

# Development of a Location-Based Game to help new students discover the UT Campus and Enschede

Emma Brouwer – student no. 1964453

Supervisor – dr. Guido Bruinsma  
Critical Observer – dr. Robby van Delden

Creative Technology Bachelor Graduation

Module 11: 202100151 ("Real World Perspective")  
Module 12: 202100160 ("We Create Impact")

7<sup>st</sup> July 2023

## Abstract

The past year, the University of Twente (UT) has welcomed over 2500 new bachelor students to their campus. The UT has several initiatives in place to support student integration, but gaps exist within the student integration process. This research looks into how a location-based game (LBG) can stimulate social interaction and support the student integration process. The conceptualized LBG is tested in two phases, evaluating the core game mechanics and validating the concept with a prototype of the game's user interface. Results show the game concept can stimulate players to get together in locations and serve as an icebreaker for social interaction. The conceptualized LBG shows the great potential for functioning as a social lubricant among students, and may be a promising tool in supporting the student integration process during introduction weeks as well as after them.

## Acknowledgements

This research would not have been possible without the help of my teachers, advisors and supporters. First of all, I want to thank my supervisor Guido Bruinsma and critical observer Robby van Delden. Their support has helped me finish this project when I was very close to giving up. I am beyond grateful for all of their help, support and feedback throughout the past year. I want to thank my study advisors Thea, Amaal and Bibian, who helped give me guidance and structure when I needed it most. Without them, I probably wouldn't have been able to start this project. Lastly, I want to thank my parents, family and friends, for supporting me when times were difficult. Especially Jan, who has been able to put up with me when even I couldn't, all the while being an amazing rubber ducky.

## Table of Contents

Abstract	2
Acknowledgements	2
List of Figures	5
List of Tables	5
1 Introduction	6
2 Theory and State of the Art	7
2.1 Player types	7
2.2 Multifunctional game mechanics	7
2.3 Reward systems in games	7
2.4 Location-based games	8
2.5 Stimulating social interaction and social behaviour	9
2.6 Technology acceptance models	9
2.7 Research aim	10
2.8 Stakeholder Analysis	10
3 Method	12
3.1 The Creative Technology Design Process	12
3.2 Evaluation process	13
3.2.1. Evaluation phase one	13
3.2.2. Evaluation phase two	13
4 Ideation	14
4.1 Project requirements	14
4.1.1 Integration into UT environment	14
4.1.2 Stimulating social interaction	14
4.1.3 Facilitating the target group	14
4.2 Technology	14
4.2.1 Smartphone	14
4.3 Ideation conclusion and chosen concept	14
5 Specification	16
5.1 Concept specification goals	16
5.2 Experience goals	16
5.3 Check-in mechanics	16
6 Realization	18
6.1 Realization goals	18
6.2 Prototype for phase one evaluation	18
6.3 Prototype for phase two evaluation	20

7	Evaluation	23
7.1	Phase one evaluation	23
7.1.1	Playtest observations	23
7.1.2	Post-play session questionnaire	24
7.1.3	Post-play session discussion	25
7.2	Phase two evaluation	26
7.2.1	Participants' previous experience in phase one	27
7.2.2	Participants' experience with the phase two prototype	27
7.2.3	Phase two questionnaire	28
8	Discussion	30
9	Conclusion	32
	References	33
	Appendix A: Prototype Phase Two	36
	Appendix B: Evaluation Questions (translated from Dutch)	38
	Player types & open questions from evaluation phase one questionnaire	38
	Interview Questions Evaluation Phase Two	38
	Appendix C: Evaluation Consent Forms	39
	Phase 1 Information letter & consent form for participants	39
	Phase 2 Information letter & consent form for participants	41

## List of Figures

Figure 2.6.1. The Technology Acceptance Model _____	8
Figure 2.6.2. The Hedonic-Motivation System Adoption Model (HMSAM)_____	9
Figure 3.1.1. The Creative Technology Design Process _____	12
Figure 4.3.1. Concept storyboard sketch _____	15
Figure 5.1.1. The Assistance check-in mechanic _____	17
Figure 5.1.2. Storyboard showing the predicted usage of the Cooldown Speedup mechanic _____	17
Figure 6.2.1. The conceptualised setup for representing the game mechanics _____	19
Figure 6.2.2. The final timer tool prototype for phase one evaluation (Dutch version) _____	20
Figure 6.3.1. The colour-blind friendly palette used for the phase two prototype _____	21
Figure 6.3.2. Three screens from the phase two prototype _____	21
Figure 6.3.3. The assistance mechanic in the phase two prototype _____	22
Figure 7.1.1. Screenshot from a WhatsApp group chat during a phase one research activity _____	24

## List of Tables

Table 2.3.1. Types of rewards in popular games, as revised by Phillips et al. _____	7
Table 2.8.1. The project stakeholders and their corresponding categories _____	10
Table 4.3.1. Intervention requirements and proposed strategies on how to satisfy them _____	15
Table 5.2.1. The functionality of the conceptualised check-in mechanics _____	17
Table 6.2.3. Roll distribution for POI Red _____	20
Table 7.1.1. Closed question results of the phase one post-playtest questionnaire _____	26
Table 7.2.1. Closed question results of the phase two questionnaire, compared to the results of the phase one post-playtest questionnaire _____	29

## 1 Introduction

The past year, the University of Twente (UT) has welcomed over 2.500 new bachelor students [1]. With the largest campus in the Netherlands, the UT offers many facilities for sports and socializing. They host a broad range of study-, student- and sports associations, together offering an even bigger amount of activities for students to partake in. After coming to the UT students form friend groups, join activities and associations, while emotionally attaching to the university. Throughout their study, each student develops a level of affective commitment towards the UT environment. Naturally, the level of affective commitment varies between students. Students with high levels of affective commitment are generally more active in the university environment, contributing to the quality of the UT's education and facilities, which in turn contributes to the UT's international reputation. Though the UT scores higher than average on six out of seven categories of student satisfaction according to the Dutch National Student Satisfaction Questionnaire (NSE) [2], creating and maintaining a high level of affective commitment remains a challenge.

To help students integrate into the UT environment and raise affective commitment, the UT has several initiatives in place. Before their arrival, the UT's Marketing and Communication department [3] provides students with the information they need for the first phase of their study. They send students emails providing information about different practicalities such as enrolment, finances and housing. Two weeks before the first lectures start, the Kick-In week [4] takes place. Students can sign up for this introduction week when applying to the UT and will then, in an intense week of activities and parties, get to know the university and their fellow students. Almost all new bachelor students participate in the Kick-In, but every year a number of students is unable to join. In practice, this leaves these students at a social disadvantage since most of their fellow students have already made friends.

To help students find the right classrooms and facilities, the UT has created the Campus app [5], displaying the student's schedule and where to find for example the classroom for their lecture. The app does not see that much use however. Most students either do not know the app exists, or have used it a few times in their first weeks at the UT and then forgot they have the app on their phone. Students tend to use the online timetable to find their schedule, which is updated more frequently than the Campus app. For their own day-to-day planning they often use other software such as Google Calendar or Outlook. The Kick-In committee has also created an app for the Kick-In week, including the schedule and activities students can take part in. This app sees most of its use in the Kick-In week, but does not offer a lot of value once classes start.

During their study, when students experience study problems or mental health issues, they can find support with the UT's study advisors and psychologists. Study advisors and psychologists will advise on the possible courses of action for the student's personal situation. Switching between different study programmes is often an option as well in the first study module. However, that also means students often have to switch to a new study environment, where they have to learn the specifics of their new study and make new friends again.

Thus, despite the efforts taken by University of Twente, there are some gaps concerning students' integration and affective commitment. To accelerate the social integration process and increase affective commitment in new students at the UT, this research will look into the ways game design can motivate students to discover their environment, as well how functional elements can facilitate social interaction and integration. It aims to combine these findings into an interesting location-based game (LBG), that motivates students to discover the UT Campus and the city of Enschede. In other words, this research aims to answer the question: *How can a location-based game stimulate social interaction among students and increase the integration process?*

## 2 Theory and State of the Art

In this section the design rules and actions with regards to games are investigated. Moreover, it looks into how games stimulate and facilitate social interaction and what other location-based games can be found in literature with similar goals to this research.

### 2.1 Player types

In order for this intervention to become as effective as possible, it is necessary to gain a big user base. The entirety of university students as a target group is very broad, therefore one of the challenges in this research will be to find out how a game can be designed to appeal to as much of the target group as possible. A starting point for this can be looking into the categorization of video game players into player types.

The first researcher to start categorizing player behaviour into types was Bartle [6]. There have been many different studies on player categorization after, many sharing parts with Bartle's theory in one way or another [7] [8]. For this research, the Hexad User Types Framework [9] [10] will be used. This framework has a clear categorization, has been validated and has significant associations with the often used Big Five Personality Traits [10] [11]. This framework presents six player types.

- **Achievers**; players motivated by challenge and mastery.
- **Socializers**; players motivated by relatedness and interaction.
- **Free Spirits**; players motivated by self-expression and autonomy.
- **Players**; players motivated by rewards.
- **Disruptors**; players motivated by change and opportunity for disruption.
- **Philanthropists**; players motivated by purpose and meaning.

### 2.2 Multifunctional game mechanics

When looking at popular games, almost all games use game mechanics that appeal to different player types. One way of satisfying multiple player types is using multifunctional game mechanics. Game mechanics should be basic in the core, leaving room to expand upon to create different ways of play. This way multiple player types find mechanics they enjoy.

A prime example of this is Minecraft [12]. It has a big active player base while in core being a basic game; players gather and craft with resources from their environment to survive. The game features a big library of resources players can gather, ranging from easily obtainable to requiring more skilled gameplay. The game creates a random new world, allowing players to explore the different biomes and build structures. The combination of these mechanics allow for many different ways of play. Achievers will be the first players to mine metals and slay monsters. Socializers will enjoy building farms, interacting with the animals and trading with the villagers. Free Spirits can build the structures of their imagination in creative mode.

### 2.3 Reward systems in games

One of the key mechanics in most games is the reward system. Phillips et al. [13] redefined a categorisation framework for reward systems in videogames, which can be found in table 1. Additionally, Phillips noted in this study that multiple types of reward systems are generally used in videogames. Using Phillips' taxonomy [13], Tyni et al. shows the steady increase in usage of multiple reward types in a single game, among both educational and recreational games [14]. Using a reward system taxonomy can contribute to balance in the game concept and can help confirm whether the game provides enough stimulus to play the game.

Reward type	Characterization
<b>Access</b>	Access to otherwise inaccessible content, such as unlocking a new game area or game mode.
<b>Facility</b>	Increasing gameplay efficiency, such as unlocking a better weapon or increased speed.
<b>Sustenance</b>	Alleviating burden or avoiding hindrance, such as receiving health potions or keeping a streak.
<b>Glory</b>	Measurable in-game progress, points, badges or achievements that display players' skill.
<b>Positive feedback</b>	In-game praise and flattery towards the player.
<b>Sensory feedback</b>	Visual, auditory or tactile feedback aimed to provoke a positive effect from the player, such as sparkles and vibrations when a player opens a chest.

Table 2.3.1. Types of rewards in popular games, as revised by Phillips et al [13].

## 2.4 Location-based games

Any game that progresses or evolves based on the user's physical location, can be called a location-based game (LBG). Most LBGs on the market today are made for smartphones and use GPS. These games have become increasingly popular recently, with the most popular two examples being Pokémon GO and Ingress. LBGs are used for a wide range of genres and applications like cultural heritage [15] or supporting learning in children with Autism Spectrum Disorder (ASD) and learning disabilities [16]. LBGs have been shown to have many different positive effects on players [17].

The Pokémon GO [18] is a commercial game introduced in the summer of 2016, in which players catch and train virtual Pokémon and use these to compete against other players. The game uses a team system to create both solidarity and competition between players; teams can own gyms and by battling gyms possessed by rivaling teams, players can weaken and take over gyms.

Ingress [19] is another location-based game, in which players join one of two teams and compete for ownership over the portals spread across the map. Teams can link these portals together and claim ownership over the territory between the connected portals. Players can earn experience points and badges by regularly registering at portals. Using these mechanics, Ingress places itself among the most popular location-based games.

A game with a similar aim to this research is one created by Singerland et al. [20], where a location-based game was developed to stimulate neighbourhood exploration and social interaction between residents. The study co-designed the game's challenges for players with the neighbourhood's inhabitants and these were put into seven different categories, which are supported by Fonseca et al. [21]: **athlete** (physical activities), **detective** (finding information), **explorer** (traveling to new areas), **inventor** (proposing new ideas for the neighbourhood), **hunter** (find specific things/people), **artist** (create art for the neighbourhood), **volunteer** (help others or contribute to the environment). In a later phase, these categories for activities might help determine how the research prototype is balanced.

Another similar project is Campus Explorer, by Bürgisser et al. [22]. Their prototype features a location-based approach as well, including building check-ins, campus expeditions and campus events. The research showed the potential of location-based games in contributing to feelings of belonging to the university among students.



## 2.5 Stimulating social interaction and social behaviour

The UT and its associations main strategy for stimulating social interaction and bonding among their students and employees, as well as increasing affective commitment, is through organising activities. The range of activities is wide, some casual get-togethers and drinks with some very formal like galas. Attendees of these activities often have something in common, like a study or hobby, which works as a social lubricant. But since every person presents a different level and amount of social behaviour, not everyone shows up for activities. The less socially active group is often the one with less affective commitment, therefore it is challenging to get this group to participate in activities and create an increase in their affective commitment. For example in personal conversation related to this project, study association W.S.G. Isaac Newton [23] explains it struggles to get the less active students to participate in their activities, thus struggling to increase the overall level of affective commitment for the association.

Through conversation with students at the UT, it was found that they obtain their knowledge about their environment through their fellow students. Information ranging from where to find good restaurants or competent hairdresser, to when there is a fun pub quiz or niche band playing in the city centre. Every student presents a different level and amount of social behaviour, but those with less social interactions than their peers may have less of this environmental knowledge.

The association between environmental knowledge and social interaction works the other way around as well, where increasing students' environmental knowledge may increase their social interaction. It often is the case that students do not know about certain places where they can spend their time, that may fit them very well.

A way of increasing social interaction might be through stimulating pro-social behaviour like cooperation. Research suggests cooperation in games can be a tool for stimulating pro-social behaviour in-game as well as in real life [24] [25] [26]. LBGs often try to stimulate social interaction with the usage of team-based mechanics. Team-based cooperation in games like Ingress and Pokémon GO has been shown to have a positive association with players' altruism and self-efficacy [27] [28]. Additionally, territorial control is shown to be a strong predictor for playing intensity [28].

## 2.6 Technology acceptance models

The Technology Acceptance Model (TAM) is a theory explaining how and why users accept and use a technology [29] (Figure 2.6.1). The model has been widely used and expanded upon with two updates, but its main components remain unchanged [30]. According to the model, different factors influence whether someone will adopt a new technology presented to them.

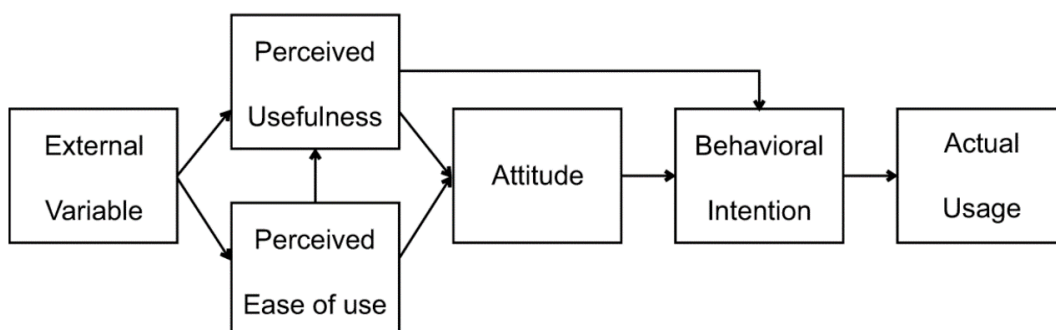


Figure 2.6.1. The Technology Acceptance Model.

The TAM has been criticized however [31]. Despite its usefulness in describing many kinds of system use, it is not effective for explaining usage in systems that mostly or only fulfil user's intrinsic motivations, such as entertainment systems like games. For this reason, the Hedonic-Motivation

System Adoption Model (HMSAM) has been developed [32] (Figure 2.6.2). The HMSAM will be used in this research in addition to the TAM to predict the effectiveness of the prototype based on its factors influencing BITU (behavioural intention to use) and Immersion.

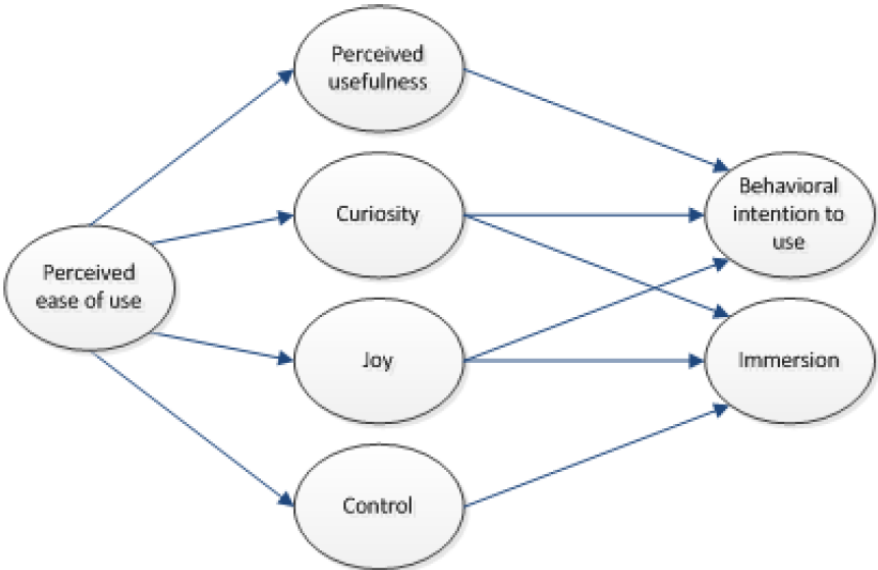


Figure 2.6.2. The Hedonic-Motivation System Adoption Model (HMSAM).

2.7 Research aim

This research aims to get insight on how a location-based game can motivate new students at the University of Twente to discover the campus and Enschede. More specifically, insight is needed in which functional elements and game mechanics should be incorporated to facilitate social integration and interaction between students.

2.8 Stakeholder Analysis

To create an effective intervention, it is necessary to perform an analysis on the stakeholders. Using this analysis, one can derive the amount of the influence that each type of stakeholder should have on the project. Stakeholders can be categorized into the following four categories, derived from the framework on stakeholder management presented by Nguyen and Mohamed [33]:

- **Users:** these are the people that will eventually use the final product.
- **Decision makers:** these are the people that are closely involved in the project and that will benefit from it.
- **Support stakeholders:** these people provide project support.
- **Potential stakeholder:** these people do not benefit from or use the project immediately, but might benefit later on.

Table 2.8.1 presents the project’s stakeholders and their corresponding categories.

Stakeholder	Category	Relation with the project
<b>UT students</b>	Users	Students are the targeted end users of the project.
<b>University of Twente (dr. G. Bruinsma)</b>	Decision maker	The University of Twente has initiated this project and provides the project with their knowledge and support. They set the project timeline and can fund the future realization of this project.
<b>Student Union</b>	Support stakeholder	If the Student Union sees value in the project, it can help promote the project at the UT's Student Services. The Student Union can offer knowledge for development of the project. If the project is realized, it can help promote the project amongst students and associations.
<b>Kick-In</b>	Support stakeholder	The Kick-In can pick up the project and promote it during the Kick-In, as it helps students discover the UT.
<b>UT Employees</b>	Potential stakeholder	The UT's pool of employees is partially from outside of the Netherlands and therefore might not be that familiar with the UT campus and Enschede. These employees may find benefit in the project and discover more about their place of work.

Table 2.8.1. The project stakeholders and their corresponding categories.

The different stakeholders all have different interests in the project. Most important for this project are the interests of the University of Twente and the students. For the University, the most important function of the intervention is facilitating the student integration process and the increased affective commitment among students that would bring. Students on the other hand are interested in playing a fun game, learning about the UT and bonding with others. These stakeholder interests will be expanded upon and translated into project requirements in chapter 4 of this research thesis.

### 3 Method

#### 3.1 The Creative Technology Design Process

This research will follow the Creative Technology Method by Mader and Eggink [34] (Figure 3.1.1). The method starts with a design question and goes through four phases: Ideation, Specification, Realisation and ending with Evaluation. The iterative nature of this model leaves room to backtrack in the design process when necessary. In the Ideation phase, relevant information is acquired and ideas for answering the design question are generated, ending the phase with a defined idea. Then, in the specification phase, this idea is explored further and early prototypes are made. In the realisation phase, the results of the specification phase are realised into a testable prototype. This prototype will then be evaluated and adapted if necessary.

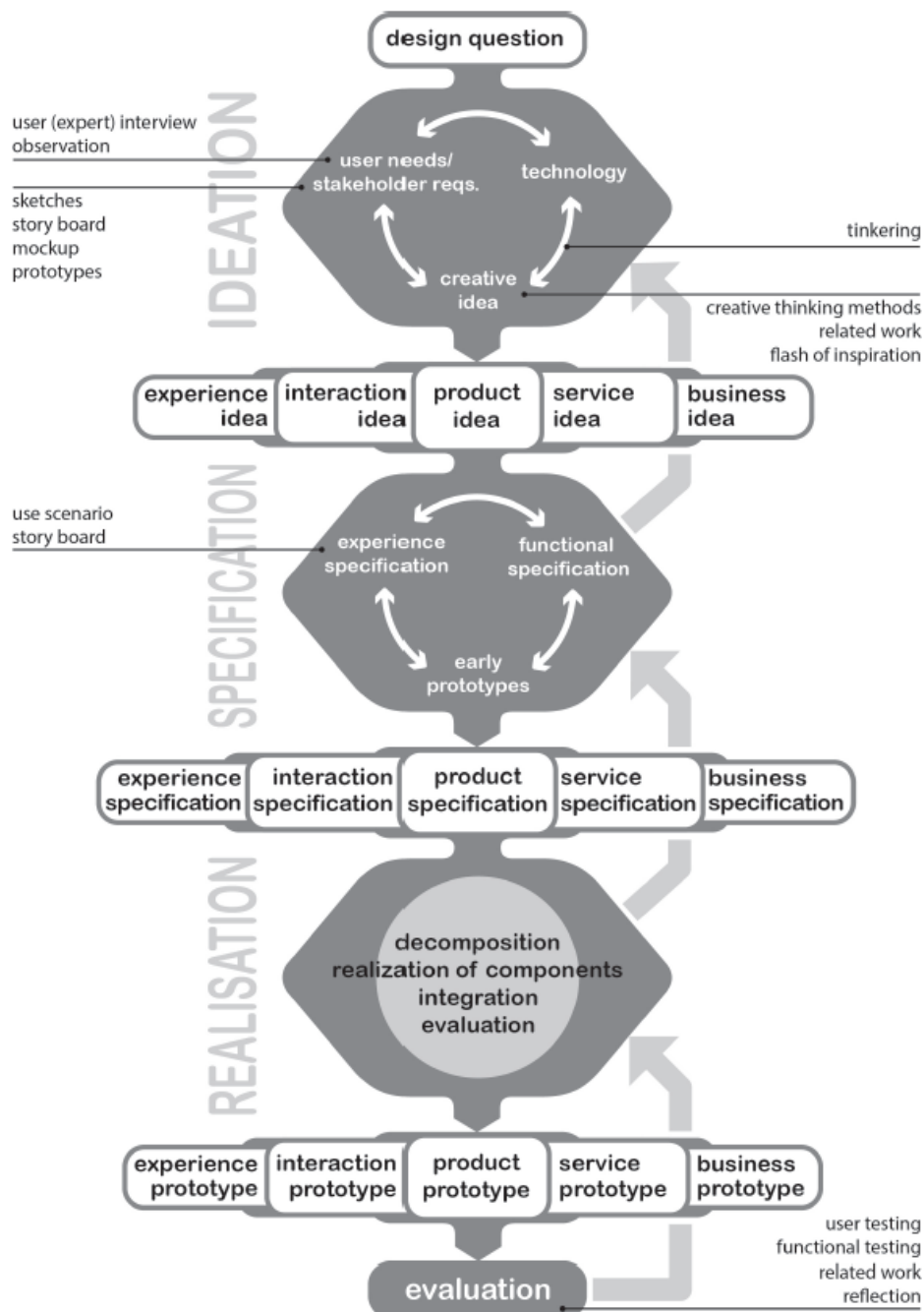


Figure 3.1.1. The Creative Technology Design Process [34].

## 3.2 Evaluation process

Because of the time constraints in this research project, it's not possible to build an entire location-based game and test it thoroughly. Therefore, to evaluate the effectiveness of the prototype, it will be tested in two phases. Phase one is a preliminary test of the core game mechanics, to check their effectiveness and what can be revised on the prototype. Participants are asked to interact with the prototype's core gameplay and share their experience. Phase two is a validation test using a mock-up of what the game would look like when built, to validate the graphic design of the game and whether it fits the mechanics tested in phase one. This evaluation strategy enables the testing of the game's potential effectiveness. As it is a compressed version of how the concept would function in its intended context, users' patterns of behaviour may mirror those they would display using the envisioned game concept. The aim is to have around 6 participants for each evaluation phase. Participants may participate in one or both of the evaluation phases.

### 3.2.1. Evaluation phase one

Phase one of the evaluation takes place in a playtest setting. Participants will be asked to play a prototype version of the conceptualised game. After playing, participants are asked to give their opinion on the prototype and its mechanics in a survey, score them based on how effective the participant finds them, as well as what they think may make the prototype better. This first phase is expected to take around 90 minutes per group of participants and will take place in a meeting room or online.

Firstly, one of the main goals of this first evaluation is to find out how the mechanics are received. Learning what is missing and what can be highlighted more, allows for the prototype to be refined such that it fits the target audience's playstyle in the best way it can. Secondly, it's main goal is to find out what weak points the game has that might cause the player to stop their play session, or worse; stop using the game. Knowing these weak points allows for a more specified tailoring of the prototype to the player's motivations. From the results of this test, the prototype will be revised into its final form for this research.

### 3.2.2. Evaluation phase two

In phase two of the evaluation, the final prototype will be validated. Participants are shown the prototype and asked their opinion on it. Additionally, participants are again asked to score the mechanics of the prototype based on how effective they find them. This validation test is expected to take around 30 minutes per participant and will take place in a meeting room or online. The results of this validation phase will be compared to the results of the first evaluation phase, to see if the revisions made on the prototype based on the results in phase one do indeed increase prototype's potential effectiveness.

## 4 Ideation

### 4.1 Project requirements

From the theory, research goals and stakeholder analysis, the following general project requirements can be determined. These requirements are formatted in italics.

#### 4.1.1 Integration into UT environment

The first requirement pertains to the integration of students into the UT environment. To combat any information students may have lost during their first week at the UT, *the game should have information on all the essential buildings and facilities included*. This way, students have a basic knowledge on the facilities and their location.

To make sure students actually know this information and these locations, *the game should stimulate players to go to locations and consume the information that the game offers*. Additionally, *these game mechanics should allow for the UT to guide players to a certain area or location*.

#### 4.1.2 Stimulating social interaction

*The game should facilitate and stimulate social interaction between players to increase the speed of students' social integration at the UT. This should be done in different ways so that multiple types and intensities of interaction are facilitated*. Keeping the barrier to interaction as low is key to involving as much of the target group as possible, whereas using a range of intensity in social interaction is necessary to keep more social players entertained.

#### 4.1.3 Facilitating the target group

Since the target group for this project is relatively large, *the game should be designed to facilitate for multiple types of players from the Hexad User Types Framework [9]*. This can be done by offering different activities and ways to play the game. Often the most efficient way to facilitate for different ways of play is to use simple game elements that can be used in multiple ways.

## 4.2 Technology

### 4.2.1 Smartphone

There are many technologies that could help the project meet the requirements. However, creating a product suitable for smartphones would offer a lot of advantages for the project. Smartphones contain many different sensors and systems that allow for basic movement and locational detection, as well as playing and recording audio and images. Almost all UT students already possess a smartphone, keeping the barrier to use the final product very low. Additionally, the implementation process would be very simple as a physical setup is not necessary.

### 4.3 Ideation conclusion and chosen concept

From the state of the art, we see that recent LBG concepts for a similar purpose as this research, often use a similar set of mechanics with promising results. This set of mechanics is based around a locational check-in game for smartphones, often combined with ownership elements or stimulants for social interaction. Popular entertainment games like Pokémon GO [18] or Ingress [19] stimulate players to go to and discover locations, by giving out rewards when they check in there. Additionally, players can overtake locations to get rewards as well. Campus Explorer [22] uses location check-ins as well, combining it with mechanics aimed for stimulating socialization and discovery: its social features have shown to be well received by students. Lastly, Singerland [20] uses locational data combined with challenges to stimulate interaction among players and their environment and shows promising results as well.

This research will build and expand upon these promising LBG mechanics. The game concept for this project will use location check-ins, ownership of points of interest (POIs), and mechanics that stimulate social interaction and cooperation. The table below shows the project requirements and the strategies to fulfill them in more detail.

Topic	Requirement	Strategy
Integration into UT environment	Stimulate user to go to locations	The game is location-based and requires the player to go to a certain location to progress in the game.
	Availability of information on essential facilities and locations	The game offers links to more information on essential facilities and locations.
Stimulating social interaction	Stimulate players to gather in a location	Give out rewards when players check into a location/POI.
	Stimulate players to bond	Players need to cooperate to complete in-game tasks.
Facilitating for large target group	Different ways of play	Players can discover new areas and points of interest. Players can collect items and customize their avatar.
	Accessibility	The game elements are designed to be inclusive to players with a form of color blindness, reduced vision and/or mobility.
	Inclusivity	Avatars feature reduced gender distinctions with many customization options.

Table 4.3.1. Intervention requirements and proposed strategies on how to satisfy them.

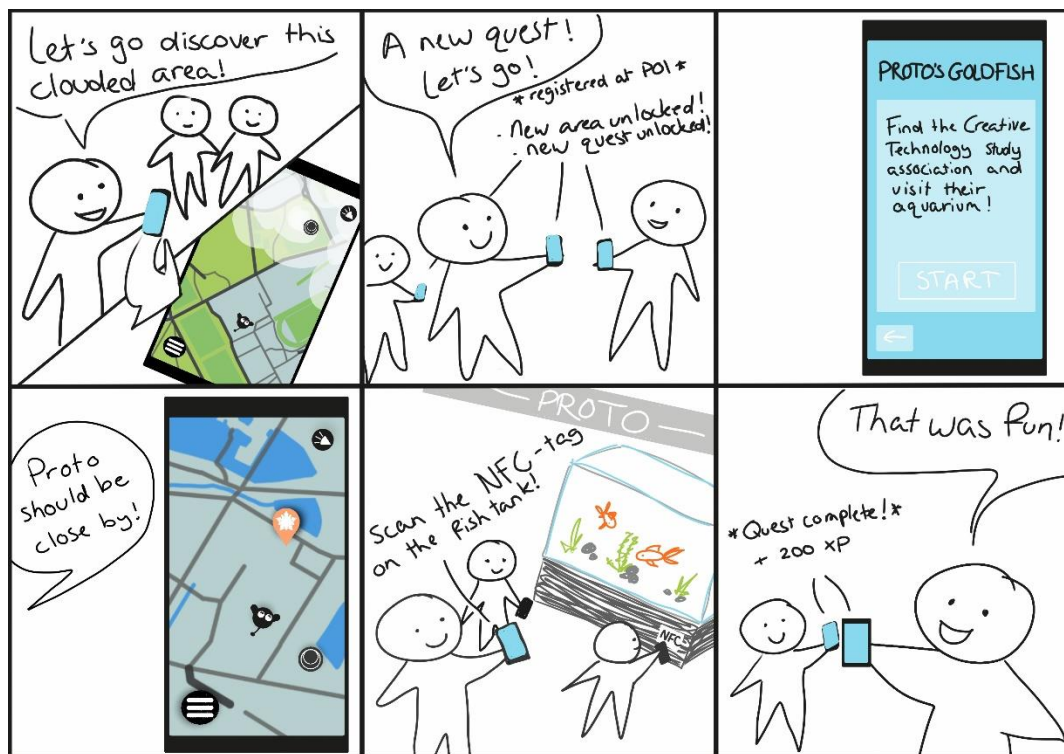


Figure 4.3.1. Concept storyboard sketch.

## 5 Specification

### 5.1 Concept specification goals

Since developing the entire game falls outside of the time constraints for this research project, the choice was made to focus on the check-in mechanics of the conceptualised prototype and how the design of such mechanics may influence player behaviour. Therefore the goal of the specification phase in this research is to design several check-in mechanics for the conceptualised prototype. First in this phase, the experience goals for the stakeholders will be identified based on the project requirements. Then the check-in mechanics will be conceptualised.

### 5.2 Experience goals

In their book, Fullerton explains the importance of player experience goals in the game design process [35]. Experience goals are the goal for what experience the player will have in the game. They serve to guide the design process and check whether the created product fulfils the needs it has been designed for.

For this research project, the main goals are to stimulate players to go to locations and interact with each other. However, players might have a different goal leading them to play the game. Translated into player experience goals, the specific game prototype goals become as follows:

1. players can play casually throughout their day;
2. players have to cooperate with other players to progress faster in the game;
3. players easily connect with other players during gameplay;
4. players have the freedom to discover the UT environment on their own pace.

### 5.3 Check-in mechanics

Before being able to stimulate social interaction with the presented concept, it is important to get players together. Additionally, in their future research Bürgisser [22] suggests the addition of more gaming and collaborative features, specifically in the location check-in mechanics. Therefore the goal for the specification phase in this research is to design a set of check-in mechanics that support the project's two main goals: stimulate players to go to locations and facilitate interaction and cooperation.

There are different specific gameplay mechanics that can be implemented in the location check-in process to stimulate players to go to locations and interact with each other. For the previously presented game concept, different check-in mechanics have been designed. These mechanics build upon a basic check-in mechanic with a cooldown timer. To stimulate players to come to a location, there are special circumstances in which players can earn additional rewards. The mechanics' functionality is presented in table 5.2.1.

The assistance mechanic especially is designed to lower the barrier to interaction with other players. The mechanic offers an easy conversation starter, working like an ice breaker and leaving room for more interaction between players when they desire it. Furthermore, the assistance mechanic can be a way for players to casually earn more rewards when they are already checked in at a location. For example, a player can check into a location for their lunch break and assist other players with their check-ins while the player eats their lunch and waits for the cooldown timer to run out.



Mechanic	Mechanic functionality	Behaviour goal
<b>Basic Check-in</b>	The player enters the location's range and clicks a button on their device to check in. Then, they receive an in-game reward.	Stimulate players to go to locations.
<b>Check-in Cooldown</b>	Players can only check in at the location once in a specific amount of time.	Balancing players' progression in the game.
<b>Location of the Day</b>	Every day, a different location is selected as "location of the day". When a player checks in at the location of the day, they earn a bonus reward.	Stimulate players to go to locations.
<b>Check-in Assistance</b>	When a player checks in at a location, the player can request assistance from other players. Players present at the location will receive a notification of a player requesting assistance and can choose to assist. The assisting player is given three symbols and must choose the symbol displayed on the requesting player's device. When correct, both the player and the assisting player earn a bonus reward.	Stimulate interaction between players.
<b>Long Time No See</b>	Players get a bonus reward for checking into a location which they have not visited in over a month.	Stimulate players to keep visiting different locations, as well as stimulate players that haven't played in a while to come back to playing the game.

Table 5.2.1. The functionality of the conceptualised check-in mechanics.

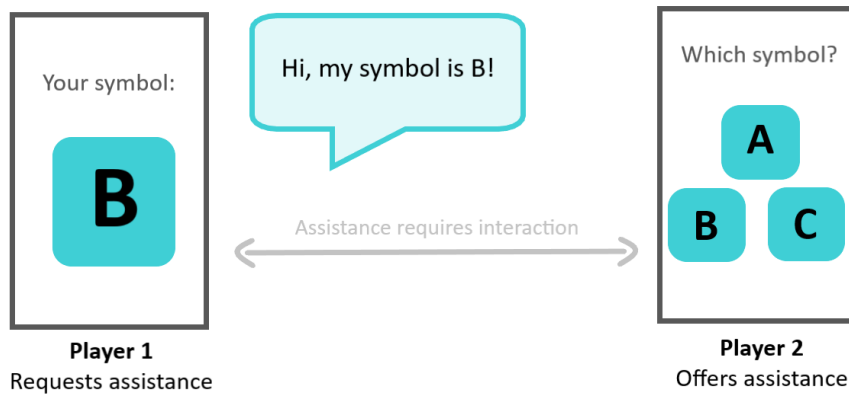


Figure 5.1.1.1. The Assistance check-in mechanic.



Figure 5.1.2. Storyboard showing the predicted usage of the Cooldown Speedup mechanic.

## 6 Realization

### 6.1 Realization goals

The aim of the realization phase is to create a prototype with which the effectiveness of the concept can be researched. As mentioned previously, it is not possible to build the entire conceptualised game within this research's timeframe and therefore the focus will be on the concept's check-in mechanics.

These check-in mechanics could be tested within a boardgame-like context, simulating the travel component of the LBG using pawns to indicate player location and markers to indicate POIs. Timers and counters could simulate the check-in cooldown and reward system. The first phase of the evaluation could then consist of a playtest of these mechanics. To further validate the check-in mechanics in the context of the concept, a mock-up is needed to represent what the conceptualised game would look like when produced. The second phase of the research could then consist of an interview with participants from the first phase, showing them the mock-up and reviewing the mechanics in the context of this mock-up of the game.

### 6.2 Prototype for phase one evaluation

Simulating the check-in mechanics in a board-game would require some key components:

- a large amount of timers to represent the cooldown per player per POI;
- a way to represent the cooldown boost;
- a system calculating and keeping track of the player rewards;
- a system calculating the POI ownership;
- a representation of the location of the day;
- a system representing the assistance mechanic.

To fulfil these requirements, it was decided to program a tool to handle the timers, timer speedup, player rewards and ownership, as well as show a location of the day. This tool was created using Godot [36]. Godot is a free, cross platform and open-source game engine, usable for both 2D and 3D games. Godot works with object-oriented APIs and many different programming languages; Godot's own GDScript, but more commonly used languages such as C# and C++ as well. This engine allows for easy deployment to many different platforms, including mobile.

Additionally, a WhatsApp group chat will be used besides the timer tool so players can call system functions, representing them clicking the check-in button in the conceptualised game. The WhatsApp group chat will be used for the assistance mechanic as well, allowing players to ask for assistance and respond. Simulating the symbol the player receives will be done via WhatsApp's private reply function and emojis. Players must then verbally communicate their received emoji, and the assisting player must reply to the assistance request in the group chat with the correct emoji to get the bonus rewards.

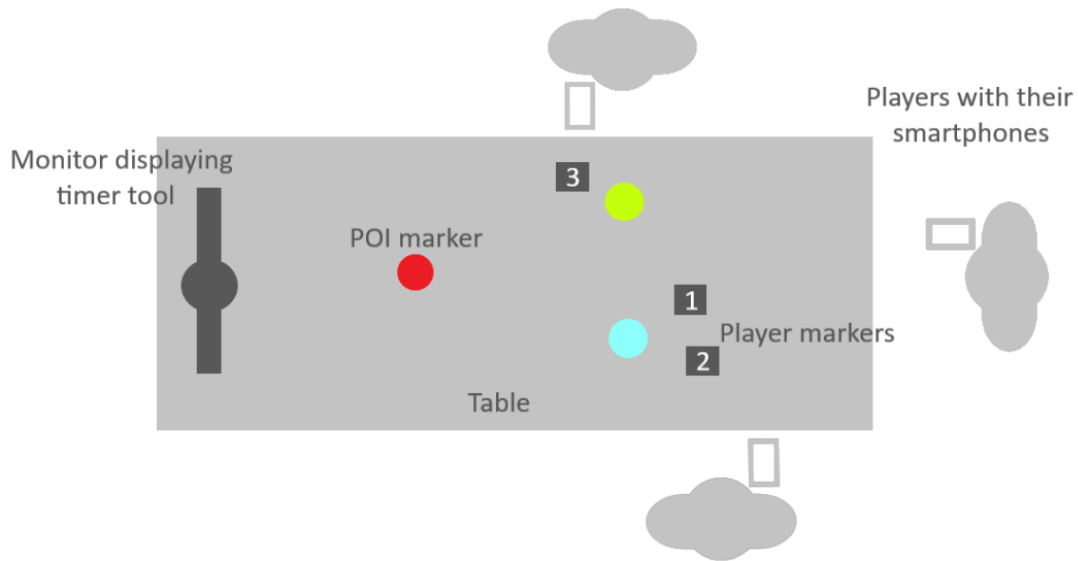


Figure 6.2.1. The conceptualised setup for representing the game mechanics.

The prototyped timer tool, as shown in figure 6.2.2, allows the researcher running the evaluation session to keep track of the locations of players and their check-ins. When a player calls a check-in using the WhatsApp group chat, the researcher checks the player as present on the correct POI. Then, the researcher starts the corresponding timer. The system then calculates the reward the player gets for their check-in using a random number generator. Rolls are POI dependent, where the chance of a specific colour reward is largest when checking in at the corresponding POI (see table 6.2.3). When players use the assistance function or check into the POI marked as the location of the day, the researcher gives them a bonus reward using the Bonus button. The right side of the tool is the reward overview, which calculates and displays the player's rewards. If multiple players are present at the same POI simultaneously, the researcher toggles one of the speedup buttons above the timers, depending on the amount of players present. This will speed up the timer for the players present at the POI. Additionally, the tool calculates which of the players has collected the most rewards corresponding to the POI colour and is therefore the location owner. For example, if player 2 has collected the most red essence, the tool will automatically set the owner of POI Red to player 2. Players present at the POI they own automatically get the X1.5 boost on their timer cooldown, regardless of whether the number of players is too low to get this boost.

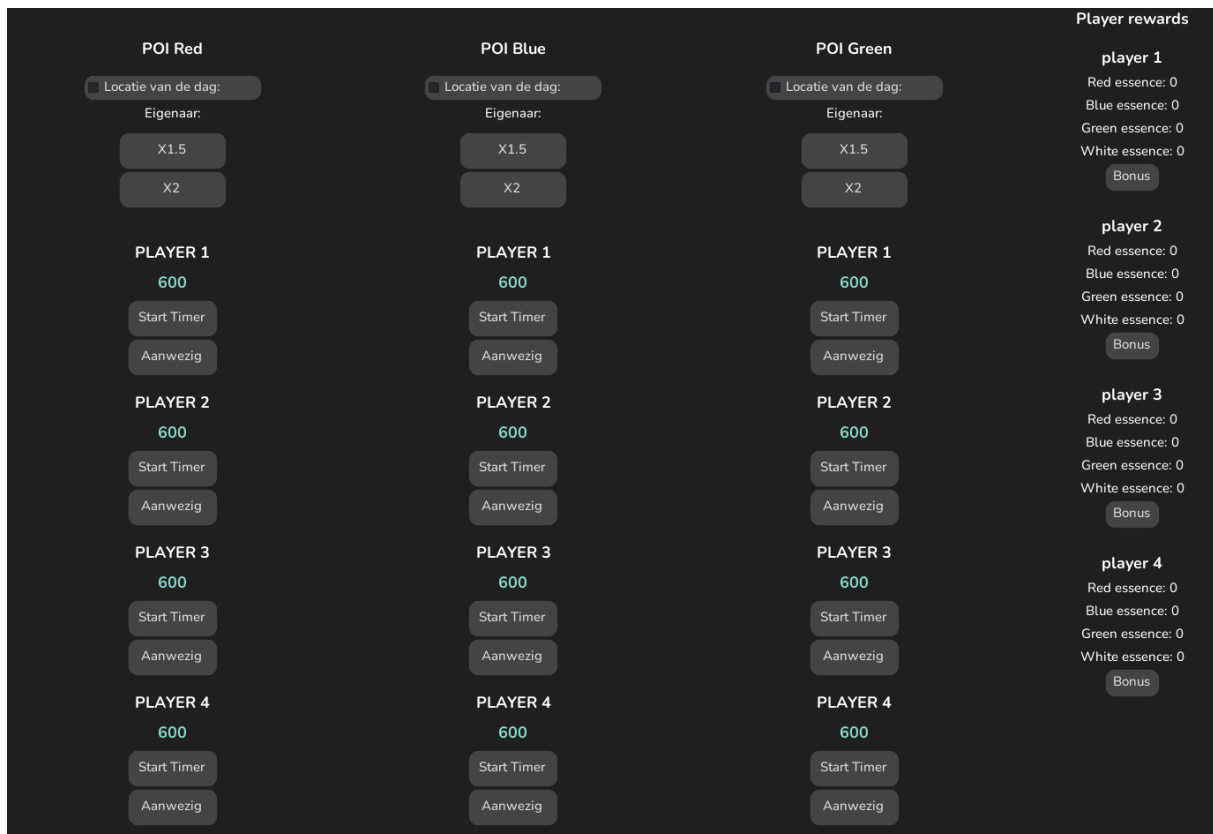


Figure 6.2.2. The final timer tool prototype for phase one evaluation (Dutch version).

Roll	Player reward
1	Blue essence
2	Green essence
3	White essence
4-7	Red essence

Table 6.2.3. Roll distribution for POI Red.

### 6.3 Prototype for phase two evaluation

For the second phase of the evaluation, a mock-up is made of what the concept would look like when built without the time constraints of the graduation project. The mock-up represents the user interface design and the graphic design of the game functions.

For colour-blind users, it is important that the UI design uses colour-blind friendly palette combined with contrast within the design. Using the website *Coloring for Colorblindness* by David Nichols [37], the colour palette for the prototype has been designed using mainly shades of blue. Red and green should be avoided as contrast colours, as they tend to be difficult to differentiate for the colour-blind. For this reason a more magenta shade of red has been chosen, resulting in the colour palette presented below. This colour palette offers enough contrast for all design elements to be clearly distinguishable from one another.

## Color Palette

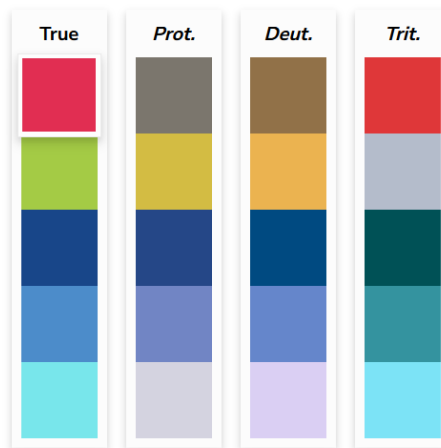


Figure 6.3.1. The colour-blind friendly palette used for the phase two prototype.

The prototype was built using Proto.io. Using this tool, the finished prototype feels like a real app and therefore gives the participants in the evaluation the most accurate vision of the concept. The prototype displays all the main concept components which would have been present in the final product; the map with POIs and check-in, a user profile, the assistance mechanic and the location of the day. A leader board was implemented in the POI screen, as participants in evaluation phase one stated they liked being able to see how close other participants were to taking over a POI. The colour-based reward system from the phase one prototype has been implemented in the phase two prototype as well. The reward system could be designed differently in future development of this project, but for this research it is meant to provide consistency for participants who participated in evaluation phase one as well as evaluation phase two. Additionally, the user profile page in the prototype features some example badges players might earn when playing the game. The complete set of screens in the prototype can be found in appendix A.

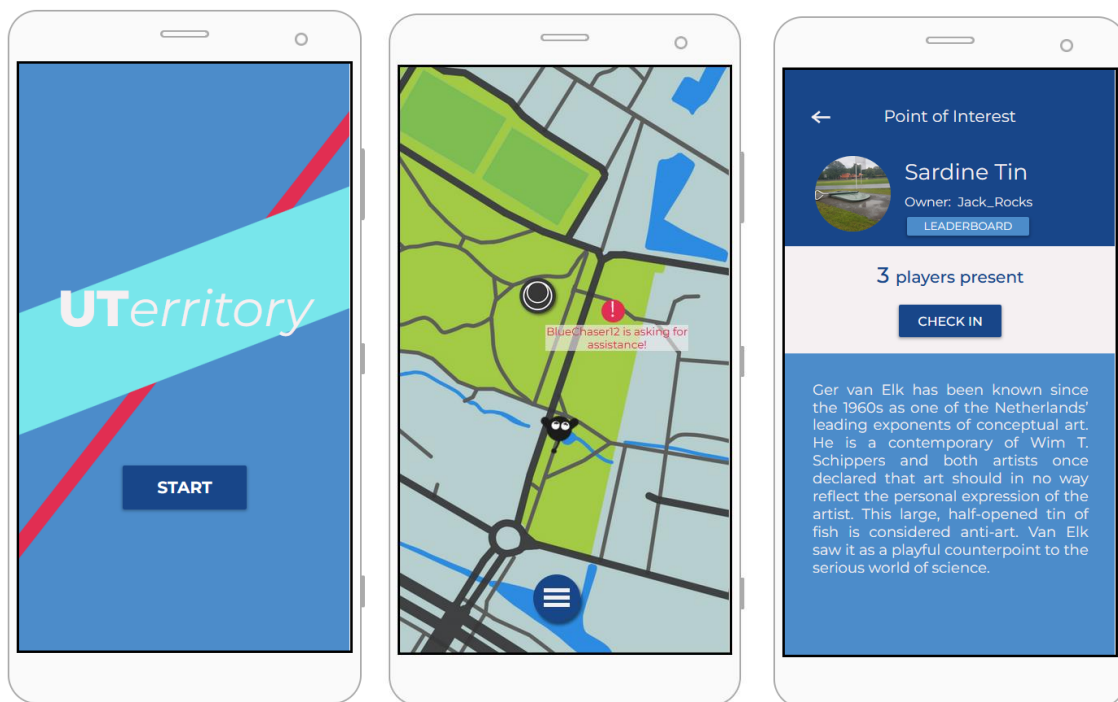


Figure 6.3.2. Three screens from the phase two prototype, representing the start screen, main screen showing the user's location, as well as the POI screen.

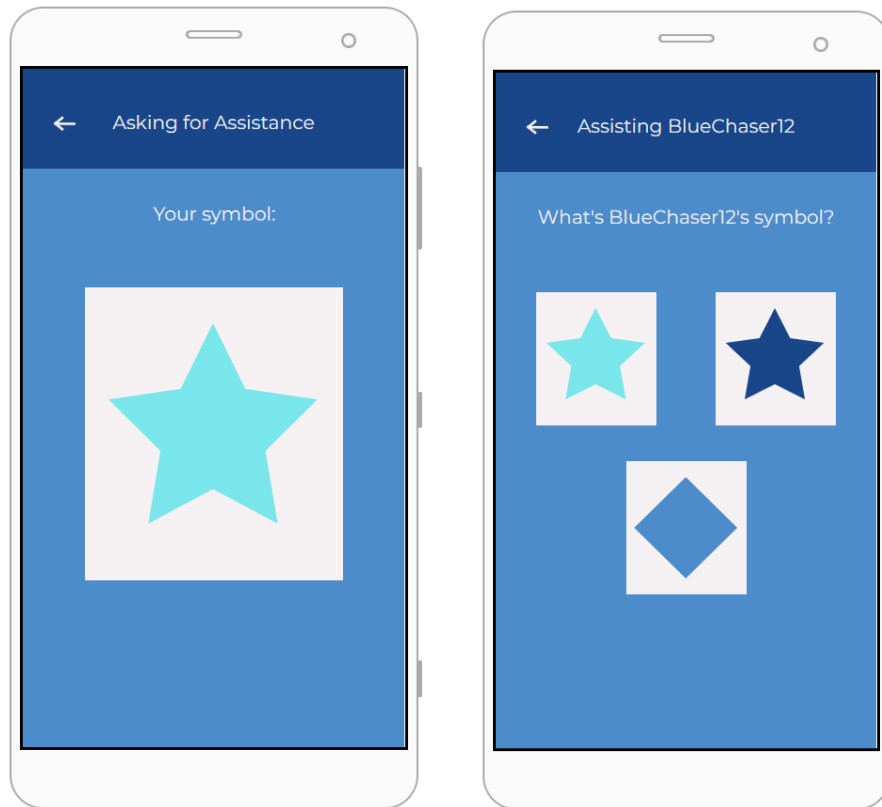


Figure 6.3.3. The assistance mechanic in the phase two prototype.

## 7 Evaluation

The evaluation phase in this research has three main goals. Firstly, it aims to evaluate whether the prototypes stimulate interaction between players and lower the barrier players may feel to interaction with other players. Secondly, it aims to evaluate whether the prototypes stimulate players to go to certain locations and learn about their environment. Lastly, for the concept to successfully contribute towards the problems encountered in the theory, this research phase aims to evaluate whether the prototypes connect to and would be accepted by the target group when developed further. As introduced in the previous chapter, the concept will be evaluated in two phases. This research has been reviewed and approved by the University of Twente's Ethics Committee Computer and Information Science (CIS). The consent forms for participants can be found in Appendix C.

### 7.1 Phase one evaluation

Phase one of the evaluation of this research is a playtest of the mechanics specified in the chapter Specification and the phase one prototype in the chapter Realization. The playtest is done in an informal setting, with 3 to 4 participants around a table (see figure 6.2.1). When the participants arrive to the research location, they are briefed on the research project and its goal. They are explained what the game concept is and what it has been developed for. Then, the consent form is presented and explained to them. While the participants are reading and signing the form, they are added to the WhatsApp group chat that will be used to call game functionality. Last before starting the play session, they are explained the game. The participants are asked to play the game in the way that feels natural to them. The play session takes 45 minutes, in which the participants are observed. After the play session, the participants are asked to fill in a questionnaire about their experience with the prototype game. When all participants have finished, a 15 minute discussion session is started, in which participants are asked to discuss their experience as if the researcher was not there. After this discussion, the researcher can ask the participants some questions or elaboration on observations during the research activity. This will take a maximum of 15 minutes as well. Then, the participants are debriefed and thanked for their participation.

During the play session, each timer has been set to a cooldown time of 10 minutes (600 seconds to be precise) without cooldown boost. Compared to cooldown boosts in other LBGs, this is a small amount of wait time. In Pokémon GO [18] for example, players have to wait 30 minutes before they can get another reward from the same Pokéstop. For this project however, a reduced cooldown allows players to switch more between POIs and thus show a sped up version of how they would play in the real world. Testing these core mechanics separately from the entire game gives a better look into the patterns of play than when the project would have been tested in a hi-fi prototype setting where participants only check into a POI once or twice during the research activity.

In total, 11 participants have participated in phase one of the evaluation. Most participants were university students between 20-26 years old from different backgrounds and studies. Three participants were between 40-45 years old, with a background in game development. While playing, the participants were observed for indications regarding the game mechanics' usability, as well as patterns in play that may arise.

#### 7.1.1 Playtest observations

In two out of three play sessions, there was some confusion among the participants at the beginning of the play session when getting comfortable interacting with the prototype, with some participants sending the wrong system commands or sending commands at the wrong moment. This confusion resolved itself however within 10 minutes, as players were learning the right system commands with some corrections from the facilitator where needed. Two observations during the playtest were most notable. Firstly, participants were showing enthusiasm and competitive

behaviour regarding the assistance mechanic. Participants would predict others' next movements, try to be the first to send the system command to assist ("I'm helping" or in Dutch "Ik help") and cheer when they were indeed the first and earn the opportunity for a bonus reward. Second most notable observation was regarding the ownership mechanic. Participants displayed a lot of competitive behaviour with this mechanic as well, showing pride when stating they were the owner as well as making comments about their plans to overtake a POI from someone else. Additionally, participants actively joined each other at locations to get the cooldown boost. Each playtest, a pattern would emerge were players would strategically coordinate their check-ins to get the most rewards out of their check-ins. Additionally, the most cooperative players would collect the largest number of rewards at the end of the play session.



Figure 7.1.1. Screenshot from a WhatsApp group chat during a phase one research activity (in Dutch).

### 7.1.2 Post-play session questionnaire

After the playtest, participants were asked to fill in a small questionnaire aimed at testing mechanics effectiveness, as well as different constructs relating to the technology acceptance models. The statements, constructs and results of the questionnaire are presented in table 7.1.1. All participants have filled in this questionnaire. The statement questions could be scored between 1 (strongly disagree) and 7 (strongly agree). Results with a mean above 4 show a positive effect regarding the construct.

From these results it appears the check-in mechanics are effective and received positively by the participants. Especially the assistance mechanic and ownership mechanic seem to be well received. Regarding the technology acceptance models, these positive results indicate a positive intention to use a game with the prototyped mechanics from the participants. When asked what



their favourite part of the playtest was, participants responded with either the cooperation with other players in assistance (7/10 responses) or being the POI owner (3/10 responses). This result strongly agrees with the observations during the playtests.

When asked what their least favourite part of the playtest was, participants raised three points: waiting for the cooldown timer to run out, the assistance system for communicating the emojis was not user friendly, and the way rewards were calculated was confusing.

The prototype's user interface is less user friendly due to the system limitations. With a finished user interface design for the game, system functionality might be more clear and user friendly. This will be evaluated further in phase two. Other improvements for a game with the prototyped check-in mechanics that participants proposed in the questionnaire, were a POI leader board to see how close the top players are to ownership, as well as features to disrupt other players' progress. Additionally, participants felt the goal of the game was unclear.

### 7.1.3 Post-play session discussion

After completing the questionnaire, players were asked to share their experiences among each other. Many of the experiences they shared correspond to the most notable results of the questionnaire: they thought the assistance and ownership mechanics were fun, had confusions about the reward system which hindered their ability to strategize, as well as what the goal of the game was. Overall, almost all participants said to have had a good time playing the game and thought their initial difficulties with the system would have been significantly less when they would have played the conceptualized game with a mobile game interface.

Regarding the assistance mechanic, every group of participants thought of a different way to improve it. One group thought there should be badges for players who offer a lot of assistance, so shy players or disruptor type players are incentivized to cooperate more. This group thought the mechanic could additionally be improved by colour-coding players on the map according to how often they assist other players. Another group of participants thought the assistance mechanic could be improved by setting a limit on how often players can assist the same player, to stimulate players to seek out players they have not met before. The last group of participants expressed that they like the idea of features to disrupt other players, like stealing their bonus reward when they assist a player or slow down their cooldown timer.

Construct	Question	Mean result	Adapted from
Playfulness	Boring	4.636 (reversed)	Webster and Martocchio [38]
	Playful	4.455	
	Flexible	4.455	
	Spontaneous	4.909	
	Creative	5.545	
	Constrained	4.273 (reversed)	
	User-friendly	4.636	
Attitude	Altogether, I think these check-in mechanics are a good idea.	5.727	Ajzen [39]
Enjoyment	I think the check-in mechanics are fun to use.	5.273	Van der Heijden [40]
Use Intention	I would play a game with these check-in mechanics.	5.091	N.A.H.
	I would play a game with these check-in mechanics to meet new people.	4.727	
Recognition	Being the owner of a POI feels like a recognition of my in-game progress.	4.455	Hernandez et. al. [41]
	It feels good to me when others can see that I own a POI.	5.636	
Usefulness	I think these check-in mechanics are useful in a game.	5.182	Davis [42]
Effectiveness	The Location Of The Day motivates me to visit different places than I normally would.	4.545	N.A.H.
	When playing a game with these check-in mechanics, I see myself interacting with new people.	5.000	
	When playing a game with these check-in mechanics, the cooldown boost would motivate me to stay in the same location for longer.	5.000	

Table 7.1.1. Closed question results of the phase one post-playtest questionnaire, scored between 1 (completely disagree) and 7 (completely agree) (questions translated from Dutch).

## 7.2 Phase two evaluation

Phase two aims to validate the core game mechanics and evaluate the concept design. This evaluation activity is done in an interview setting, with participants who also participated in the first phase of the evaluation. Four participants were interviewed in a one-on-one interview in Dutch, approximately two weeks after phase one. The translated list of interview questions can be found in Appendix B.

In the first part of the interview, participants were asked about their experiences during the playtest. This helps the participants place the phase two prototype into context. Then they are asked to view and interact with the phase two prototype. When the participant has seen all the prototype screens, the participant is asked about their experience with the prototype and what they think could improve it. Additionally, to take first steps in validating the method of testing the core mechanics separately from the graphic design, the participant is asked whether seeing the design of the game changes their opinion on the game mechanics they've interacted with in the playtest.

### 7.2.1 Participants' previous experience in phase one

Most participants stated they had a bit of difficulty getting familiar with the game mechanics at the start of the phase one playtest and thought the interface looked unfinished. However, these participants also stated that they could imagine the final game through the prototype. Half of participants liked the cooperation elements in the prototype best, where the other half of participants liked the ownership mechanic and its competitiveness best. When asked what was their least favourite part of the playtest, two participants stated they thought the prototype felt constrained with only three POIs, leading to moments where they had to wait for their cooldown to run out. One participant felt the reward system was confusing which kept them from devising a strategy for their play. Another participant stated that they thought the cooperation between players was less interactive than they preferred and would like to see a more meaningful way of interacting with other players. Other improvements participants suggested in this phase of the interview were:

- more activities to participate in besides assisting with check-ins;
- the bonus reward contributes to the necessities for ownership at the POI where the reward was earned;
- more transparency on how the reward system works.

### 7.2.2 Participants' experience with the phase two prototype

When the prototype was presented to the participants, most of them made positive comments on the graphic design of the prototype. The participants were asked what their first impressions were of the game and all participants said the game looked appealing to them. One participant enthusiastically recognized the part of the UT Campus on which the map was modelled. Another participant enthusiastically spoke about how they thought the badges were very motivating for them, as they would be able to show these off to friends or be inspired by friends' collected badges.

When asked what their favourite part of the game was, all but one of the participants gave the same or a similar answer as before viewing the prototype. The other participant answered that they very much enjoyed the information about the POI, as this information was very interesting to them and made them feel connected to their university. Asking participants for their least favourite elements of the game and what they think could improve it, gave the following results.

- Some participants think the game is missing a goal and story that would provide more guidance in the gameplay.
- A participant would like to be able to see other players on the map, with their friend group differentiated from the other players by for example colour. They said this feature would be especially useful during introduction weeks and events, where you could keep track of your friend group and be less likely to lose them. Another participant had a similar suggestion where they would like to be able to add players to a friend list and form groups within the game.
- A participant thought players who do not seek interaction and just guess a symbol during assistance should receive a small punishment.
- A participant would like to see some balancing mechanics in the game that would allow new players to participate in a meaningful way as well. They added that seeing other players be very far ahead of them felt very un motivating to them. A comparable suggestion came from another participant, who suggested POI ownership might be bought with in-game items to balance the lead that more seasoned players may have over the newer ones.
- A participant suggested customization features within the game, such as customising your game character or the colours of the app.

Three participants stated that they would play the game with friends, especially during special events such as the introduction week. One of these participants said they would have really enjoyed playing this game during their own Kick-In introduction week. One participant stated that they would not play the game yet, as they thought other LBGs on the market were more appealing to them than this game in its current state of development.

Lastly, participants were asked whether now they have played the core game mechanics, they think themselves more capable of accurately judging the game concept compared to when they had been presented with solely a mock-up of the game design. Three of the participants answered they felt they had a more complete vision of the game and therefore were more capable of judging it accordingly. One participant said that on the one hand they did feel more capable of accurately evaluating the game concept, but on the other hand had to dig for memories of the playtest which made the evaluation a bit more difficult.

### 7.2.3 Phase two questionnaire

The final component of evaluation phase two was a questionnaire, comparable to the questionnaire from phase one. Most of the statements in the questionnaire are the same as in phase one, allowing for a comparison between participants' evaluation of the concept prototype in both phases. This questionnaire has some additional statements aimed at evaluating and validating the phase two prototype. The statements, constructs and results can be found in table 7.2.1.

Overall, the results of the phase two questionnaires are very positive. The concept appears to score well especially on playfulness, enjoyment, usefulness and ease of use. Participants seem especially motivated by competitive elements such as the POI ownership and leaderboard. Participants seem to have less intention to play the game for the purpose of interacting with other players, than to go out and play the game for other reasons.

While participants rated the prototype and concept positively in phase one, the prototype and concept seem to perform better in phase two when participants can see the graphic design of the game. The playfulness and the recognition construct especially seem to be more present than in phase one. Usefulness seems to also be a better scoring construct than in phase one.

Construct	Question	Mean result phase one	Mean result phase two
Playfulness	Boring	4.636 (reversed)	4.500 (reversed)
	Playful	4.455	5.500
	Flexible	4.455	5.250
	Spontaneous	4.909	5.750
	Creative	5.545	6.250
	Constrained	4.273 (reversed)	4.750 (reversed)
	User-friendly	4.636	6.250
	Modern	---	6.250
Attitude	Altogether, I think this game is a good idea.	5.727	6.250
Enjoyment	I think the check-in mechanics are fun to use.	5.273	6.000
	The design of the game does not look attractive to me. (reversed)	---	5.000 (reversed)
	I think the game looks good.	---	6.250
Use Intention	I would play a game with these check-in mechanics.	5.091	5.750
	I would play a game with these check-in mechanics to meet new people.	4.727	4.500
	I'd love to go out on adventures and visit new places with this game.	---	6.000
Recognition	Being the owner of a POI feels like a recognition of my in-game progress.	4.455	5.750
	It feels good to me when others can see that I own a POI.	5.636	6.000
Usefulness	I think these check-in mechanics are useful in a game.	5.182	6.000
	I think this game is useful to play.	---	5.250
Effectiveness	The Location Of The Day motivates me to visit different places than I normally would.	4.545	5.500
	When playing a game with these check-in mechanics, I see myself interacting with new people.	5.000	4.250
	When playing a game with these check-in mechanics, the cooldown boost would motivate me to stay in the same location for longer.	5.000	4.500
	Leaderboards in the game motivate me to play the game more.	---	6.000
Ease of Use	I think this game is difficult to use. (reversed)	---	6.250 (reversed)
	This game is user friendly to me.	---	6.500

Table 7.2.1. Closed question results of the phase two questionnaire, compared to the results of the phase one post-playtest questionnaire, scored between 1 (completely disagree) and 7 (completely agree) (questions translated from Dutch).

## 8 Discussion

The methodology used for evaluating this research concept has provided valuable feedback on the extent to which the concept's check-in mechanics can stimulate social interaction and support the student integration process. Evaluating the core game mechanics in an early stage of the research has given insight into how they are experienced by the target group and what would make the final prototype more successful. Additionally, the method has given insight into what behavioural patterns players may display when the game is played over longer periods of time.

However, a drawback of this methodology is the concessions that had to be made in the user interface and user-friendliness of the first prototype. However, as the second prototype performed well regarding ease of use and the results (though more positive in the second evaluation phase) seem consistent over the two evaluation phases, the valuable feedback participants could give on the gameplay may be worth these concessions.

Another negative experience the participants raised was a dislike for waiting until the cooldown timer ran out. This result can partially be blamed on the evaluation method as well. In the small-scale setup version of the prototype where the participants are sitting around a table in a research setting, the wait time is more obvious to the players compared to when they would play the enlarged version of the system in their day-to-day setting. Nevertheless, as the cooldown time is a mechanic designed to slow players and balance their game progress, it is to be expected that this mechanic is experienced as an inconvenience to the players. In further development of the project, research should be done on the influence of cooldown duration as well as different factors of boost on playing intensity, to find a correct balance.

During the evaluation sessions, there was some confusion around the reward system among a number of participants. This can be improved with an expanded explanation of the reward system mechanics before the play session. During the realization phase, it was assumed that participants would be expecting the rewards to be calculated semi-randomly, like in Pokémon-GO [18]. However, when in conversation with some participants about this issue, they stated they expected the check-in reward to match the POI colour and got confused when the rewards were calculated randomly. They thought it a good idea to keep the random reward distribution for the regular POI check-in rewards as is, but link the bonus reward to the POI colour. If players get a matching reward to the POI where they have earned it, they can implement more strategy. For example, a player can stay at POI Red while assisting other players and increase their ownership claim on that POI. In future research, different types of reward systems could be developed and tested for their impact on cooperation and playing intensity [13] [28].

While this research shows promising results regarding the potential LBGs may have for student integration, extended, larger scale testing of the concept is necessary for more statistically significant results. First of all, the experience goals 1 and 4, as well as the "Long Time No See"-mechanic could not be evaluated on this small scale. In the methodology of this research, the prototype was not tested in a casual setting where participants would play the game as a side activity, or wander around the UT Campus. Larger scale testing might show to what extent the game functions as casual side activity, as well as to what extent it stimulates discovery. In-game quests like initially ideated in this research may add value to this discovery element of the concept, as results suggested an additional interactive activity might improve the game. In the evaluation questionnaires, participants were asked to choose which of the Hexad Player Types [8] related most to them when playing games (see Appendix B). However, due to the relatively small amount of participants in this research, it was difficult to find patterns between individual participants' related player type and how they score different types of game mechanics. More research should be done into how additional game

mechanics may contribute to different players' enjoyment of the conceptualized game, ideally in a similar way as the study by Lopez and Tucker [43].

In further development of the project concept, players can help develop POIs and quests. User-aided development increases students' access to information about locations and associations that may be of interest to them, as well as help publicise niche associations and sustainable initiatives within the UT environment. This might not only increase student integration further, but increase affective commitment towards the UT as well, as players learn more about what makes the University of Twente so special.

## 9 Conclusion

This research shows how location-based games can support the student integration process through social interaction. Firstly, the conceptualized game can function as an icebreaker for students via the cooperative elements such as the assistance mechanic and the cooldown boost. Participants seemed to enjoy the cooperation and connection elements in the game, even when their reasons for playing the game were different. Participants who cooperated indeed ended the play session with more rewards than the players who did not cooperate as much. This indicates the experience goals regarding connection and cooperation are met. While in this research the cooperation mechanics were designed to stimulate small, initial interactions, these cooperation mechanics can be improved on by designing mechanics that require social interaction in different levels of intensity for players that seek more meaningful or interactive interaction with other players. An additional mechanic might also improve the playfulness aspect of the concept further: participants did not necessarily rate the game concept as boring or constrained, but they were less positive about the game on these specific statements than the other statements relating to playfulness. Nevertheless, the results indicate that the cooperative mechanics in the game concept can be successful in stimulating interaction among players.

Secondly, competitive elements in the game, like the ownership of POIs, the badges and leaderboard, are shown to lead players to locations to meet others. During the evaluation, participants showed flocking behaviour to get a cooldown boost, as well as strategizing their check-ins to compete for POI ownership. Participants rated these competitive elements highly, seeing the progress of other players and the POIs they owned made them play more intensely during the phase one playtest. While the participants indicated to be motivated by these elements to play the game more, results indicate competitive elements can be demotivating for players with less in-game progress. Therefore, it is important to balance competitive elements with cooperative game elements to keep stimulating prosocial behaviour among players [26].

As the prototype in evaluation phase two has shown to be clear and user-friendly, the conclusion can be drawn that the issues in the UI of the first prototype are a drawback of this research method. Even though testing the core game mechanics separately from the graphic design of the game may have skewed some of the phase one evaluation results regarding ease of use, participants were able to play and test out a small-scale version of the game concept similar to how it would be played on a large scale in the envisioned context. This enabled participants to provide valuable feedback on the game concept as a whole in the second evaluation phase. Additionally, this method provided more insight into how participants experienced the game concept and which patterns of behaviour might emerge when the game is played for longer periods of time. This method strengthens the indications that this game concept is effective in its goals and that the same patterns of behaviour observed in the evaluation can be expected when this game concept is developed and tested in a larger scale.

Lastly, the evaluation results regarding constructs of the TAM and HMSAM indicate the project to have a positive acceptance potential within the target group. Results from the evaluation indicate participants enjoyed interacting with the prototype and would like to use the game with friends. The game concept shows great potential for functioning as a social lubricant among students, and may be a promising tool in supporting the student integration process during introduction weeks as well as after them.



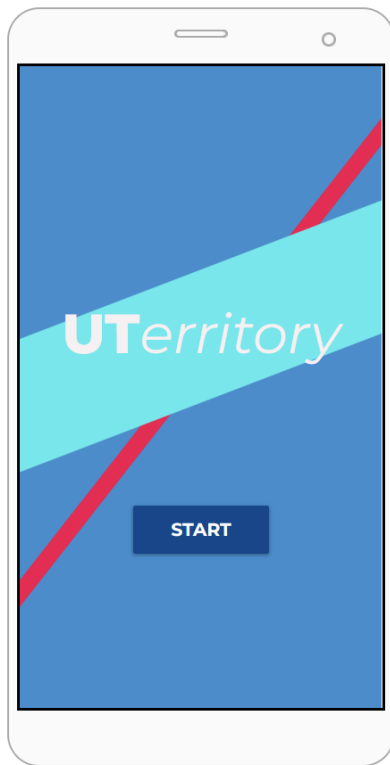
## References

- [1] „Facts & Figures history | (Intern.) Education | Organisation,” University of Twente, [Online]. Available: <https://www.utwente.nl/en/organisation/facts-and-figures/past-years/#influx-first-year>. [Geopend January 2023].
- [2] „NSE Dashboard - Studiekeuze123 - Studiekeuze123,” Studiekeuze123, [Online]. Available: <https://www.studiekeuze123.nl/nse/dashboard>. [Geopend January 2023].
- [3] „Marketing & Communication | Service Portal | University of Twente,” University of Twente, [Online]. Available: <https://www.utwente.nl/en/service-portal/services/mc/>. [Geopend November 2022].
- [4] „Kick-In -- Portal,” Kick-In Committee, [Online]. Available: <https://www.kick-in.nl/nl/>. [Geopend November 2022].
- [5] „CampusApp | Service Portal | University of Twente,” University of Twente, [Online]. Available: <https://www.utwente.nl/en/service-portal/communication/websites-portals/campusapp#product-video>. [Geopend November 2022].
- [6] R. Bartle, „HEARTS, CLUBS, DIAMONDS, SPADES: PLAYERS WHO SUIT MUDS,” April 1996. [Online]. Available: <https://mud.co.uk/richard/hcdis.htm>.
- [7] J. Hamari en J. Tuunanen, „Player types: A meta-synthesis,” *Transactions of the Digital Games Research Association*, vol. 1, nr. 2, 2014.
- [8] A. Mora, G. F. Tondello, L. Calvet, C. González, J. Arnedo-Moreno en L. E. Nacke, „The quest for a better tailoring of gameful design: An analysis of player type preferences,” *XX International Conference on Human Computer Interaction*, June 2019.
- [9] A. Marczewski, „Even Ninja Monkeys Like to Play: Gamification, Game Thinking and Motivational Design,” 2015.
- [10] G. F. Tondello, R. R. Wehbe, L. Diamond, M. Busch, A. Marczewski en L. E. Nacke, „The Gamification User Types Hexad Scale,” *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play*, p. 229–243, October 2016.
- [11] „Big Five Personality Traits - Wikipedia,” Wikipedia Foundation, Inc., [Online]. Available: [https://en.wikipedia.org/wiki/Big\\_Five\\_personality\\_traits](https://en.wikipedia.org/wiki/Big_Five_personality_traits). [Geopend 11 November 2022].
- [12] Mojang, „Welcome to the Minecraft Official Site | Minecraft,” Mojang Synergies AB, [Online]. Available: <https://www.minecraft.net/en-us>. [Geopend 2023].
- [13] C. Phillips, D. Johnson, P. Wyeth, L. Hides en M. Klarkowski, „Redefining Videogame Reward Types,” *OzCHI '15: Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction*, p. 83–91, 2015.
- [14] J. Tyni, A. Turunen, J. Kahila, R. Bednarik en M. Tedre, „Reward Types in Popular Recreational and Educational Mobile Games,” *IEEE Access*, vol. 11, pp. 1166 - 1174, 2022.
- [15] I. Malegiannaki en T. Daradoumis, „Analyzing the educational design, use and effect of spatial games for cultural heritage: A literature review,” *Computers & Education*, nr. 108, pp. 1-10, 2017.
- [16] S. D. Silva, F. M. M. Neto, F. T. d. Macêdo, R. M. d. Lima, J. R. S. Santo en W. L. N. Silva, „Knowledgemon Hunter: A Serious Game with Geolocation to Support Learning of Children with Autism and Learning Difficulties,” in *19th Symposium on Virtual and Augmented Reality*, Brazil, 2017.
- [17] S. Laato, T. Pietarinen, S. Rauti en M. Paloheimo, „A Review of Location-based Games: Do They All Support Exercise, Social Interaction and Cartographical Training?,” *Proceedings of the 11th International Conference on Computer Supported Education*, pp. 616-627, 2019.
- [18] „Pokémon GO,” Niantic, Inc.; Nintendo / Creatures Inc. / GAME FREAK inc., [Online]. Available: <https://pokemongolive.com/>. [Geopend 2022].

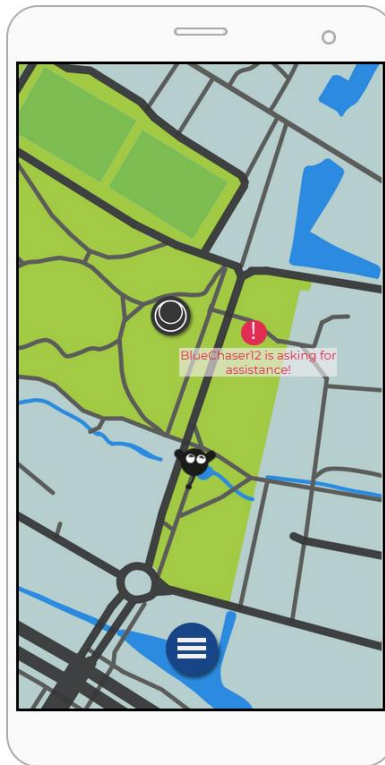
- [19] „Ingress Prime - Ingress Prime,” Niantic, Inc., [Online]. Available: <https://www.ingress.com/>. [Geopend November 2022].
- [20] G. Slingerland, X. Fonseca, S. Lukosch en F. Brazier, „Location-based challenges for playful neighbourhood exploration,” *Behaviour & Information*, vol. 41, nr. 2, pp. 433-451, 2022.
- [21] X. Fonseca, S. Lukosch en F. Brazier, „Design Framework for Social Interaction with Location-based Games,” *International Journal of Serious Games*, vol. 9, nr. 1, 2022.
- [22] B. Bürgisser, F. Zünd, R. Pajarola en R. W. Sumner, „Campus Explorer: Facilitating Student Communities through Gaming,” in *Proceedings International Conference on Game and Entertainment Technologies*, Madrid, 2018.
- [23] „W.S.G. Isaac Newton - Home,” [Online]. Available: <https://www.isaacnewton.utwente.nl/home>. [Geopend December 2022].
- [24] J. Velez, „Extending the theory of Bounded Generalized Reciprocity: An explanation of the social benefits of cooperative video game play,” *Computers in Human Behaviour*, vol. 48, pp. 481-491, 2015.
- [25] J. A. Velez, T. Greitemeyer, B. J. Bushman, J. L. Whitaker en D. R. Ewoldsen, „Violent Video Games and Reciprocity: The Attenuating Effects of Cooperative Game Play on Subsequent Aggression,” *Communication Research*, vol. 43, nr. 4, pp. 447-467, 2014.
- [26] G. P. Verheijen, S. E. Stoltz, Y. H. v. d. Berg en A. H. Cillessen, „The influence of competitive and cooperative video games on behavior during play and friendship quality in adolescence,” *Computers in Human Behaviour*, vol. 91, pp. 297-304, 2019.
- [27] M. Riar, B. Morschheuser, J. Hamari en R. Zarnekow, „How Game Features Give Rise to Altruism and Collective Action? Implications for Cultivating Cooperation by Gamification,” *Proceedings of the 53rd Hawaii International Conference on System Sciences*, pp. 695-704, 2020.
- [28] S. Laato, B. Kordyaka, A. N. Islam, K. Papangelis en J. Hamari, „Territorial or nomadic? Geo-social determinants of location-based IT use: a study in Pokémon GO,” *Internet Research*, vol. 32, nr. 7, pp. 330-353, 2022.
- [29] V. Venkatesh, „Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model,” *Information Systems Research*, vol. 11, p. 342-365, 2000.
- [30] V. Venkatesh en H. Bala, „Technology Acceptance Model 3 and a Research Agenda on Interventions,” *Decision Sciences*, vol. 39, nr. 2, p. 273-315, 2008.
- [31] I. Benbasat en H. Barki, „Quo vadis, TAM?,” *Journal of the Association for Information Systems*, vol. 8, nr. 4, pp. 211-218, 2007.
- [32] P. B. Lowry, J. E. Gaskin, N. W. Twyman, B. Hammer en T. L. Roberts, „Taking “Fun and Games” Seriously: Proposing the Hedonic-Motivation System Adoption Model (HMSAM),” *Journal of the Association for Information Systems*, vol. 14, nr. 11, pp. 617-671, 2013.
- [33] T. S. Nguyen en S. Mohamed, „STAKEHOLDER MANAGEMENT IN COMPLEX PROJECTS,” in *The 7th World Construction Symposium 2018: Built Asset Sustainability: Rethinking Design, Construction and Operations*, Colombo, Sri Lanka, 2018.
- [34] A. H. Mader en W. Eggink, „A Design Process for Creative Technology,” in *Proceedings of the 16th International conference on Engineering and Product Design*, Enschede, the Netherlands, 2014.
- [35] T. Fullerton, *Game Design Workshop: A Playcentric Approach to Creating Innovative Games*, 4th Edition red., CRC Press, 2019, p. 12.
- [36] J. Linietsky, A. Manzur en et.al., „Godot Engine - Free and open source 2D and 3D game engine,” Godot Engine Team, [Online]. Available: <https://godotengine.org/>. [Geopend 2023].

- [37] D. Nichols, „Coloring for Colorblindness,” [Online]. Available: <https://davidmathlogic.com/colorblind/#%23E12E52-%23A4CB45-%23184689-%234C8CCA-%2378E6EB>. [Geopend June 2023].
- [38] J. Webster en J. J. Martocchio, „Microcomputer Playfulness: Development of a Measure with Workplace Implications,” *MIS Quarterly*, vol. 16, nr. 2, pp. 201-226, 1992.
- [39] I. Ajzen, „The Theory of Planned Behavior,” *Organizational Behaviour and Human Decision Processes*, nr. 50, pp. 179-211, 1991.
- [40] H. v. d. Heijden, „User Acceptance of Hedonic Information Systems,” *MIS Quarterly*, vol. 28, nr. 4, pp. 695-704, 2004.
- [41] B. Hernandez, T. Montaner, F. J. Sese en P. Urquizu, „The role of social motivations in e-learning: How do they affect usage and success,” *Computers in Human Behavior*, nr. 27, p. 2224–2232, 2011.
- [42] F. D. Davis, „Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology,” *MIS Quarterly*, vol. 13, nr. 3, pp. 319-340, 1989.
- [43] C. E. Lopez en C. S. Tucker, „The effects of player type on performance: A gamification case study,” *Computers in Human Behavior*, nr. 91, pp. 333-345, 2019.
- [44] J. Hamari en J. Koivisto, „Why do people use gamification services?,” *International Journal of Information Management*, nr. 35, p. 419–431, 2015.

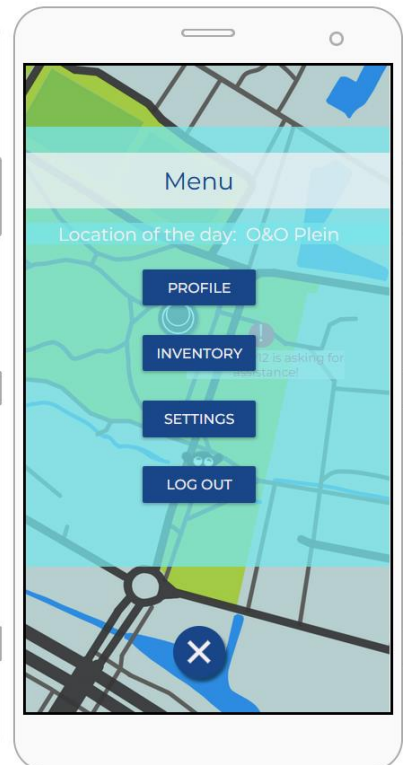
## Appendix A: Prototype Phase Two



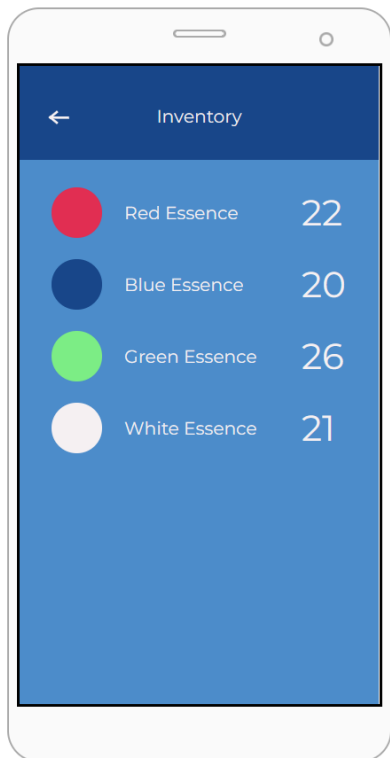
Start



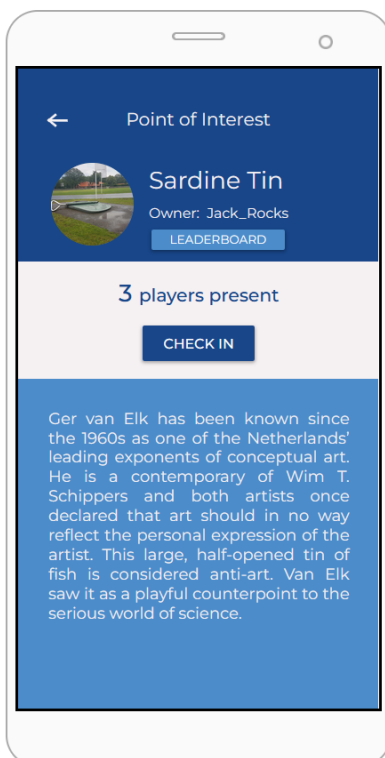
Main



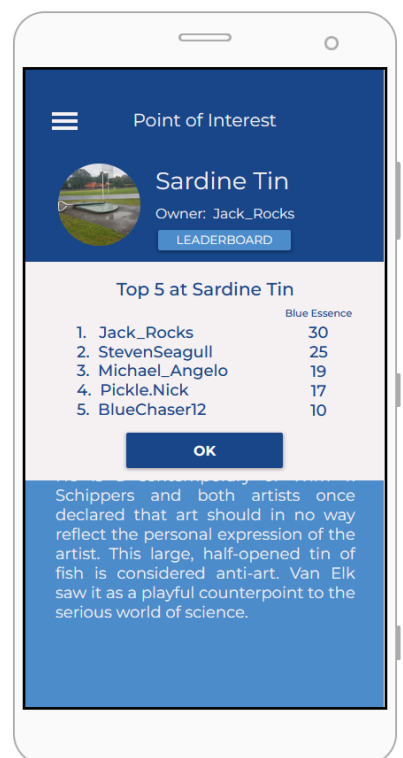
Menu + Location of the Day



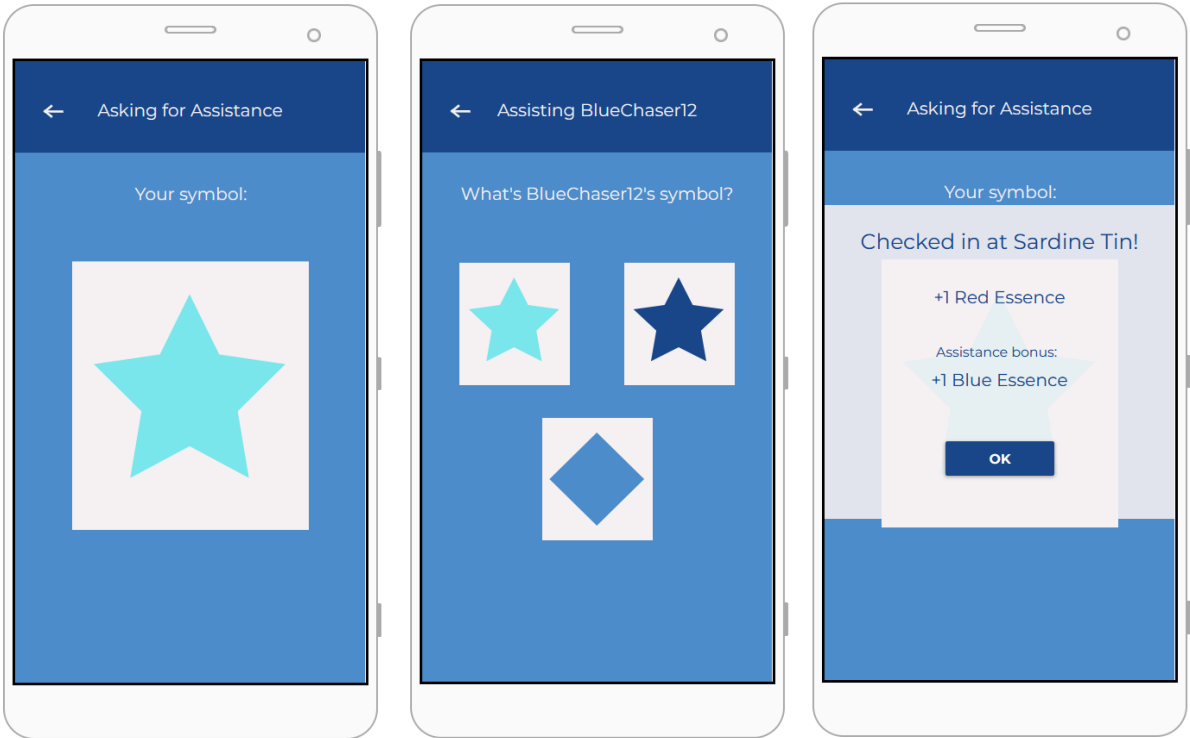
Inventory



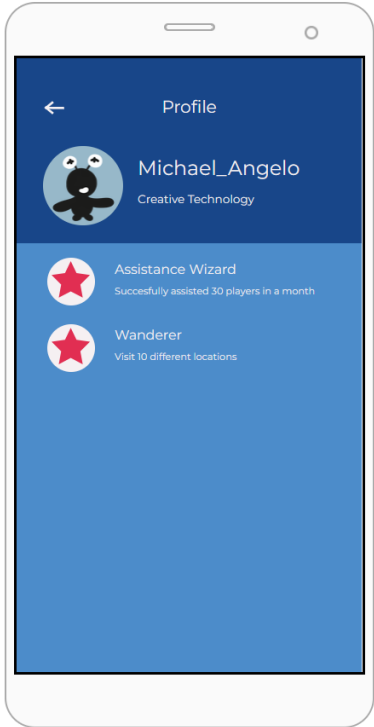
Point of Interest



POI Leaderboard



Assistance Mechanic: asking for assistance, assisting a player, pop-up for successful assisted check-in.



Profile

## Appendix B: Evaluation Questions (translated from Dutch)

Player types & open questions from evaluation phase one questionnaire

**Q: Which of the following options do you relate to most when playing games?**

- A. I want to complete all of the game's challenges and show off my skills.  
(Achiever, 2 / 11 participants)
- B. I think the interaction and cooperation with other players is the most fun.  
(Socializer, 4 / 11 participants)
- C. I want to earn as many rewards as possible in the game.  
(Player, 3 / 11 participants)
- D. I like to figure out how to turn the game upside down.  
(Disruptor, 2 / 11 participants)
- E. I want to discover the deeper meaning and goal within the game.  
(Philanthropist, 0 participants)
- F. I like to express myself in the game and make my own choices.  
(Free Spirit, 0 participants)

**Q: Out of the game mechanics you just played, which is your favourite and why?**

**Q: Out of the game mechanics you just played, which is your favourite and why?**

**Q: If the game mechanics you just played were in a real game, what do you think would make it better?**

Interview Questions Evaluation Phase Two

**Questions asked before viewing the phase two prototype**

1. What do you like most in games? What games do you play often?
2. What was your experience with the prototype in the playtest?
3. What did you enjoy most during the playtest?
4. What was least enjoyable to you during the playtest?
5. What do you think could make the prototype better?

**Questions asked after viewing the phase two prototype**

1. What are your first impressions of the game?
2. Would you play this game yourself?
3. Does this mock-up change your opinion about the game mechanics in the playtest?
4. What is your favorite part of the game as a whole?
5. What is your least favorite part of the game as a whole?
6. What would you want to improve about this game?
7. Now you've experienced the core game mechanics in a playtest, do you feel you can judge this game more accurately than when you would have only seen the mock-up?

## Development of a Location-Based Game for students to discover the UT and Enschede

### Phase 1 Information letter & consent form for participants

This research project aims to design a location-based game that motivates students to discover the UT campus and Enschede. The goal of the game is to speed up the integration process for new students, help them easily expand their knowledge on their new environment and find new people and places to spend their free time with.

In this session, the aim is to evaluate the usability and effectivity of the first prototype of the project. The participant will be asked to playtest the prototyped mechanics, as well as afterwards asked some questions about their experience during the play session and opinion on the mechanics. The session is expected to take around 90 minutes.

To evaluate the research prototype, some personal information will be collected from the participant during the research activity session. This information will **not** include any personal identifiable information, aside from this consent form. Collected information published in the thesis of this project will not be usable to personally identify the participant. The participant has a right to request access, rectification and erasure of the data collected from their session. The collected data will only be used in the thesis of this research project, and will be erased immediately once the research project is concluded.

Participating in this research does in no way pose any risks to the participant or their health. The participant is free to withdraw from participation at any moment during the research activity session.

This research project has been reviewed by the University of Twente's Ethics Committee Computer and Information Science (CIS).

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Computer and Information Science.

#### Researcher contact information

Emma Brouwer

E-mail:

[e.e.b.brouwer@student.utwente.nl](mailto:e.e.b.brouwer@student.utwente.nl)

#### Ethics Committee CIS contact information

ethicscommittee-cis@utwente.nl

Date: 29<sup>th</sup> May 2023

***Please tick the appropriate boxes***

**Yes    No**

**Taking part in the study**

I have read and understood the research information dated 29<sup>th</sup> of May 2023, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

(

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

(

**Use of the information in the study**

I understand that information I provide will be used only for the thesis of this research project, and will be erased once the project is finished.

(

I understand that personal information collected about me that can identify me, such as my name, nationality and gender, will not be shared beyond the study team.

(

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



# Development of a Location-Based Game for students to discover the UT and Enschede

## Phase 2 Information letter & consent form for participants

This research project aims to design a location-based game that motivates students to discover the UT campus and Enschede. The goal of the game is to speed up the integration process for new students, help them easily expand their knowledge on their new environment and find new people and places to spend their free time with.

In this session, the aim is to evaluate the usability and effectivity of the first prototype of the project. The participant will be asked to complete some tasks with the prototype, as well as answer some questions about their experience and opinion on the prototype. The session is expected to take between 30 and 45 minutes.

To evaluate the research prototype, some personal information will be collected from the participant during the research activity session. This information will **not** include any personal identifiable information, aside from this consent form. Collected information published in the thesis of this project will not be usable to personally identify the participant. The participant has a right to request access, rectification and erasure of the data collected from their session. The collected data will only be used in the thesis of this research project, and will be erased immediately once the research project is concluded.

Participating in this research does in no way pose any risks to the participant or their health. The participant is free to withdraw from participation at any moment during the research activity session.

This research project has been reviewed by the University of Twente's Ethics Committee Computer and Information Science (CIS).

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Computer and Information Science.

### Researcher contact information

Emma Brouwer

E-mail:

[e.e.b.brouwer@student.utwente.nl](mailto:e.e.b.brouwer@student.utwente.nl)

### Ethics Committee CIS contact information

[ethicscommittee-cis@utwente.nl](mailto:ethicscommittee-cis@utwente.nl)

Date: 20<sup>th</sup> June 2023

***Please tick the appropriate boxes***

**Yes    No**

**Taking part in the study**

I have read and understood the research information dated 20<sup>th</sup> June 2023, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.

(

I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.

(

**Use of the information in the study**

I understand that information I provide will be used only for the thesis of this research project, and will be erased once the project is finished.

(

I understand that personal information collected about me that can identify me, such as my name, nationality and gender, will not be shared beyond the study team.

(

\_\_\_\_\_  
Name of participant

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date