go screenshot (with AR turned off), [Accessed: March 2019]

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Mockup of navigation app with normal app view with AR camera button.

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Mockup of AR view with chosen route.

Appendix

Appendix 1 - Design concept interview questions + transcripts

Interview transcripts

Masters Thesis 2019

Idamaija Pitkonen Piguet

Summary

The concept: An addition to a navigation app which uses AR, or augmented reality, to help the user find the correct public transportation stop before or during their journey. You may find a cheeky surprise guide you to your destination; dance steps or hopscotch. Navigate in a mixed reality space where you see your surroundings with additional information, to help you on your way.

[show video]

Questions

1. A bit of background on you:
 - a. Could you tell me your occupation?
 - b. Age and gender?
 - c. Nationality
2. What are some of the apps on your phone you use the most?
3. How tech savvy are you, scale 1-5 (5 very knowledgeable)? Why?
4. Do you use navigation apps? If yes, when/what for?
5. What is your first impression of the app concept I showed you?
6. Do you perceive an overall need for this type of AR application?
7. Would you use this app?
8. What would you use it for?
9. How do you feel about the hopscotch/ jumping part in the video? Would you use it?
10. Was there anything surprising or unexpected about this app?
11. What's most appealing about this app?
12. What could be done to improve this app?
13. Anything you would like to add? Thanks for your time.

Participant 1

1. I am currently unemployed, but I've graduated University last summer. I'm 31 and female, Finnish.
2. Currently I think, to my shame Pokemon Go and then Twitter, Instagram and probably Reittiopas to check for public transport. And also Google Maps.
3. I would say 4, I know the basics but if I would have to do some, for example extra settings which don't show up in the usage of the app I would probably go online to try to find information.
4. Well , I usually use Reittiopas more for transportation, while Google Maps is for routes if I need to walk a certain distance and I also usually use both at the same time because they might give different suggestions. Like I know that in other countries Google Maps is very reliable for public transport but I'm not quite sure how it is in Finland. But yeah, it depends, I usually I use the Reittiopas for transport, but sometimes because if i need to have, I think that Google Maps sometimes has, you can see sort of the distance better but then Reittiopas has the details for the tiny alleyways and things better, it's for more detail if I need to know exactly where to go and small pathways show up better, I think.
5. I think it's very interesting and especially if you would think of a place with many many bus stops to find and be able to pinpoint the one you need quickly would be really important. And the only app that I have used with AR is Pokemon Go, and there I always have it turned off because it's so much slower and so much clumsier than having it turned on. If this AR app would work quickly then it would be very useful, especially when you need to like switch transportation or something, then I can see that that would be very handy.
6. I think for quick decisions it could be very handy. As far as trying to find a route, then there are apps for that, but if you need to get the finer details, then it could be very useful.
7. I would like to try it. I don't know if I would need it, but because sometimes Reittiopas is slow and it might not always show the, if you walk it might show your GPS point being not where it is exactly. It's nice to try to find some apps are more precise at certain times, maybe because of data traffic or something. But I would definitely try it out and see what it does.
8. I think I would try to see if it's better than the Reittiopas, basically because Reittiopas is sometimes clumsy and there are times when my own opinions differ with Reittiopas. Like basically the stop that I need to get off on with the bus if there is another route I would like to take. In Google Maps you

can move the route, so that it will estimate your time again, and you can choose a different road to walk or something. But reittiopas doesn't allow you to do that. So if let's say you want to get off a stop earlier you need to do big adjustments for your route to be able to, sort of do that. And I had a couple of weeks ago, a thing where I had to walk in an area where there was construction work, but because it didn't show up in the data for reittiopas it didn't give me any alternate routes. So be able to manually move that would be very convenient.

9. I think it's, if it was something that you could choose, opt in or opt out of, that would be fun, because it's one of those because it would be a new think people would stare and it's always, im taking pokemon go again as an example, before people know what's going on, they will look at you funny and that might be something that would prevent people from enjoying the sort of funny aspect of it. But yeah, I think it's fun and also if there are some interesting sites or interesting electric cabinets or something, something basically that you should look up from your phone to see, then that would be cool to enjoy as well, because when you have your phone in your hand, that's the thing you'll look at, most of the time.
10. Not really, it's more of a thing where it would be interesting to know what would be different compared to other, it's a navigational app in the end right? I am not really sure if there was anything unexpected because I had no expectations, so I don't know. And have nothing really to compare it to that would have AR in this type of way.
11. Well, like I said, if it was fast that would be very handy, because sometimes you have for example, so many bus stops that you need to find the right one in a very short time. Let's say that the bus came with is a little bit late and then your transfer time is even shorter and you need to make a decision really fast, then that would be very very good to see immediately where you need to go.
12. Well I would be able to tell you more if I had it, and had actually tried using it. I think it's going to be a thing of those what can it give the user that these other apps don't have, and this AR aspect is obviously one of them, but is there something else the functions which makes the user want to use it. And the hopscotch thing and adding other details might be something that make the navigation fun, so that could be interesting to see.
13. I would really like to see this app working. I had a friend who was helping develop an app earlier but I don't think that the app ever made it to actual users, so it would be fun. And I'm always fascinated by new technology and new ideas, and I'm so happy that we don't have to only rely on paper maps

anymore. So even AR sound really cool, like a futuristic sort of thing.

Participant 2

1. Software developer, specializing in mobile frontends. 32 male Finnish.
2. One of the apps I do use the most is the Reitti GPS app, which tells me where to go and when to catch the bus and stuff. Specially very handy in unknown locations where I happen to traveled quite a bit. And apart from that would probably be music applications which I use a fair bit, but also these kinds of news digestive apps like Flipnote, Reuters and Dagens Nyheter and these kinds of things.
3. It depends on the context. If it comes to computer science, fairly knowledgeable and mobile devices as well. As a user I usually don't have a problem finding/navigating these kinds of consumer spaces.

Question about the ReittiGPS app:

Well back in the old days before reittiopas was a pretty good user experience where the alternatives for the first generation app store apps, like for the phone model 3Gs or something, and that was like this one guy who implemented the public API into this payware app which just had a nice interface in the app. And since I bought it for a couple of bucks so I continued using it ever since. So I use that more actually than the public service Reittiopas. However the public service reittiopas now is fairly good actually also.

4. It's either about getting some information about something that I happen to be needing right then and there which is highly contextual. For information consuming it's mostly then I'm on the go.
5. The first impression of this is that I would like to have it. It's something that I think is pretty obvious usage of AR technology, is finding your way around. For consumers it's usually about finding unknown locations out in the open. Which is barely, likes in a fairly straightforward AR concept but also has challenges. It looked appealing and as a concept it feels like something I would like.
6. Yeah sure, I guess it's like need or need? I think it's going to become the de facto standard at some point, that's more how I perceive it. It's more that this is the way information we will be provided, during the coming some near future. So instead of having a website, Reittiopas kind of thing where you fill in the fields and look at a 2D map like that default experience is going to

become this sort of AR experience. How we went from text messaging, to web then AR. It's a good question on whether we need this, I think we don't perhaps necessarily need it, it's more about it's very convenient to have and that's why it's going to be a demand for it because of convenience.

7. Yeah, definitely try it.
8. Well I would replace it with what I use ReittiGPS now. It's true that the concept here is perhaps more about finding the location, but if finding the location, which I don't need to find the location, because I know where my usual bus stop is. It's more like in the other end where I don't know where the bus stop necessarily is or I don't know where the destination is. Yeah then I would use it. If I could also check timetables and stuff in it, and point at any stop and see it's timetables and see how long is it until the bus arrives. Then I would definitely use it. There is the issue that's getting more and more troublesome for me personally is the issue of actually interacting with the keyboard. It's not necessarily always easy, especially in Finland when you're outside, it's cold you can't take your gloves off or even if you do it's very hard to get the correct information input there. The biggest part of my frustrations with interacting with phones is actually inputting text into input fields as silly as it sounds, that's the biggest friction there is. And anything that removes this need, so I could just point it at something and tell me what it is. There is going to be a benefit to that sort of experience.
9. The idea of having something unexpected or funny happened on the way, is of course funny. Then, what's funny to different people varies. But I like hopscotch or there's some kind of game where you only walk on the tiles but not in between them, these different types of OCD games that you can have while just walking around. I think that's a great idea. It would totally be a fun addition to the experience.

Would you use it:

It depends on what it is. Maybe not the hopscotch part but something else, more subtle, like don't fall into the lava, or just walk on this line, something that doesn't look too silly while I'm in public. And if it doesn't distract from when I really need the information, if I can easily dismiss it, and doesn't kill the primary use, then yeah.

10. It's surprising that nobody has done it yet. It's a pretty obvious choice and I've seen people try to do it indoor which as it's obvious positioning complication so like outdoor AR mapping even though the demos have been off for years. I guess it's maybe the actual real fact is that the thing that's holding AR back

is the hardware. That the AR is really only super smooth user experience if you have some kind of head mounted display, see through glasses or something. The fundamental issue of AR in a phone is that you have to keep holding up the phone and look through a small window on the world and that's inherently a little bit debilitating, if the UI isn't extremely good and the software I've seen don't have extremely good UI, they have super crappy UI so they perhaps fall as application experiences. So it's not about the AR, in a sense, it's more about how it's presented in this pretty limited hardware that is the thing that is keeping us from AR mass adoption at this point.

11. Of course it would be appealing to see new cool tech and use it. But I think it's appealing if it's more convenient than what I already have. So if it's as good as Reittiopas/ReittiGPS for example by direct comparison, to me personally, and in addition to adds this layer of, okay I can also use it in a hands free mode, just whip it out and point it at stuff and it tells me the same information that I need. It makes retrieving information even easier.
12. We didn't see so much of how the UI is going to work. I think the main challenge is that when you point at the world with one hand with your left hand usually, the whole thing becomes kind of shaky. And so if the UI information window is somehow tied into the real world like anchor position like the real world object then it's going to be really hard to to keep it still enough to actually see anything to interact with as a direct fundamental issue of the UI, so like that's the thing that has to be really thought out well. How do you translate between stuff you're pointing out there and all this information is displayed in a way that is just optimised for this flat 2d screen that you are holding in your hand. So that you can just point at it and for example lock it and look down and still have the information there and choose between you stops. It's just hard to do the UI, so that's what I would assume from purely application experience, disregarding all the other challenges of building apps, building the right kind of UI is perhaps not so easy.
13. Seems like a cool idea. I think it should be built, I want to see it built.

Participant 3

1. I work as a freelance illustrator. I'm 26 and female. I'm from the US, the United States.
2. I use Google Maps a lot, WhatsApp. Well I can get my phone out. I don't really use any games or anything I have my banking app I use Instagram,

Discord, Kindle reader, Safari, Google News, Spotify. But not really any games or anything.

3. I guess maybe a 4. I'm not like super tech savvy, but I'm better than my mother, so. she struggles with it.
4. I mainly use Google Maps. I use it when I'm trying to find a place that I'm going to, or like if I need too, like if I'm going somewhere or looking at like when buses might be coming or something like that, but it actually works really well even in Finland. Yeah just mainly for, cuz I don't have a car, so I use it for like public transportation and that kind of stuff.
5. Like I really like the idea of the AR, because I have experienced moments where I'm looking for the right bus stop and I'm like is it on this side of the street or the other side? Cuz sometimes it's a little bit confusing, especially over by the Aalto bus stops, the 550, I seen so many people waiting at the wrong bus stop there because they don't know which one goes to the right direction. so that be nice, so it could actually show you which bus stop it is. but I like the idea and I thought it was really cute that you have the Hopscotch in there as well.
6. Maybe not for me, it would be nice to have for me, cuz I have pretty much gotten used to figuring out how Google Maps work. But I have come across a lot of people who come up to me and ask which bus stop they need to get to and stuff like that, or maybe they don't speak English or they don't speak Finnish and are lost or something like that. So I think it could be really useful, especially for people who are traveling.
7. Yeah, I think I would use it. If it was integrated with Google Maps or something probably. I don't know if I would download it separately and use it separately Then I think I would use it.
8. I think mainly finding the right right bus stop, I would use it for that. I don't know if I would need to look down at my feet to see the correct path, unless I was somewhere where there were no street signs or something and I didn't know where I was. If I wasn't in a hurry maybe if I was leisurely going somewhere, going on a walk/sightseeing, then maybe I could see using that part of the app. With the little hopscotch and the little elements, but if I was in a rush i don't know if i would use it.
9. I thought it was fun, but I guess that person has to be taking their time. They know that their bus isn't coming. I think I would do it, I wouldn't be embarrassed, it would be fun. I think it would be fun if there was more things, like you had to collect things, or some kind of other aspect to it would be fun.
10. Well I mean the little hopscotch thing was kind of surprising. I think I went

“whoa” when the little indicator popped up over the bus stop, I that was really nice. Maybe that was a surprising part.

11. I think mainly just, you know, having that really clear visual of where you need to go. Especially if I was in Japan, this would be great because everything's in kanji and I'm sure I would be lost. But if I had the app that actually told me where I needed to go that would be really amazing.
12. I think maybe adding, like if you are going to have elements like the Hopscotch, maybe going even further and gamifying a bit more. You could have collectibles or even interesting information. If you hold it up to a monument a little text would appear to tell you about that monument. What it is or something like that would be really cool, especially if you are a tourist, you hold it up and it would give you information about things. Of course this would be if you have unlimited resources for this app. But I think that would be interesting.
13. Also If you hold it up to the bus stop and there's the indicator that you're there, maybe also a little time of when the bus your taking is coming. Is that one there? (Answered yes) Well then you already covered that.

Participant 4

1. I'm a communication manager in a creative technology agency. I am 39, female and Finnish.
2. I use Google Maps all the time, when I go to places. I use the public transportation app, HSL, where I have my mobile ticket. Social media sites and also Helsingin Sanomat. Social media is both work and my private but other than that most of them all private.
3. I would say 3 maybe 3,5. I would say that I'm knowledgeable but I'm very conscious of safety, and my private data. Even though that I know about an application that I might use, I might not use it because I don't know about the service settings and privacy statements and I don't want to give my data just to anybody.
4. I probably never use the HSL app for navigation, I always use Google Maps. Every time I need to go somewhere, if it's not a metro or a tram which run so frequently that I don't need to check the timetables, I always check the time tables. For example, in an hour I'm going to the airport so I'm checking which train should I take to be certain that I will arrive to the airport at the right time. And I'm also checking it for if there's any traffic jams that I need to be aware off.

5. That was good. I like the funny, playful side of it. It would be nice to see people jumping on the street and wondering what they are doing. Often times when you're in an environment that, ok I know that there is a bus stop somewhere or there are multiple bus stops in the same intersection, so you're wondering which one should I go to. That would be very helpful. On the other hand, I thought that because I'm a traditional person who navigates the Sea with the paper map, and I appreciate a lot the skills that you have to have in navigation. You need to know South and West, to know the directions. Google Maps has made me a lazy navigator, because it always tells you: turn here, turn left. I think this might make me even more lazy, it just draws the line that I walk on.
6. I think, for example, for children that would be very useful, because they don't have that strong sense of direction. Interpreting Google Maps it's a bit difficult for a child so this one will be very useful.
7. Yeah, I would.
8. If I will be in a hurry and I wouldn't have any time to sidetrack, so I wanted to make sure that I get there as soon as possible, this will be very helpful.
9. I would definitely do it. If it would go in circles or turn around 360 I would do it. Just for the fun of it.
10. Not really in the short introduction. I might have thought a little bit forward, instead of looking at the line from my mobile phone, the line would just appear on the street and I would be the only person who sees it. Glasses or a chip in my head, or whatever in the future.
11. I seemed very straight forward, easy to use and easy to understand. You don't need to read a manual in order to use it.
12. It would be nice if the line could appear on the street, not on the mobile phone. Maybe I don't know if it has one, but maybe a sound, going like "beep beep" if you go the wrong direction. So it would notify you if you divert from the line and not just by 2 meters, but if you take a wrong turn. At least for children that would be good. And if you are looking at the traffic or you are talking on a phone. At least when I'm walking and talking on my phone I might miss the intersection, so it would be nice if it starts beeping or vibrating: "you went the wrong way".
13. When is this coming? When can I get it?

Participant 5

1. I'm a student of economics and I work on the side, but I'm mainly a student. I'm 21 years old and of the male gender and Finnish.

2. I think is WhatsApp, Snapchat, Instagram, maybe Facebook also, and Tori application. Those are the ones that I use mainly the most.
3. Maybe a 4, because I think I'm pretty good with technology. Always when we have a problem with a project or something I would be able to figure it out at school. I read tech news from time to time, so I know what's happening in the world.
4. Yeah, I use Apple Maps app and Google Maps mainly. I actually used it to find here, Kaisaniemenkatu, today. If I don't know the exact house number it's easier to find a house with it. Or then, if I have to drive somewhere to an unknown area I would use the Apple Maps to see where I have to drive.
5. It was quite interesting, because I haven't seen anything like that before, where you use your camera and it indicates "oh there a bus stop". It's quite an interesting concept, when you have to follow the line on the phone, I think you look quite much on your phone and not so much on your surroundings.
6. Maybe not for me, but I think that younger children could find it fun. And they would really find where they had to go, because they might have a hard to read maps from a phone like the classical maps, because it's like a quite straightforward with where you have to go: is just follow the line.
7. I would try it out, but I'm quite good at reading old school maps. I don't really see the need for me to use it, but for a more playful person maybe.
8. To try it out.
9. It looked fun, it made the journey a bit more fun, I think for the person who was going from A to B. I would definitely try it out. I think it would be fun actually.
10. No, I don't really think so. But I just wonder how it could see the bus stops, is it using the street view from Google Maps to pinpoint the places? Maybe the unexpected part was like it was able to know which bus stop had the different buses on them. That was the unexpected part for me I think, a bit surprising.
11. Maybe it's pretty easy. It's pretty easy just to follow a line, not much thinking. You just put the address in and follow the line.
12. Can you see the map in the application of where you are going? (Answer: yes) I missed that one. It's quite appealing then if you have them both, the classical map and this one (meaning AR view).
13. I think it's quite good if you are new to a town, and don't know anything about, like the major cities. It would be good but if you're familiar maybe it's not that useful, but for tourists and people who don't know their surroundings, I think it's a good concept. Because is quite clear if you have to use the public transit. It make it a lot easier. You have to skip all the Googling, also because if you use the HSL sites they are quite, primitive or a bit hard to

use, so maybe this would like make it easier. With the mix up with them both (meaning the maps).

Participant 6

1. I'm principal lecturer in Online Media at Arcada. I'm 67 and male, British.
2. I use calendar, Whatsapp, Instagram, Todoist, Reittiopas, Lastpass and a browser.
 - a. (P6 later checks his phone and recounted all the applications on his front screen; Feedly, The guardian, Lastpass, Pi music player, Slack, Todoist, Instagram, Whatsapp and a Phone.)
3. Well probably 5, because it's my job. I have to test loads of apps in order to see what's going on. In order to teach things that might conceivably be useful.
4. I use Reittiopas and the other navigation app would be Nysse, and HSL's app, although I didn't find that very good. The problem we have is that I tend to carry my iPad with me and I tend to use my phone as a hotspot. So I tend to look at thing on my iPad. I use Reittopas and Nysse. I have looked at HSL's, but only the latest upgrade allows you to favourite places, and without favoriting places the whole thing is pointless. If you said: let's meet at Hakaniemi, I know very well how to get to Hakaniemi. But if you said: Let's meet at hakaniemi, I want to show you my AR app, let's meet about 3 o'clock, then I would work backwards. "I want be be in Hakaniemi at 3 o'clock" here I am how can I do it, that sort of thing.
5. Two first impressions: one that I'm not sure how significant that problem is, because both Nysse and Reittiopas provide me with 2D handmade or custom-made little maps to show me how to get from the metro in Hakaniemi to the 17 bus stop, or whatever. That was my first thought. And the second thing is: bus stop numbers, you didn't make any use of bus stop numbers. (Ask to explain further) Well all bus shelters, well one of them does and one them doesn't and can't remember which way around it is on my apps, or is it Google Maps that doesn't? One of the possible ways navigating round with a phone or and iPad doesn't make use of bus numbers, it might be Google, and so I'm never quite convinced; is this the right bus stop. (Tells that there were bus numbers in my app) Cuz the numbers are vital for me because if you go somewhere like Rautatietori , or even here, there are sometimes I find myself, and this could just be me being stupid, here I am somewhere where I'm not that familiar with, K  pyl   say, and here I am waiting for the bus,

but which side of the road am I supposed to be? And the number on the on the bus stop is a vital piece of reassurance, for me not necessarily for anyone else.

6. I have yet to see much compelling evidence for the benefits of AR, but the one I have seen, is this kind of navigation. The particular use of it I saw, which impressed me was around the insides of hospitals. You know how if you go to a big hospital in Helsinki and you want to go and get an x-ray, or whatever it is you're supposed looking for, and certainly in Töölö hospital, there are a lot of pre-AR taped , colored lines down the corridors. So you have to go to the x-ray room, so that's the purple tape, so i'll follow the purple tape. There are obvious benefits to replacing that with AR, amongst which is you can get more different colored tapes then you can on the floor. And you can change the route much more easily, if you shift the x-ray room to the third floor. I was already convinced that navigation of that sort is useful. And navigation of the sort you are talking about, "I've go to get from one side of Rautatientori to the other, and then up past, Frnds and Brgrs to Mannerheimintie to get the bus, that's good. A little imaginary line to show me which way to go, where to turn seems to be fine. Or anywhere where there is, like in hospital many doors which are wrong, or in the center of the city, there are lots of places where to turn left, but only one of the is the right place. So lines down the road and numbers, yes.
7. How does it fit with something like Reittiopas? If replaces the pedestrian map part. (answer question) Well reittiopas consists of several things, first layer is "I want to get to Hakaniemi by 3 o'clock" so I'm given a list of choices "oh look I can go entirely by tram, let's try that" so I click on that so I see the route. And the route consists on basically 2 elements, the elements I'll be sitting in the tram while doing and elements where I change from one tram to the other. Which are the bit presumably where your app would come in. It makes perfect sense.
8. I think that, (meaning the last point) So I can see how to get from Hakaniemi metro to the 17 bus stop in 2d or 3d. So yes, I would see it as being a useful option.
9. Non-commercial. I see what it's doing, I'm not sure, I was thinking to myself what other examples are there? If it provided hopscotch for me, everytime I went somewhere, I don't think I'd necessarily get much use of it. But if that's an example of other surprises it could provide me with then I'm not sure what the others examples might be. I was thinking about that as al watched it. My answer would then to be no, I think. Because if I use a navigation app it's usually because there is a definite element of stress involved. If you said

to me "let's meet in Stoa", let's assume I didn't particularly know where it is, and I said "that's fine", that's a cafe, a library and a culture center, isn't it, and you said "yes". "So at what time should we meet there" and you go "I don't know, I don't care, I'll just be sitting there writing from about 2 o'clock to 5 o'clock, so just come along", then I probably wouldn't use an navigation app. Under those circumstances I would probably think "Ah, that's very nice, that's near Itis isn't it? I could get there around 2 and wander around. If I'm lost that I can find it". If you said to me "let's meet at Stoa at 15:15 and I can only stay for 20 minutes" and I wanted to meet you, then that means that I got to be at Stoa at 15.10 ideally. So now I got a reason to be there that would cause me to use an navigation app, now I need to work backwards, ok so if I'm going to be at 15.10, what time do I have to leave here now? "Oh, god. I got to leave in 3 and half minutes " so at that point my interest in playing hopscotch or polishing my tango is not very high. So it's an odd mix, if I was in a tangoing mood I wouldn't be using a navigation app, that's my problem with that.

10. No, it seemed to work as I expected it to work, and that's fine.
11. The lines on the floor, up until point when they trick you and it all goes wrong, the lines of the floor are an easier, more believable, less stressful way of navigating across a big space like Hakaniemi or Rautatientori or corridors of a hospital. again you've got you appointment for 3.15 and trying not to be late and "oh my god, I'm in the entirely wrong part of the hospital" is not the thing to say 1 minute before your appointment. So in those circumstances an imaginary line down the floor which says "yes, turn left exactly here" or "no, this may look like you're supposed to turn left here but it's not the place, keep going" is better than any of the 2D diagrams which can leave you, have left me, thinking "was I supposed to turn left back there? Is this really the place". The answer to the question "is this really the place", is a nice reassuring orange line pointing into the distance, and turning left 2 corridors along. That is comforting, reassuring, making the assumption that it's correct.
12. When you get to the place, assuming it's a bus stop, then when you get to the place it should not just say "you are here", but it should say "you are looking at bus stop number 3526" so that you can look up and link it back to the AR, "yep, it's 3526, I'm in the right place". In other words, hooks back into reality periodically, so that you can crosscheck. Especially on walks that suggests it might take 7 minutes and you find yourself 8 minutes into the walk, and you think "Am I walking slowly or am I lost".
13. No, I think it makes sense. The basic project makes sense and as I said I think there is a definite improvement, under some circumstances, in having a line that tells you that you are in the right place, rather than trying to make certain

that the illustration in Google Maps that's trying to join parts of this big area together, that you are reading it right.

Appendix 2 - Video

The video can be found here: <https://vimeo.com/329834099>

Password: thesis

