Bachelor Thesis Creative Technology
UNIVERSITY OF TWENTE

COME PLAY WITH ME!

ATTRACTING PASSERS-BY TO INTERACTIVE FLOORS IN SEMI-PUBLIC SPACE

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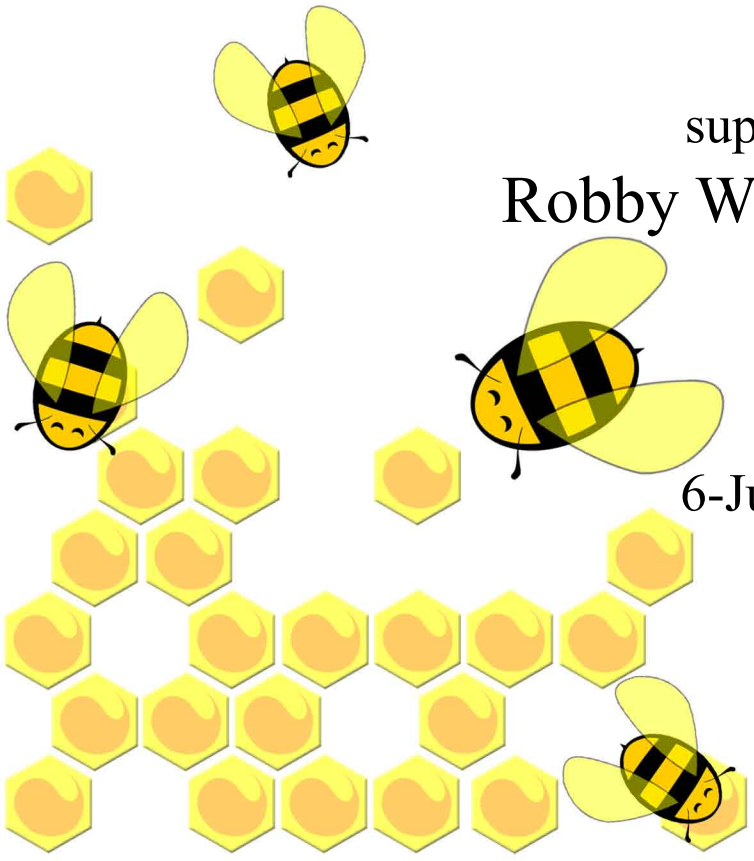

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Abstract

The task of this bachelor thesis, as assigned by the HMI department of the UT, was to develop playful experiences and elements in order to attract passers-by to the interactive floor in the DesignLab, to motivate them for more frequent interaction, and eventually get them interested in the underlying system and its functions. The goal of the proposed prototypes is to attract passers-by to such systems in public space by making them curious.

This is summarized in the main research question: How can careful prototyping based on established theories, design principles, guidelines and models be used to design interactive floor systems which attract passers-by in semi-public space? The sub questions guided my approach of research in related work and user testing.

The research in related work includes insights in the role of design and perception in interactive play and cyberculture, as well as exploring interaction through the Honeypot Effect, social, and performative interaction, with the goal of finding the most effective motivational strategies. Furthermore, it includes system and user group specifications. The covert research method and its ethical concerns are discussed in terms of privacy and persuasive design, defending the practise of observations without consent. The following sections explore interactive artwork as well as goal-based games, whilst paying respect to user autonomy, preferences, competition and the overall timespan of interaction. The prototype concepts are described and the refinement process is clarified, illustrating functions as well as design choices, and the test setup, planning, and preparation are introduced. Known limitations of the research and system are described.

The evaluation of this thesis suggests that the visibility of the interface greatly influences its noticeability and engagement, since visual feedback is a strong engaging factor. Between students, interface experts and OpenHouse visitors, “Vote“ was the least effective proposed concept. The “Uncover“ prototype performed strong, however the slightly more goal-relatedness of the “Buzz“ prototype introduced competition, which additionally boosted the motivation of its users, and made it the most effective at attracting passers-by. To outline my findings, interactive floor systems should improve their visibility as much as possible, since visual feedback is their strongest engaging factor, tailor their game content to their specific target group and environment, and eventually give hints about underlying functions in order to get users interested in the system. Competition, visual and auditory feedback are concluded to be highly effective in grabbing passers-by attention.

Acknowledgement

The art challenges the technology, and the technology inspires the art.
– John Lasseter

First and foremost, I have to thank my research supervisor Dr. Ir. Robby W. van Delden. Without his assistance and involvement in each step throughout the process, this thesis would have never been accomplished. I would like to thank you very much for your support, understanding and trust over this past time.

I would also like to show gratitude to my committee and its advisors, including my programme coordinator Dr. Ir. E.J. Faber. Furthermore, my thanks go to my graduation project coordinator R. Ing. Richar G.A. Bults, and my external supervisor, HMI and CreaTe faculty member R. Ir. Dennis Reidsma.

I wish to express my sincere thanks to Mark Blijleven from ConnectAndPlay for providing me with valuable feedback on my prototypes and information on the popularity of commercially sold interactive floor systems.

I am grateful for the help and constructive criticism of fellow students who accompanied me when setting up my prototypes on the system, amongst others Denise van Ingen and Betina Markova. Their support was greatly appreciated for tasks which I could not have completed myself, and they provided important feedback on the prototypes in early design stages. Furthermore, I would like to thank the DesignLabs DreamTeam for numerous positive remarks, which greatly motivated me during the testing phases.

Special thanks go to my course tutor Ir. Eddy. L. de Weerd for supporting me throughout the CreaTe program, even after his official tutoring duties had ended. I would like to thank you for your motivating words and high beliefs, which never failed to make me work even harder in order to outperform them.

I also place on record my sense of gratitude to all researchers from which I have adapted theories or guidelines, and all artists from which I have borrowed visual or auditory elements.

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1. Introduction

This graduation project was done in collaboration with the Human Media Interaction department of the University of Twente. The task was to create new, playful elements, experiences or games to attract passers-by to the interactive floor in the DesignLab and motivate them to interact more frequently, eventually even getting them interested in the bigger picture and underlying research. The HMI departement was specifically interested in creative methods to attract people, make them curious and get them to interact with the system. The goal of the project was to attract passers-by to interactive floor systems in public space, thus the interface should make the passer-by curious. Creative skills and insights are a key when designing for such an experience, whilst also taking in account cultural or social backgrounds unconsciously influencing the passers-by behaviour. In the course of this project, new elements and experiences were designed which could eventually be adapted in a system that is motivating to a wide range of individuals in the 18-24 demographic.

Interactive floor playgrounds appear more and more in semi-public or public places, for instance shopping malls. People interact by own choice and the success of the systems is usually determined by whether interaction happens often enough. The systems employed are simplistic in functionality and there are currently few scientific explorations, studys or design guidelines concerning interactive floors in specific. This thesis aimed at filling this gap by serving as a study and guideline for designers of such systems.

The guiding problem is outlined in the Main and Sub Research Question:

How can careful prototyping based on established theories, design principles, guidelines and models be used to design interactive floor systems which attract passers-by in semi-public space?

How can passers-by be motivated to play with interactive floor systems?

How can passer-by interaction, observed satisfaction and self-reported experience be evaluated in order to measure if the design approach is successful?

The sub research questions concern the state of the art review and user testing outcome measures in specific. The first sub question was approached by studying established design approaches, in order to elicit curiosity. Theories and guidelines discussing factors influencing user perception, engagement and interpersonal interaction in various environments will be explored. Amongst other fields, information was drawn from cyberculture, which serves as a major inspiration due to its strong connection to the target demographic. For the second sub-question, knowledge was drawn from prior projects and courses of the Creative Technology program. Furthermore, a careful user study design and thought-out evaluation plan was developed in order to collect meaningful data.

The projects task was approached by scanning existing literature for contents and practises which have a strong impact on their recipients perception and interaction. The impact of interactive and social play was examined in digital and real-life settings, whilst paying attention to user perception, introducing intrinsic motivation, the users role as performer in a co-located environment to possible spectators, and the Honeypot Effect. This was concluded with functionalities and requirements for prototypes, which were observed in a natural setting. Following from those observations, the prototypes were redefined and further evaluated through observations and expert feedback. Prototyping and user testing was done on the interactive floor playground in the corridor leading to the DesignLab, in the Gallery Building at the UT. Doing covert research with passers-by means they can not give consent before interacting, therefore ethical elements had to be dealt with early in the project. Access to current systems and coding frameworks was permitted, with the option of installing additional activators, screens or input devices. Furthermore, contacts in the larger domain were provided by the supervisor, including contacts with companies and system designers.

This thesis includes a review of related work, reflects on ethical issues which arise when conducting covert research, draws a set of strong motivational strategies, and from those concludes with requirements for the prototypes. The prototype concepts will be explained and their functionalities will be exhibited, the test setting and observation methods will be outlined and outcomes of the research will be analysed. The following evaluation sums up all findings, and finally the thesis is concluded with a summary including a set of guidelines for the design of interactive floor systems in semi-public environments. Furthermore, a discussion reflects on the limitations of the research.

2. Related Work

2.1 Rationale

The problem challenged by this thesis can be generally defined as designing experiences which motivate passers-by, and assessing what factors could influence or steer their behaviour in the DesignLab. This was approached by scanning established design approaches, theories and guidelines for factors influencing user perception, engagement in play and interpersonal interaction. In order to foster new and creative ideas, the assessed literature spanns multiple subject areas, including but not limited to interactive floor environments. The 18-24 demographic frequently present at the DesignLab belongs to the main consumers of digital media, therefore motivating content was examined to some extent through analyzing the pull-factors of cyberculture. The areas that were discussed include the internet meme and digital gaming. In order to classify user motivation and engagement, the social interactions of users and their potential role as performer were paid attention to. Interactive installation and movement-based game studies were examined in order to best prepare for and design the user testing. The phenomenon Honeypot Effect and its motivational pull was assessed in order to make the installation as engaging to bystanders as possible. Furthermore, Moreno et al.'s case study [21] was taken into consideration, because it takes place on the same playground system which this research took place on.

2.2 Design & Perception

This section builds on research in interactive play and internet culture, which adopt functions, aesthetics and to some extent persuasive methods to influence their recipients perception.

2.2.1 Interactive Play

When examining how interactions take place and to what degree they can be mimicked in a digital form one must first assess what motivates interaction in the real world. Lowes essay [1] provides a description of the general look and feel of various real world interactions with objects and human beings. He illustrates that the appeal of a situation is not caused by a singular sense but rather by a combination of different factors, by describing in detail the feelings and thoughts related to certain situations, actions, or even just smells. In regard to an interactive floor system, this suggests that mimicked real world situations may lose some of their motivational factors. In order to imitate real world situations digitally, research of the past has derived certain guidelines to be considered by designers and programmers. Snibbe and Raffle [2] offer a set of useful principles for character aesthetics and animation, focusing on the ease and natural feel of the visible elements. They suggest design approaches which describe how objects and interactions play out in real-life through mimicking and exaggerating natural actions, interactions and deformations. This proves to some extent that real-life interactions are less motivational when translated into digital systems or games, but at the same time provides methods to increase the engagement by other means. For example, a pigeon chase game, where pigeons explode upon collection, designed in a cartoonish style. Furthermore, it introduces the strong motivational pull of the impossible interaction, which is also a strong engaging factor of play and games in general. Make something the user could never do in real life: let him walk across a pond and interact with the fish swimming in it. There are no specific user memories allocated to such interactions, therefore there is no expectation to be satisfied.

Although those papers focus on different environmental settings, they agree on several points considering the receivers perception. The concepts of motivation, attention span and timing for example are examined in both Lowes [1] and Snibbes [2] work. Lowe [1] incorporates all senses in his discussion and broadly reports on situations connected to timing, motivation, eager expectation, self control and distraction. This can be useful to distinguish between real life events and their digital adaptations, as much of what makes the real life event appealing could be lost by removing certain sensual aspects. For example, a phone application simulating bubble wrap might be much less tempting compared to actual bubble wrap because the tactile aspect of feeling the texture of the bubble, squeezing it and eventually bringing it to a burst has been removed. Snibbe and Raffle [2] suggest design approaches which take in account how receivers perceive the world around them with a singular focus of attention, taking in account familiarity and sensitivity for timing or exaggeration. Familiarity also is a highly motivational factor of a certain category of internet memes, which will be discussed in the following section.

2.2.2 Cyberculture

This project targets to some extent the 18-24 demographic, which belong to the main consumers of digital media. Cyberculture, especially its communicational and entertainment branches, employ several principles that could prove effective in relating to this demographic, their familiarity and emerging identity. A depiction of internet culture can be most prominently found in the subject of the internet meme. Considering its general concept and definition, Castaño [3] concludes that the general concept of an internet meme is not static and can therefore never be fully defined, whilst noting that their range of their themes ranges widely. Its general sources for motivation include simple fun and recent political or social issues. Davison [4] notes the significance of anonymity for granting the creator a sense of freedom. Most of the internet memes, as well as large parts of fundamental internet culture, stem from websites such as Reddit and 4chan. Chen [5] identifies those roots and explains how the standardization of meme formats, for example the confession bear meme, which depicts a seemingly frowning bear with an adaptable personal and unpopular confession statement, can create value and meaning. Furthermore, he argues that the recipients of internet memes are divided into social groups. Miltner [6] further exposes the tensions between genders, cultures, social life and demographics between users and deduces that whilst everyone has a voice, only few get heard. Guadagno et al. [7] discuss the underlying principles responsible for emotional responses, researching what determines the popularity of a video. They suggest that content generating positive emotions is most likely to be shared. It can be concluded from the research on the phenomenon internet meme that an interactive floor installation using such memes should pay attention to the contents time relevance and use a standardized, popular format. The content should promote positive emotion, whilst also accounting for the anonymity, culture, social life, demographic and gender of its target audience. This could mean drawing from general knowledge on teenager habits, including specific regional events, for instance a FC Twente football match.

In digital gaming, a widely used method to model the level of enjoyment of users is the Self-Determination Theory. Ryan et al. [8] list the contents of the theory as relatedness, autonomy and competence and state that it addresses factors that facilitate or undermine intrinsic and extrinsic motivation. They point out that high levels of autonomy, which can be achieved in game design through flexibility, freedom of choice, structured rewards and feedback, greatly increase the users intrinsic motivation. Seeking for a strong motivational factor of digital games, Przybylski et al. [9] state that immersion is very effective in amplifying the effects of virtual content on decision making and goals. Describing the effects on user perception, they note that immediate feedback on in-game performance is important. For example: the player of a shooter game realises he has hit the target when as soon as he sees blood. The concepts of intrinsic motivation, system feedback, performance and immersion introduced here are discussed in more detail in the next section.

2.3 Interaction & Perception

This section explores research on open ended artwork, interactive art installations and goal based games in order to examine the role of interaction, spectator settings and interpersonal barriers in shaping user engagement.

2.3.1 The Honeypot Effect

The effect that this project aimed at accomplishing can be outlined very suitably with achieving a Honeypot Effect. The term was first mentioned in Brignull and Rogers article in 2003 [20]. Wouters et al. [19] define the Honeypot Effect in Human-Computer Interaction as the effect of active users, which stimulates passers-by to observe and approach the system, and eventually engage in the interaction. Tieben et al. [15] describe an aspect of said effect, the process of social curiosity, as "the fact that passers-by often want to know what other people are looking at or doing" [15, p.352]. For attracting said spectators, they propose to make the required interaction short lasting and similar to everyday actions. Wouters et al. [19] conclude on the optimization of the Honeypot Effect the following characteristics: one should aim for optimization in the physical environment, include triggers and easy transitions between roles, steer users towards collaboration through social play and allow for easy commencement and termination of the interaction. Ten Koppel et al. [18] also note that the natural walking path plays an important role in noticing the installation.

2.3.2 Perception

In order to examine what factors influence user perception of, and willingness to engage with different systems, I considered Morrison et al. [10], who outline in their work the effects of various open-ended art work installations. They argue that it is important to maintain an active state in which the users navigates through, experiences and interprets the work. Furthermore, they link presence, intrinsic motivation, engagement, flow and immersion as elevated states of engagement. De Valk et al. [11] identify methods for open-ended intelligent play environments, covering both first encounter motivation and long term use. The article maintains that immersion as well as competition is only present in repeated usage stages, and states the first encounter stage as depending heavily on curiosity, challenge and fellowship. Isbister and Mueller's article [12] lists guidelines for movement based games and observes that instantaneous feedback on movement articulation can have an engaging effect on the user. They argue that this feedback should not only mirror the users timing but also the quality of their articulation, thereby helping them to improve quicker, whilst also noting that "Moving can demand a lot of mental attention, creating high cognitive load" [12, p.382]. Their suggestion is to reduce the feedback and cognitive complexity when the user is performing a movement. Tieben et al. [14] claim that curiosity can be achieved by presenting the user with a gap in knowledge, which should be not too small nor too big. In their study, they employ implementations of partially hidden information, uncorrelated interaction, distorted expectations and cognitive distortion. The article establishes the importance of not telling the subjects that the installation is part of a study, as this will most certainly change their perception and explorative atmosphere, and concludes with three principles for evoking curiosity: novelty, complexity and uncertainty. In a later

study, Tieben et al. [15] highlight that the context in which an installation is set up has to be taken into account when designing to evoke curiosity, contrasting between environments such as public education facilities and airports or train stations. Here as well, they stress the downside of first encounter exploration, as knowledge about the installation being part of a study might spread fast in social settings, potentially influencing the first-time experience of users. This could be very relevant for this projects research approach, as the primary interest is in passers-by engagement with the system, which might become distorted due to prior briefing. Through avoiding this, the user experience would not be pre-influenced by peers describing the research goal of the system, and it lightens the burden of participating in a study, thus having to spend extra time filling in surveys.

2.3.3 Social Interaction

Social and interpersonal interaction in public places differs vastly between cultures and countries, however, assisting overlaying guidelines can be extracted from literature. Dalsgaard and Hansen [13] argue that immersion takes place not only within the game or installation but also with the immediate surroundings, for example in fellowship, in the act of performing and in the risk of embarrassing oneself. They suggest not to thrust the user out of their established role when creating an interaction. Mitchell and Olsson's article [16] mentions the general sense of discomfort experienced by strangers interacting with each other and notes that the anonymity of internet interactions seems to reduce this social hindrance. They also argue that interpersonal touch should be reduced and alternatives should be provided in order to allow users to connect. On the other side, Mitchell and Boer [17] acknowledge the positive effects of touch in social interaction, and propose in their 3rd design pattern to increase sociability by increasing the chances that users are standing close to each other. Listing various guidelines for designing social play, Tieben et al. [15] highlight the importance of limiting socially unacceptable play, for instance harassing other users.

2.3.4 Performative Interaction

A crucial factor that must be accounted for when designing for public places is the performative interaction of the user with the system, and how playing out this performer role alters his perception of and behaviour in the system. Dalsgaard and Hansen [13] argue that the user of an interactive installation enacts three roles at once: first, perceiving the system and its users from a spectator point of view, then secondly, interacting with the system as an operator, and third, performing for people to observe. Their work partially agrees with Ten Koppel et al.'s article [18], which describes similar stages of user interaction but does not address the spectator role in detail, instead focusing on the user interaction with the installation. Isbister and Mueller [12], whilst admitting that movement is a form of self-expression and accounting for its enjoyable aspects, are also concerned with the influence of spectators on said self-expression. They suggest to make this performative aspect part of the interaction, but also note that in public spaces, this might create awkward situations. The spectator point of view is outlined in Dalsgaard and Hansen article [13], stating that, for interactive art installations, it is important to conceal, partially conceal, reveal, transform and amplify manipulations. This reinforces the prior findings on cyberculture. Finally, Morrison [10] argues that the system should engage the audience to participate by offering them the possibility of creating personal, unique meaning.

2.4 System Specifications

Commercially available systems for interactive floor playgrounds will be accounted for, furthermore the specific target user group is defined whilst taking in account the daily routine and atmosphere at the location of the used system.

2.4.1 Interactive Floors

Interactive floor playgrounds are appearing more often in semi-public or public places, however the systems employed for recreational use are usually simplistic in functionality and there were few scientific explorations or design guidelines concerning interactive floors in detail. The challenge of this project lies in the novelty and creativeness of the elements or experiences it aimed at designing.
An interactive floor system is generally defined by its ability to track the users movement and having a horizontal projection or screen on which the feedback appears. Interactive Floor systems usually include projectors as feedback devices and radar or computer vision to track users. There have been several studies on interactive floors conducted with a wide range of demographics. Over the last decade, many implementations of interactive floor systems have made it into the commercial market, as for example the Lumo Play[1], Active floor[2] and vertigo systems[3].
The case study conducted by Moreno et al [21] states that my specific setup consists of four Microsoft Kinect sensors and two projectors, one PC for tracking calculations and one PC for the visualization and logic of the game. All sensors and actuators are connected over the two PCs.

2.4.2 Target User Group

The specific environment which the prototypes had been designed for was the corridor leading up to the DesignLab in the Gallery building of the University of Twente in Enschede, NL, which is generally referred to as the DesignLabs Playground. The Human Media Interaction department wanted to get more people interested in its interactive floor system, I therefore tried to target my design towards the DesignLabs users and visitors in specific. Most commonly, people walk through the playground whilst they are working in the DesignLab, for example to get lunch. Furthermore, there are around 25 startup company offices located in the DesignLab, which sometimes host events and association presentations. Professionals however make up only a small fraction of expected passers-by on the playground, as about 90% of people using the DesignLab are students which are in process of or have already achieved a higher education degree, and the rest consists of DesignLab staff, generally referred to as the DreamTeam, university professors and professionals. Based on personal communication with the DreamTeam, the dominant educative field of students and university employees is engineering, and common studies are amongst others Electrical Engineering, Industrial Engineering and Creative

[1] Lumo Interactive Inc., 'Lumo Play | Interactive Floor and Wall Games', Lumo Interactive Inc., 2018. [Online]. Available: https://www.lumoplay.com/. [Accessed: 18-Jun-2018].
[2] Active Floor, 'Active Floor – Interactive learning for everyone', Active Floor, 2018. [Online]. Available: https://activefloor.com/en/frontpage/. [Accessed: 18-Jun-2018].
[3] vertigo systems GmbH, 'interactive floor projections, walls, tables', vertigo systems GmbH, 24-Jan-2018. [Online]. Available: https://www.vertigo-systems.de/en/. [Accessed: 18-Jun-2018].

Technology. Professors often give lectures, conduct meetings with students or perform idle work, whilst students use the space for group or project work, installation building, conversation and discussion. The noise level might rise when there is project work, however this does not affect the generally silent atmosphere on the playground.
Concluding from my conversations with DreamTeam members and observations I made whilst working close to the playground during my research, most students and professors working in the DesignLab might not pass the playground due to using a different entrance, therefore the young entrepreneurs were expected to make up a larger part of the passers-by. Furthermore, there are school class visits around once a month along with workshops, tours and other events hosted by the university. The peak hours of passers-by on the playground appears to be around lunch or otherwise depending on events, module projects, or other presentations in one of the rooms located close to the playground.

2.5 Summary

The review of interactive play and cyberculture concluded in a set of functions, designs and other methods to influence user perception. The summative evaluation of design guidelines to influence user perception suggested that a systems aesthetics should not only mimic but exaggerate natural interaction. From the field of cyberculture there are numerous inspirations on how to create appealing content for a wide audience, in areas including politics, sociability, culture or pure entertainment. Through digital gaming, the self determination theory has been introduced, highlighting feedback on user performance and freedom of choice as vital factors for motivation. Furthermore, a factor which must be taken into account is the attention span of the user and his susceptibility to distraction. From the research on user perception and the Honeypot Effect, it could be concluded that there are several factors influencing user interaction, engagement, social and interpersonal barriers and spectator settings. Intrinsic motivation seems to have a strong impact on user engagement, whilst immersion is mostly found in subsequent play. Instantaneous feedback on movement articulation must be kept in mind, however reducing the feedback and cognitive complexity whilst movement is performed is also advised. Strong methods for inducing curiosity are novelty, complexity and uncertainty, furthermore, first encounter exploration should be avoided. Regarding social play, the established role of the user should be considered, including the possible discomfort of strangers interacting with each other, and interpersonal touch should be avoided. However, increasing the chances that users are standing close to each other has proven to increase their sociability, thus motivating new encounters and social experiences. The limitation of socially unacceptable play, for instance harassing other users should be kept in mind. Considering the users role as performer in a co-located environment, possible spectators should be accounted for when designing for enjoyable display of self-expression, and awkward situations should be avoided. It is suggested to engage the audience to participate by offering them the possibility of creating personal meaning. When designing in order for passers-by to observe and approach the system and eventually engage in the interaction, the required interaction should be short lasting and similar to everyday actions. The users natural walking path should be considered and the transition between active play and spectators must be quick and simple.

3. Methods

In the following, the testing setup and research practises will be outlined. My approach was to observe passers-by in a natural setting, whilst considering their privacy, in order to draw conclusions and recommendations.

3.1 Test Setup

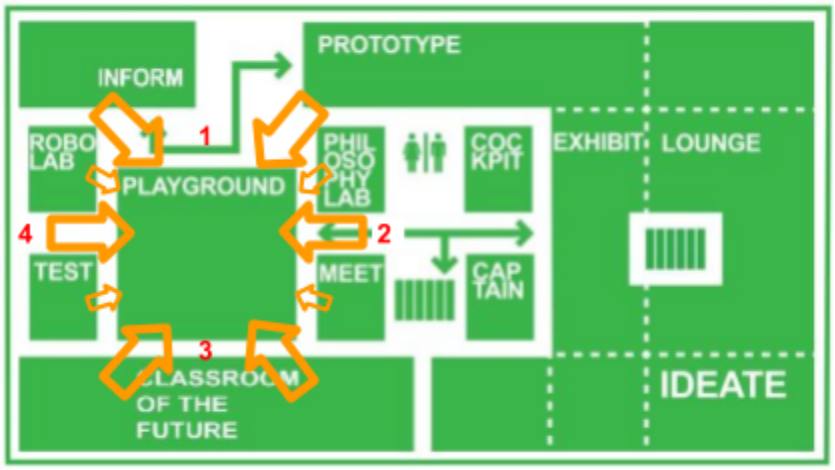

Figure 1: DesignLab Floor plan[4] with directions

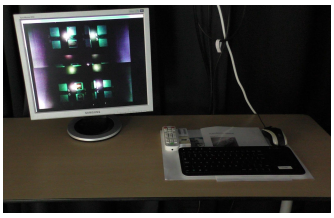

Figure 2: Desk Setup

As noted before, the playground in the DesignLab can be accessed from multiple directions. Figure 1 illustrates the floor plan of the area in which the playground is located, the orange arrows show the directions from which passers-by enter and indicate how frequently they were used.

[4] Universiteit Twente, 'About us | UT - Designlab', Universiteit Twente, 5-Dec-2017. [Online]. Available: https://www.utwente.nl/en/designlab/organisation/Facilities/. [Accessed: 19-Jun-2018].

Figure 3: Playground View, direction 1

Figure 4: Playground View, direction 2

Figure 5: Playground View, direction 3

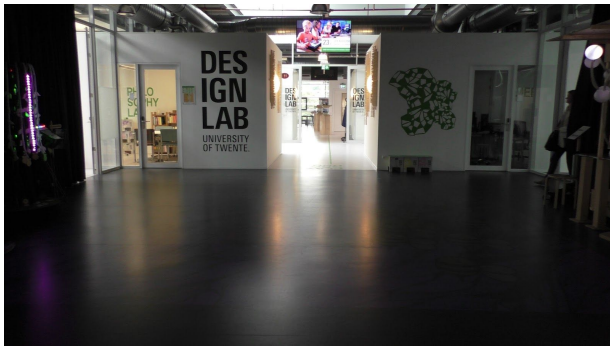

Figure 6: Playground View, direction 4

The playground is located in the corridor between the DesignLab and the Gallery, which is home to offices of staff and entrepreneurs as well as large presentation and prototyping rooms. The room has black curtains to block light from the other rooms and outside, and other interactive installations are displayed in the area. Figure 3-6 show the playground from the directions 1, 2, 3 and 4 (Figure 1) respectively. Figure 2 shows the setup of the monitor whilst running the covert research, with the display showing the video of the four kinects.

Figure 7: Observation View

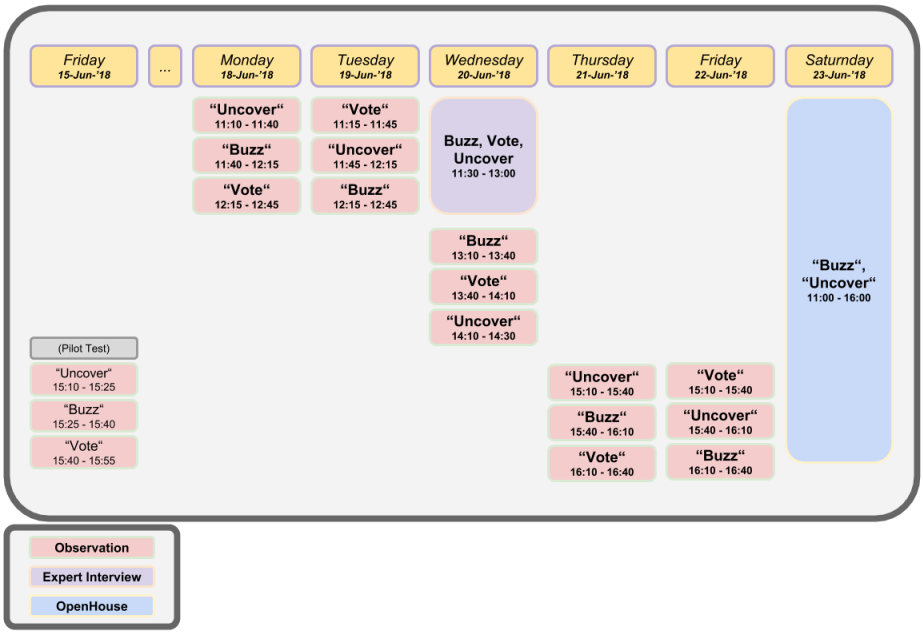

Figure 8: Observation Test Timetable

The observation of passers-by took place from the upper right corner of the playground, close to the PhilosophyLab. Figure 8 shows the time plan of observations which took place, as well as the expert Interview and OpenHouse event. The view on the playground during the observations is depicted in Figure 7, and users in the blind angle could be observed over the monitor. The observations were carried out using written observation forms and a stopwatch running on a regular laptop or smartphone. The full observation forms can be found in appx. 3.

3.2 Persuasive Design Approach

Recent commercial products in different applicational branches are trying to steer the behaviour of their users using subtle design. This can be used to nudge and guide but also to manipulate and coerce the user. The intended consequences of a product should certainly always be positive, but a good study has to estimate and identify the unintended consequences as accurately as possible, and reduce any negative consequences. I learned during my thesis reflection course that the term persuasive design generally describes a products design which encourages interaction beyond proposed use. It could be argued that my system in itself is a persuasive design of the floor, as its standard use is just standing on or walking across it, and through the projector-kinect system it transforms into an interactive playground. I believe this design does not reduce the users autonomy, because they always have the option to disregard or not make use of the functionalities it provides, without it having an effect on the act of walking or standing. This is also why, in all the prototypes, the sound effects are very subtle and non-distractive, as not to disturb a conversation, alarm passers-by, or patronize subjects in any way. However, too much choice might, in certain situations, overwhelm the user, and he might be inclined not to use any of the offered opportunities. Whilst my intentions for the usage of this research and practises were mainly to promote fun and interactivity in gaming, this could also be adopted in purposeful manipulation. My research and proposed designs could easily be altered to support subtitle advertisement, steering of public perception and even alter social or political opinions. But almost all my sources and many more can be used for the same unethical purpose, which still should not justify their censorship.

3.2.1 Interaction

For my prototypes, I not only tried to design games and interactive installations but also design parts of the intended interaction and loosely envision their users behaviour. Their general aim was to create awareness for the installation and nudge passers-by to engage intentionally. The functions of the games are of course limited but there is no condition of using them and users are free at all times not to use them. All technological functions are to my knowledge free of unintended negative side-effects and fully rely on design incentives to motivate interaction. During the design process, I concentrated on promoting the values user satisfaction, autonomy and privacy. Even though my design uses certain methods of digital games, the chance of diminished user wellbeing through addiction are minimal. In conclusion, my prototypes are trying to influence and steer the behavior of their users through nudging and persuasive design. Studies involving this kind of subject manipulation generally need the consent of its users in order to be ethically approved, however exceptions can be made if the research is harmless in nature and has a very low risk of causing any physical or psychological effects.

3.2.2 Reasoning & Restrictions

For the covert research, the selection of subjects happens by chance: I only conducted research on days on which competent and adult subjects were present, based on the events in the DesignLab, and observed passers-by, consisting mostly of UT students and staff. It should be noted that covert research does not entirely fall under one of the descriptions of standard research, instead it includes the observations of users with the researchers status not made clear to the user. The covert research on the prototypes was only conducted on adult, competent subjects with no other exclusion criterias made.

I abstained from including a sign or other notice next to the floor installation informing the passers-by about their participation in my study because passers-by might be scared off by the thought of having to fill in additional surveys, or knowledge might spread in the study area about the system being part of a study. My research suggested that this would influence users first-interaction prejudges, curiosity, motivation and interaction with the system. Participants were not necessarily aware of being part of the study, therefore they were not completely free to withdraw from participation whenever they wished and for whatever reason. This was also due to the reason that no personally identifiable information was stored and a certain subject could not be identified. However, because the expected burden from participating was very low and I did not record any personally identifiable information, this was not seen as problematic.

Due to the unawareness of subjects participation in the study, I had to make sure that there are no, for one reason or another, unpleasant elements in my prototypes. This was however is not problematic due to the projects harmless nature and very low risk of any physical or psychological effects. Material which for certain groups of people is offensive or inappropriate for any number of reasons including but not limited to religious beliefs, examples include racial or explicit sexual photographs or films, use of alcohol and subjects alike, was not included in projects contents. This might prove problematic, as the most representative demographic in my specific environment is known for being attracted to those controversial subjects. I had to refrain from using such content, although it might have had even stronger influences on user motivation than the other factors. Furthermore, the options for socially unacceptable play, for instance harassing other users, were limited in the design of the prototypes by not giving a user the option to destroy another users process. The risks of adverse effects was very low, and I refrained from flashy and epileptic triggering visuals, and no deception took place.

Regarding subject anonymity and privacy, no personally identifiable information was gathered and subject anonymity was guaranteed. No video, audio or photographic data was collected and pictures in the report were staged, this way there were no adverse effects for the participants. Upon noticing the installation, participants may of course also decide to walk around or away from the interactive floor.

If children want to use the system their parents have to be asked for consent, therefore I refrained from making personal remarks on minors. This became relevant when running the prototypes on DesignLab events such as the OpenHouse. Not using potentially valuable information on one of the main target users of most commercial interactive floor playground systems arguably renders my projects outcome less useful for a substantial fraction of designers of such systems.

3.2.3 Data Collection

The study observed user behaviour on the prototypes and drew conclusions in order to improve the next generation systems. The raw data collected included the position over time and observational behavior remarks such as motivation, excitement, immersion and familiarity, including if they seem to know the system already or if it is their first time seeing it, and possible quotes of people whilst interacting, with anonymized demographics. Subjects were not briefed or signed an informed consent before participation, instead research was conducted where users were not disclosed the nature of the study in order to limit influences on their perception of the system. I was primarily interested in passers-by engagement with the system, which can hardly be researched by briefing and requesting consent from users in advance. The expected procedures, discomfort, risk, duration, purpose etc. associated with the subjects involvement in the research were minimal and I was not imposing certain behaviour. Researcher observation were written down manually and were only done on interaction, but keeping track of how many people passed by. The scope of data collection included 6 workdays and the OpenHouse event. On workdays, observations were taken between 11 and 17 o'clock, and each prototype was running each day for around ½ hour. The observations provide the most insights for analysis, however the position data could be used to support conclusions drawn from them. No raw data was produced because the observational and position information gathered was not personally identifiable. Data from the research was not obtained or disclosed in any way that would make it possible to link the findings with a particular subject.

The Data type of information collected by the system included only player ID and position, as xpos, ypos and zpos. The data was sent as a string over UDP to a javascript which forwards it to a game PC, from where it could be copied and sent to an IP address. The unity script storing the raw position data was not protected, neither was the javascript which the position data was send to.

3.3 Privacy

A leading part of my analysis was the observations of users on my prototypes. A major issue of covert research is the fact that passers-by could not give consent before interacting. The resulting ethical assessment of the systems had to be taken in account, furthermore, a research proposal had to be approved by the Ethics Committee of the university before the study could be performed. The full proposal can be found in appx. 1.
In order to be allowed to conduct research, the collection of personal data was limited and the subjects privacy had to be taken into account. According to the European Convention Art. 8 and the Universal Declaration, Art. 12, Privacy is a right, but the scope of things considered private is largely dependent on culture and demographic of the subject. A general example of this could be that some parts of the human body are conversationally referred to as private parts, whilst others can be named as what they are, for instance arms or eyes. The privacy of such things is so significant that even their names become too private to be used in a conversation. On the other hand, the significance of privacy of things differ greatly between cultures, religions and demographics, for example the habit of muslim women to hide their hair, or the general open design of homes and living rooms in the netherlands, whereas their neighbours in germany conventionally try to screen their private lives from view. This can be due to intrinsic or

instrumental reasons, for instance if a certain thing is able to endanger other parts of a person's life, especially when there is a fear of abuse of the provided data. The privacy related values of each subject, including his autonomy, independence, self expression, but also his general mental wellbeing, dignity and protection of their interests are key when designing for a good relationship to the consumer and builds their trust.

In regard to my prototypes, conformity might play a role when assessing to what extent subjects agree to being observed and their data being collected. My covert research aimed at protecting subject privacy at all costs. Subject privacy may however be outweighed, for example if someone commits a serious felony and my system would have been able to identify him, but neglected this due to the rare occasion of such events. Although the raw data of the position of the players was stored in an unprotected file, it is not personally identifiable with a certain person. This research is not interested in the demographics of the passers-by, therefore the observational information gathered also guarantees anonymity which would not make it possible to link the results or other findings with a particular subject.

The trade-off between user privacy and the quality of design provided aimed at being as beneficial as possible, with low personal data commitment and highly satisfying system design. Regarding the storage of data, copies of the javascript and some scanned observation files were stored on my laptop and shared via the student account with the supervisor. Processed data was be shared over the official UTwente email accounts. Publications of the data included the presentation and discussion in a GP colloquium and a GP report. All data saved was processed and anonymous or data that was not part of the resulting GP report and presentation was deleted upon finishing the thesis, before July 6th 2018. The processed data was only handled by myself and my supervisor, extracts of it were presented at the final presentation to the GP Examination Committee, the Graduation Semester Coordinator and Programme Coordinator, and this thesis, including extracts of processed data, is publicly accessible.

3.4 Covert Research

The timetable of observations is outlined in Figure 8. For each test and game, test date and time were noted, so that further evaluations could refer to events that took place at that time and how they impacted the observation results. Any quotes of passers-by about the system that seem valuable were written down. Every passer-by who crossed the playground during the observation study was counted. passer-by was defined in such a sense that when a person interacted with the game, left the playground and entered it again, they were counted as two passers-by. Each passer-by was counted, and notes were taken on whether they interacted with or even noticed the system. Passers-by who noticed the system were counted and reactions were written down. Passers-by who actively engaged with the system were counted and the time of their interaction was measured with a timer, whilst also recording their reaction amongst other general observations. Finally, the count of people who engage with the game for more than 3 minutes was put down as a threshold between short term and long term engagement.

For each individual prototype, there were a few leading question on which notes were being taken:
Regarding "Uncover", I was mainly interested in the games potential in grabbing attention, attracting bystanders, the possible irritation through its constant sound output, the possible collaboration between users and the potential favoritism of one background image over the others. The observations of "Vote" were meant to leave me with a clear idea of what content motivates or triggers passers-by, to what extent they care if they are being watched whilst voting, how their behaviour differs when they interact with a group, and in general if this kind of oversized application offers its users any kind of satisfaction at all. For "Buzz", I was trying to find out to what extent competition plays a role in the motivational pull of interactive floor systems, to what extent passers-by can be attracted by flashy design and whether they are willing to engage in long term interaction.
The full observation forms can be found in appx. 3.

3.5 Expert Interview

During my research I had the opportunity to meet with experts in the field of interactive floor systems, including members of companies which develop commercial systems. After briefing my goals, I showed them either the real games or pictures and videos outlining the main functionalities. I was mainly interested in finding out which game they considered the best at fulfilling my goal and due to what reasons. Furthermore, I was unsure on how to implement instructions correctly and leave them out when unnecessary. Finally, I asked for their opinion on different factors which could influence user motivation and engagement, addressing how much impact those factors can achieve.
The full question forms can be found in appx. 5.

3.6 OpenHouse

I was granted the opportunity to showcase my game at the OpenHouse event, where families and potential future students visited the university to make themselves familiar with the university. I presented "Buzz" and "Uncover", the most applicable prototypes for this cause. I was particularly interested in the differences in the behaviour of students and young adults in a working context to the behaviour of families, children with parents and individuals in a leisure context. Regarding "Uncover", I set out to assess its noticability, its motivating aspects, potential aesthetic preferences shown by its users, specific questions users might ask upon engaging, the users general reactions and quotes. For "Buzz", I paid additional attention to the role of competition in the general interaction.
The full observation form can be found in appx. 4.

4. Ideation

This section explains the prototype design approach, which is based on grounded choices and iterative observations.

4.1 Design Approach

There are some general conclusions to be drawn from the review of literature and research on what makes an interactive game motivating and engaging. First and foremost, the prototype games should aim at grabbing the passers-by attention, engaging them through aesthetics and functionalities, and eventually get them interested in the underlying systems. The approach for the prototypes was therefore to combine as many strong methods as possible in different games and test which aspects prove most efficient in my context. I sought to explore interactive artwork as well as goal-based games, pay respect to user autonomy, preferences, their sense of competition and the overall timespan of engagement.

4.2 Functionalities

Figure 9: "Uncover", Interactive Artwork

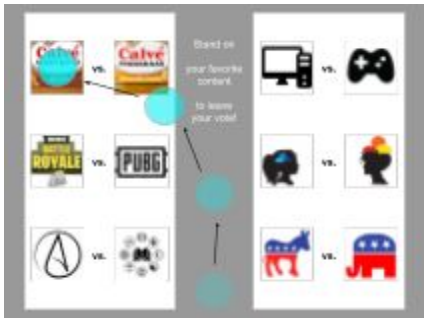

Figure 10: "Vote", Application Interface

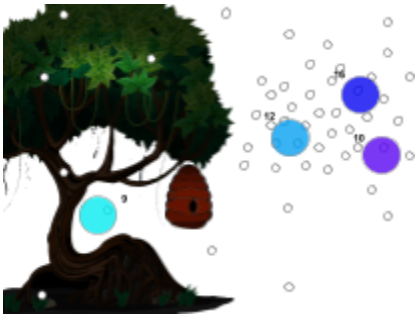

Figure 11: "Buzz", Simple Game

The three prototype concepts I settled upon include an interactive artwork, an application interface and a simple game, for which I decided to explore the differences in effectiveness of several motivating strategies.

The interactive artwork (Figure 9) was made to find out if, through high user autonomy and presenting them with a gap in knowledge, passers-by could be made curious or show higher engagement. The concept is largely grounded in the context analysis, more specifically on its recommendations regarding performance and engagement. It was envisioned with a very simplistic required interaction, not forcing the user to derive from his natural walking path, and having a sense of sudden impact upon noticing. Furthermore, it was made to find out what content is generally considered aesthetically pleasing in my target group. I decided on an interface where the user can uncover the floor as he walks over it.
The projection shows a black floor until a user enters it. Upon entering, the users movement is translated into a wide brush which uncovers an aesthetic background image. After the user has uncovered a certain amount of the image, a countdown appears, after which the projection turns black again and the user can uncover a new image.

The application interface (Figure 10) aimed at exploring preferences related to cyberculture, understanding the target group better, and engaging them through a sense of exaggerated real world interaction. Those recommendations were drawn from the content analysis and pay attention to its suggestions concerning design and perception. It was envisioned to give me a better view on what the general preferences around the lab are and whether people are defensive or shy of their opinions. I chose an interface concept which lets the users give an upvote to cyberculture-related themes.
The basic layout consists of categories of content items competing against each other. The user stands on the contents image for several seconds to cast a vote. The categories of content include but are not limited to: cyberculture, politics, culture, lifestyle, leisure time and self-image. Real world interaction is exaggerated and celebrated through operating a giant application and satisfying sound effects.

The simple game (Figure 11) was envisioned being very simplistic, however employing some of the strong methods which commercial digital games use. Through this, I wanted to find out how personal scores or otherwise gain, competition and long term engagement influences the interaction. The methods were derived from the context analysis and its guidelines regarding digital gaming. My decision fell on an endless particle collector game with personal score for each user.
The user is presented with an aesthetic background and a beehive. Users can release bees by stepping on the hive, which will flock in a swarm and move around the projection. The users catch bees to increase their personal score. The game includes engaging sound effects upon bee collection and release from the hive.

5. Specification

In the following section, the prototypes developed on Unity[5] [25] will be defined in more detail, and the reasoning behind their design choices will be explained.

5.1 The Prototype “Uncover“

Figure 12: “Uncover“

Figure 13: “Uncover“

The games main goal was to engage or otherwise trigger spectators and passers-by. Its advantages are the simplicity of the required interaction, the user plays without even noticing, just by walking across, and the sudden impact upon noticing the function. The default background was black, a user might not have noticed that the system until his movement uncovers background image. Interaction is easily initiated due to the required action not differing greatly from normal behavior, and not enforcing a path which derives from the usual walking path. Furthermore, active players will be likely to attract bystanders and direct their attention to the system. Engaged users may make use of the systems as they wish, for example draw shapes or write with the eraser brush. On the other hand however, the selection of background images I made for this game might not reflect what many of the passers-by generally considered satisfying, as this of course depends greatly on personal preferences and prior experiences.

[5] Unity Technologies, ‘Unity’, Unity, 2018. [Online]. Available: https://unity3d.com/. [Accessed: 19-Jun-2018].

5.2 The Prototype “Vote“

Figure 14: “Vote“ (early ideation)

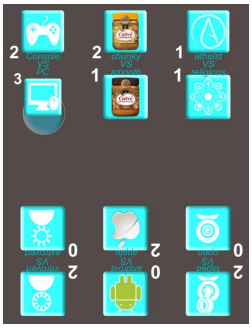

Figure 15: “Vote“ (pilot version)

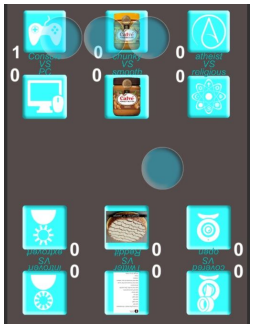

Figure 16: “Vote“ (final version)

The goal was to address the subject of cyberculture in more detail and, to some extent, exaggerate and celebrate real world interaction through giving the user the feeling of operating an oversized web application. The advantages of this game include the briefness of the voting interaction, the clear anonymity of whoever decides to engage and the triggering effect of seeing content which has less votes than it deserves. Changing content categories were implemented to figure out which content is most triggering and familiar to passers-by, however, the self awareness of others watching and judging of one's preferences might have scared off potential users.

5.3 The Prototype “Buzz“

Figure 17: “Buzz“ (early ideation)

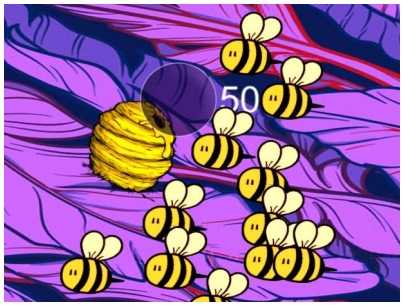

Figure 18: “Buzz“ (final version)

The game explores the principles of performance and engagement regarding the exploration of social and interpersonal interaction and the celebration of the performer role. Its advantages include its viability for short term interaction, all the functions are available from the start on, as well as for long term engagement, as users can compete with others and boost their personal score. It can be played in a group, together with friends, strangers, or as a single person who prefers to explore the game alone.

6. Realisation

A major question when designing those games was the orientation of text, images and instructions. Since the playground can be entered from all sides, passers-by could view the games from different angles. As a result, I explored different orientations in the three games: “Vote“ offers the passer-by a path in the middle, with the options displayed left and right, facing the middle, and the orientation of “Uncover“ is the flipped orientation of “Buzz“. A game designed in Unity will be displayed in the right orientation for direction 3 of Figure 1. Figure 12 and 13 show “Uncover“ after the implementation of a set of changing backgrounds. The design of “Vote“ was changed to Figure 15 for the pilot study and later 16 as a final version, due to Figure 14 not being clearly visible on the playground and the orientation being impractical. The design of “Buzz“ was changed from Figure 17 to Figure 18 due to similar reasons as the “Vote“ game, and the game element design was associated to the Honeypot Effect as a hidden message from the researchers. Special attention was paid to the color scheme as to increase visibility.

6.1 Pilot study

During the 15min pilot tests it became apparent that most passers-by were in a hurry, on their phones, or transporting something. Furthermore, they seemed less likely to notice the game when in a group or conversation. People who did have time and motivation to interact were generally more impressed by the other installations on the playground, especially the creative mind.

“Uncover“ yielded overall non-negative reaction, and out of the 3 people who noticed the game 2 engaged for about 20 sec. They seemed to understand the function and reacted amused and impressed. The game appeared to be stronger at grabbing the attention of young people than older passers-by, but no one actually stayed long enough to uncover a whole picture. No clear aesthetic preferences were shown, furthermore there was no intended collaboration with strangers. The further refinement of the game included an adjustment of the sound levels and the implementation of a timer, after a comment of a fellow student who tested the game and got sad when she was not able to uncover a whole picture.
“Vote“ proved ineffective in attracting attention, even though there was a lot of traffic due to an event. No one noticing the interface at all, and no one voted, not even by accident. Due to the low engagements, the option set Apple vs Android was changed to Reddit vs Twitter as a more cyberculture related topic (Figure 15 to Figure 16).
“Buzz“ had the highest fraction of passers-by noticing the game, however many of them only looked back without engaging. They were mostly not interested if there were no bees and did not notice their count. Therefore, competition did not play a role in the interaction, and they treated the game more like interactive artwork. The passers-by somewhat showed appreciation for the design even though not all of them made use of the hive function. After the pilot tests, a function was implemented which causes bees to appear if scene had too little bees, in order to keep passers-by attracted.

7. Evaluation

This section discusses the observation outcomes of the performed covert research, expert interview and OpenHouse remarks.

Figure 19: “Uncover“ on the playground

Figure 20: “Vote“ on the playground

Figure 21: “Buzz“ on the playground

Figure 22: “Uncover“ in action

Figure 23: “Vote“ in action

Figure 24: “Buzz“ in action

7.1 Covert Research Outcomes

This section discusses the observation of the three games, illustrating their total passers-by counts and outlining the behaviour of its users.

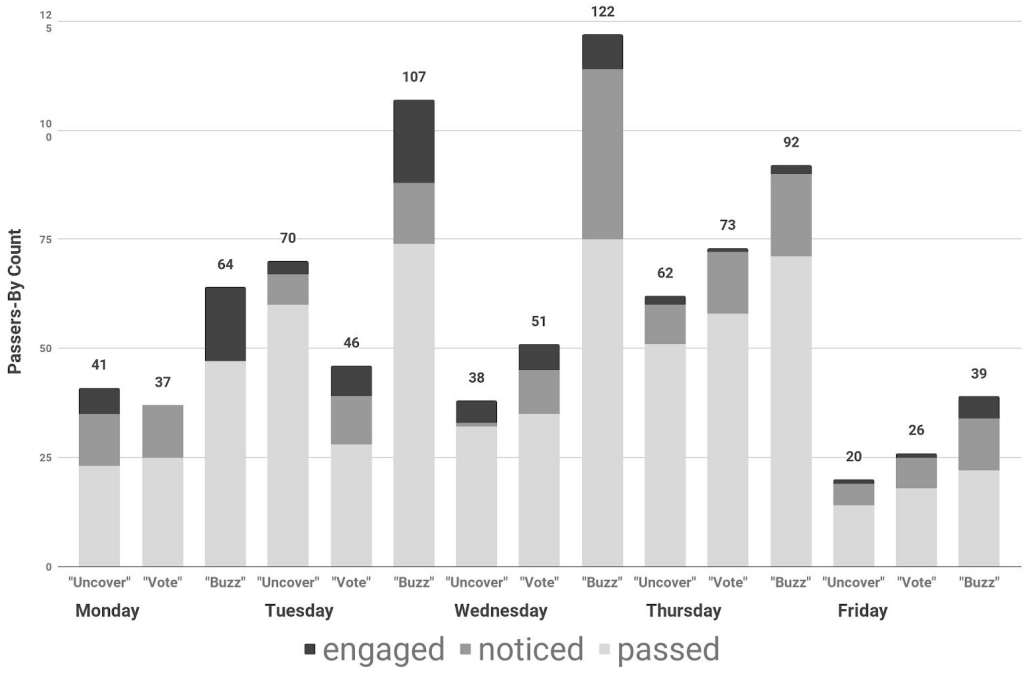

Figure 25: Covert Research Passers-By Counts

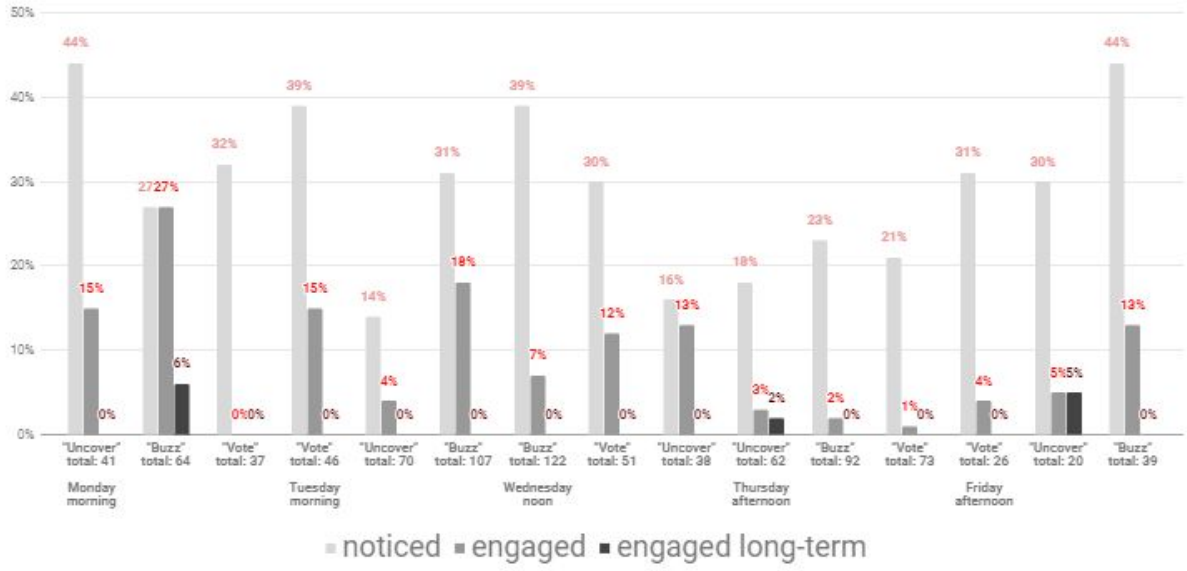

Figure 26: Observation Fractions of total Passers-By Counts

7.1.2 General Observations

During my covert research, the most popular time for passers-by to cross the playground seemed to be around lunch, with 51-122 passers-by in 30 min. In the morning, I counted 37-107 passers-by and 20-92 in the afternoon. In general, they seem to be busy, in a hurry to get from A to B, and quite often on the phone. A major factor in noticing the game appeared to be not only its visibility on the floor, due to especially bad visibility from the corridors to the sides, but also the games sound effects and the display of the monitor on the desk (Figure 2). I noticed that events, tours and project work greatly influenced the number of people crossing the playground, however it reduced the effect of novelty which is one of the driving force for motivation in my prototypes. Passers-by who encountered the game for a second or third time tended to ignored it, as project groups on the playground or in the ClassroomOfTheFuture (Figure 1), other courses working nearby, DreamTeam members and event staff lead to increased traffic. The observation of reactions furthermore showed that the engagement and strength of reaction for all games dropped over the course of the week, which could suggest that people got used to the games and knowledge about it spread across regular users of the DesignLab. Figure 25 outlines the counts of people for the three games over the week. The number indicates the total count of passers. In order to compare the games, even for varying amounts of passers-by, I used percentages to model the overall interaction over time. Figure 26 depicts the tests in the order of conduction, providing the fraction of total passers-by who noticed or engaged with the games.

After my observation session on Wednesday, I was kindly asked by a member of the DreamTeam to shortly explain my project and system to international, adult tour guests. I showed them “Buzz“ and “Uncover“. They were very interested in the system setup and scripting language. Furthermore, they asked if the games would be made commercially available.

7.1.3 Uncover Observations

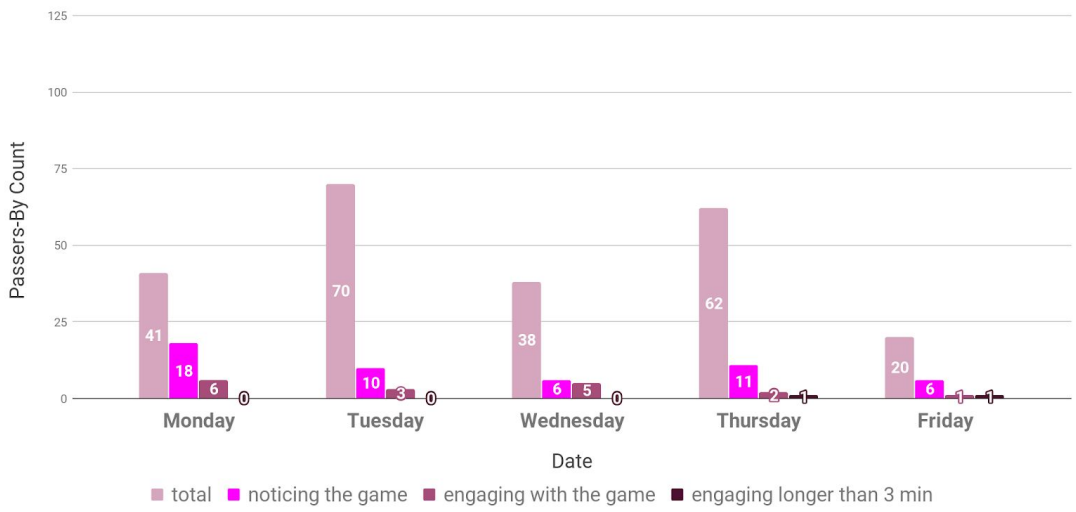

Figure 27: “Uncover“ Passers-By Counts

As depicted in Figure 26 and 27, the highest fraction of passers-by noticed the game on Monday, with the average being around 24%. People were often made aware of the game by seeing themselves on the monitor (Figure 2), or the sound caught their attention. Those factors were often more effective than the actual uncovering of the floor, due to the initial hiding of the system, however this still applied to some extent, even when prior passers-by had left tracks on the black surface already. Of the passers-by who engaged, some seemed satisfied by uncovering only a small part of the image, as in they did not really care about the whole picture but only about their own erasing function. Their overall reaction was mostly looking back whilst passing or a short realisation and look over shoulder, with general positive, impressed, surprised, appreciating or indifferent facial expressions.

The highest fraction of passers-by who had noticed the system engaged with the game on Wednesday, however it should be noted that this study has a higher error margin due to this observation only being 20min long. The lowest fraction engaged on Tuesday, and the average engagement was around 31%. The time spent engaging ranged from 10sec to almost 5min once, with passers-by who shortly explored the game spending around 20-60sec. Some users engaged casually whilst on the phone and generally did not notice or care about the timer. Some played more actively, but no real playful movement was performed. In some instances, people who had passed before came back with more time to explore it. Light backgrounds seemed to be more visible and noticeable. The general reactions of users included looking down and noticing, stopping, exploring the functions for short while, then carrying on. Facial expressions of users showed surprised on encounter, no apparent negative distraction through sounds, interest, and overall positive emotions, however there were some cases of sad expressions on sudden image changes. A small group of guests worked together to uncover a few backgrounds.

On Friday, one person interacted with the game for longer than 3 minutes, whilst a project group was performing work on the playground. Seemingly bored, he wandered around the playground, not really trying to reach a goal or engaged and half-aware of his function. On Thursday, another person interacted for around 5 min, walking on and off the playground whilst on the phone. He was focused on the call and not playing the game or engaging actively at all, furthermore he did not mind the constant uncovering sound effect.

Over all, “Uncover“ was moderately strong at grabbing attention, and if it did, it appeared that sound in quiet settings and the view on the monitor were much more effective than the actual visuals of the game. Those only proved effective when the passers-by viewfield was directed downwards. The game had no apparent Honeypot Effect, due to no one really playing long enough and no bystanders being around at most times, furthermore, it is hard for bystanders to see the floor. No clear aesthetic preferences were shown, at most users expressed appreciation for the best resolution images and lightest or most contrasting images with the best visibility, furthermore no one seemed to notice the timer. The sound was often too silent for passers-by to notice but still at an acceptable level not to disturb phone calls or tour stops on the playground even though the uncovering sound effect is constantly playing and can become annoying due to this repetition. Users seemed to have no shyness of spectators and would use the system with strangers, but rarely work together with them discover, however sometimes working together in groups of friends. In general, the installation proved more effective in showing the natural walking paths of its most recent users in a very aesthetic manner, but images would remain uncovered for a long time due to people walking in each others tracks. It could be debated if the fact that passers-by can see the image through the tracks of prior passers-by engages them more, or if the initial effect of discovering by erasing the first stroke has a higher motivating effect.

7.1.4 Vote Observations

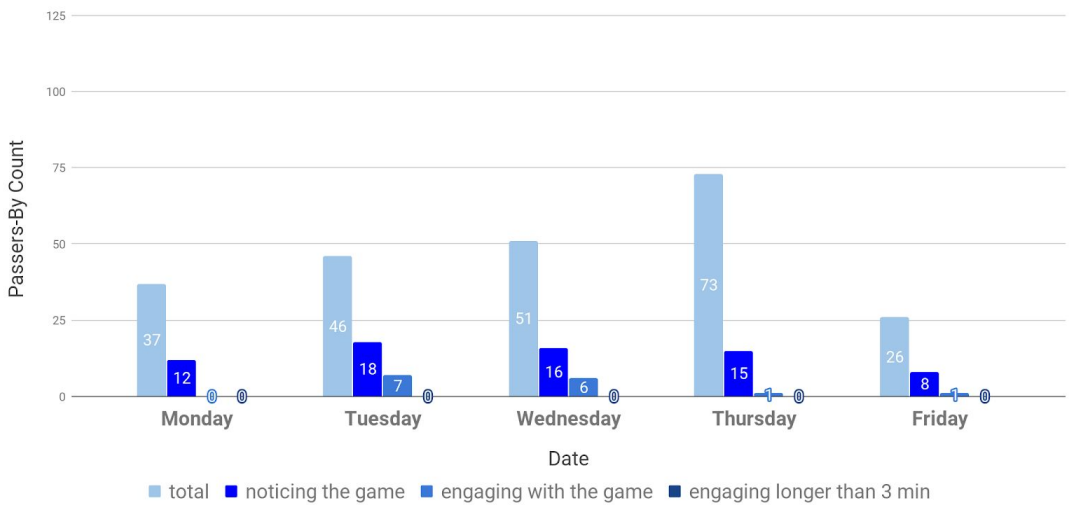

Figure 28: “Vote“ Passers-By Counts

As depicted in Figure 26 and 28, the highest fraction of passers-by noticed the game on Tuesday, the lowest fraction on Thursday, with an average around 31%. There were several votes by accident, for example by a project group working on the playground, furthermore there were the general visibility problem. Most passers-by seemingly did not care about the game at all even if they had noticed it. This appeared to happen through them noticing their player character first on the ground. Some stopped and look at the choices, but it appeared as if the selecting feedback, for instance the icon getting smaller on select, was more engaging to play with than the actual game or content of categories. Over all, it appeared that the game was just not playful enough to engage passers-by, it seemed more educational, dull and boring to passers-by than the other games. One person engaged casually whilst on the phone. The general reactions were slight amongst indifference or boredom maybe a short stop and show of interest interest which quickly dissolved. Some passers-by appeared to be searching for their content as if they were not able to find their categories, some noticed the icon feedback and walked off quickly whilst others noticed it but seemed not at all triggered. If interest was shown, it was mostly in the selection feedback and rarely in the categories content.

The highest fraction of people engaged with the system on Tuesday, the lowest fraction on Monday. The average engagement was around 19% with a general interaction timespan of 10-30sec. Most users did not stand on the icons long enough to vote, eventually becoming impatient and leaving. As previously mentioned, there were accidental votes, for example on tour stops on the playground, from project groups or due to phone calls. Whilst many users in one way or another tried but failed at voting, some actually did vote, few even voting several times in different categories. A group of two friends each voted twice for the same content. The general reactions were non satisfied, for instance on failed voting attempt. Most did not understand how to vote and lost interest very fast, however if they succeed to vote they showed somewhat satisfied facial expressions whilst walking off successfully. There was no sign of fun or play in

interactions, but some users tried to jump on the icons to cast a vote. No one engaged in long term interaction.

Even though most crucial functions were displayed visually, there was some confusion on how long a user had to select a category in order to cast a vote. This was understood well if only the user was patient enough, therefore the lack of engagement should not be fully contributed to the fact that there were no clear instructions. There were no strong popularities of content, however the Twitter vs Reddit, Peanutbutter and PC vs Console options received slightly more attention than the other categories. In rare occasions, content would seemingly spark the interest of an individual, but they did not necessarily vote afterwards and most passers-by did not show any excitement for the displayed categories. Engaged users showed a higher shyness of spectators than on the other prototypes, they somewhat looked around but never seemed seriously worried, assumingly because bystanders could not see the floor due light reflections. Over all, users were mainly playing with the functions instead of actually casting votes. Groups showed somewhat more attracted to the system, presumably due to all identifying with certain categories, and voted for similar content. No one minded how many votes something already had, which was most likely due to them suspecting a lot of accidental votes. There was no interaction with strangers based on their vote as there were never many people using the interface at once. The quotes of users whilst interacting “Noo, I don’t wanna vote...“ (on first encounter) and “I’m open!“ (intentionally misunderstanding the webcam category) summarize the general impression “Vote“: it is mainly too dull to spark interest and too complicated to truly take serious or make an effort to make sense of.

7.1.5 Buzz Observations

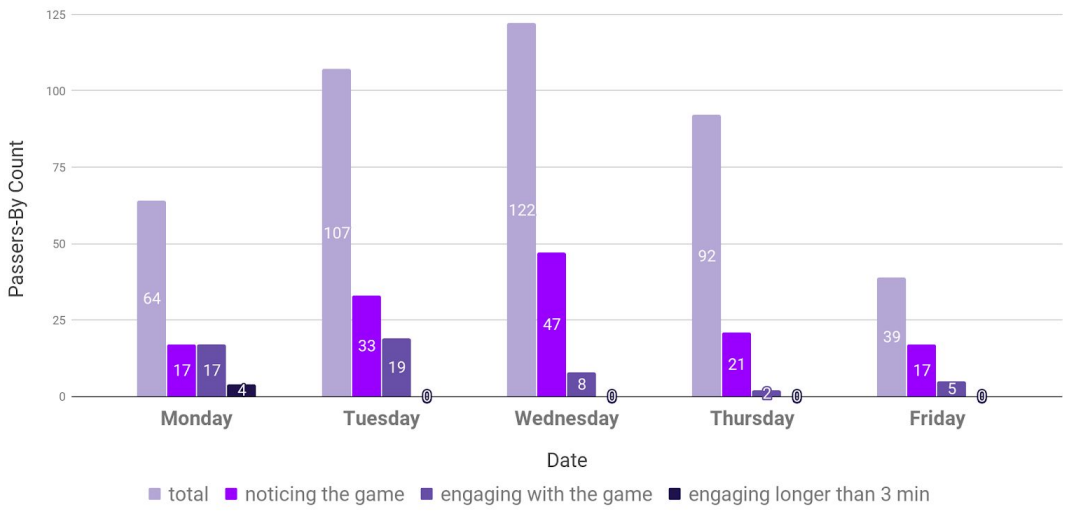

Figure 29: “Buzz“ Passers-By Counts

As depicted in Figure 26 and 29, the highest fraction of passers-by noticed the game on Friday, the lowest fraction on Thursday, the average was around 33%. Passers-by were often busy or otherwise distracted, and the visuals or sounds effects of the hive made them notice the system. Sometimes passers-by would slow down to stand, look around on the floor, turn around on the playground or derive from their path. For most passers-by, there was a strong decline in general motivation on second and third encounter with the game, for some however it was engaging even on multiple encounters, and they would engage for a longer period every time they passed by. The games simple functions and design also seemed to amuse passers-by which only stepped on bees on their path but did not stay for engaged interaction. The general reactions were all in all non-negative, indifferent to positively surprised, interested, satisfied and joyful, whilst not being afraid of strangers or spectators.

The highest fraction of people engaged with the game on Monday, the lowest on Thursday, and the average was around 43% with an engaging timespan of 5sec to 2min. Some users jumped on the bees or hive whilst passing and not minding the entirety of functions, others reversed their path in order to activate all functions. On some occasions, individuals would spend a longer time period collecting bees and increasing their score, whilst attracting and engaging bystanders. Some engaged in multiple encounters whilst showing high engagement. Over all, the relatively good visibility and the moving bees proved more effective in grabbing the users attention than the monitor display. The general reactions were overall positive, ranging from surprised over satisfied and playful laughing, and users got a lot more active then they necessarily had to be. Tour guests took pictures of the game and one visitor even collected bees whilst listening to the guide. Small groups were observed jumping and engaging actively in close proximity to friends and strangers. They tried to steal bees, cheat by standing on the hive (which does not work). Users engaged loudly in exclamations and expressions of joy, stomped and jumped on the bees with smiles on their faces. There were even people coming back and bringing friends to show them

the game. Users played with their image on the monitor, trying to understand their underlying function and determine their position.

There was one interaction for longer than 3 min, by a group of 4 students on Monday. They played and competed actively, going as far as convincing friends to join them.

“Buzz“ showed strong competition in its interaction, even though the game is simplistic and has no real defined goal, instead users make the goal up themselves. Groups are especially attracted to it, not necessarily to increase their own personal score, but rather trying stealing bees from each other. If they were aware of their score however and somewhat proud, they were often sad of losing it, for example due to a bug or due to leaving the playground detection and their player resetting. Overall, the low difficulty did not disengage users, they showed high satisfaction due to the design and moving elements, and no one seemed to be irritated by the sound effects. Users were able to understand the hives function without instructions, and performed non-normal actions, showing almost childlike behavior, whilst not minding bystanders and spectators at all. This was surprising in regard of my research, for instance Dalsgaard and Hansen’s findings [13]. It appeared however as if the adjustment of releasing new bees once the scene becomes to idle had changed the behaviour of players significantly: the hive function became less important, since the player could just try to collect all the bees whilst being showered in new ones. Over all, they seemed to care less about bystanders than on any of the other games, furthermore I concluded from my observations that a first time group interaction makes for more confident second encounter interaction. One member of a group tended to engage first and the others quickly follow, whilst individuals discovering the game appeared to be more timid. The game was often used together with strangers and even sparked short time interaction between such strangers from time to time. Users expressed appreciation (“Uuuuh!, Nice!“, “Ooh! You can catch bees!“, “Awwww, so cute!“, “I fell in love with it!“ (second encounter), “yes, that one is cool!“, “I wanna catch them all, WEE!“ (loudly, whilst running across the playground)), conversed about the functions of the game (“Is that my score?“, “Look, look! Get them!“, “I’m player one? No...“, “No, that's how many bees you have!“), but also criticised the game (“I dont wanna pop them!“, “They should be bubbles...“ (due to the collection sound being similar to a popping bubble), “ I had 30 and it went back to 0...“ (on accidental score reset), “It doesn't make sense...“). Comments to friends and peers included “Have you seen the game? “ and “Its new!“, whilst showing increasing interest in who made the game.

7.2 Expert Interview Outcomes

Through my supervisor I was granted the opportunity to join a meeting with Mark Bijleven from the company ConnectAndPlay[6] in Rotterdam, which develop and sell interactive projection systems. I was able to show him “Buzz“ and “Uncover“ on the playground, explained “Vote“ through videos and images, and briefed him on the main goals of my project. He considered “Buzz“ the strongest game in attracting passers-by and grabbing attention, due to its aesthetic design, moving elements, and the meaningfulness and satisfaction which motivates player movement. Similar to my observations so far, he assumed that the “Vote“ interface would yield the lowest engagement due to its stale interaction. He pointed out that his company has had experiences with similar interfaces on floor projections, where they performance was weak. When they displayed the interface on a wall and changed the interaction from stepping to selecting using arms and hands, they performed much better. When asked about the implementation of text instructions, Mr. Bijleven suggested that they should preferably not be necessary, and otherwise be shown fullscreen and well visible. Furthermore, he suggested visual feedback the most important factor in attracting passers-by, followed by auditory feedback, and competition. He noted that high difficulty and teamwork had not proven to be successful in interactive floor systems.

Overall, Mr. Bijleven was impressed with the capabilities and projection size of the interactive floor system, but suggested the replacement of the interface, since the projections image quality is poor, and the interface is not very user-friendly. This could have advantages for the DreamTeam as well as increase passers-by engagement, however it should be noted that the impacts on the process of developing the prototype would be minimal. My supervisor mentioned that there had been efforts made to make a projection in a different section of the playground more visible through covering the floor with white material, however it seemed to make passers-by avoid the area altogether, which lead to its removal. Mr. Bijleven noted that his company was able to fix a similar problem in a shopping mall through officially labeling the area as playspace, which resulted in many more people participating in the game. This interesting line of thought suggests that the playground in the DesignLab might be able to increase its popularity by implementing similar area constrictions, but this might not be practical regarding the playgrounds functions as exhibition room for other big installations and catering route for events in the DesignLab. However, since the floor bordering the playground to all sides is white, the DesignLab might consider layering the floor of the entire room in white, in hopes of better visibility of the projection without the passers-by perceiving any borders.

[6] ConnectAndPlay International BV, ‘ConnectAndPlay - Creator of Interactive Fun’, ConnectAndPlay, 2017. [Online]. Available: http://connectandplay.nl/. [Accessed: 20-Jun-2018].

7.3 OpenHouse Remarks

During the OpenHouse event hosted by the UT, I showcased “Buzz“ and “Uncover“ for the guests. My general observations included the difficulties due to bad visibility, and the implications due to only 4 players being recognized by the system at once, wich is too little for large visitor groups. Guests would arrive in large groups within certain time intervals, and there was either no one or around 10 people interacting at once, with rarely any moments where there was just one or two individuals playing. Furthermore, parents standing to the sides of the playground where recognized and prefered by system due to their height, therefore smaller children often did not get to play the game. Some were visibly sad, some also did not care at all, and this mostly affected children under 3 years old who mostly did not understand the functions altogether and were just fascinated by the design style and moving elements. On some occasions an older individual understood the shortcomings of the system and walked leading the kid in front of him, therefore merging to a single player and allowing them to play together. This might not be valuable since my target demographic interacts in smaller groups and has no height difficulties, however it might become important when considering events alike. Over all, guests were again more interested in the interactive brain installation on the playground. I displayed the coordinates on the monitor and observed several individuals observing them with heightened interest, trying to work out functionalities or coordinate who was assigned wich player id.

“Uncover“ appeared to be more noticable for visitors than for the students examined in the covert research, and a member of the DreamTeam specifically noted that he preferred it over “Buzz“ due to its aesthetic design. The game seemed motivating, especially for kids but also for adults, even though there were no clear aesthetic preferences shown. Several groups understood the games goal as a race against the timer and thought the whole interaction was timed. Some even suspected that I was controlling the image change and approached me, for instance saying: “No! Don't change it!“. They showed astounding teamwork and often uncovered all pictures in the background library until they received a picture they already knew. This stood out to me as no one had showed this behaviour during my covert research. There was a slight dissatisfaction due to not being able to uncover a picture in its whole, but this also introduced a whole new kind of motivation, to beat the timer, which was approached with friends, family, but also strangers. The interaction was engaged and motivated, yielding similar amounts of satisfaction as “Buzz“, and guests seemed to like it a lot more common users of the DesignLab. Children were running and loudly conversing, remarking “Oh! What’s that?“, “Woow... Dad, look!“, “Faster, faster!“ (on timer race) and similar expressions. However, the game showed less effectiveness in getting the guests aware of the interface than “Buzz“.

As expected, small kids were sad that they did not get picked up by the system, but “Buzz“ was still more popular than “Uncover“, it was even specifically requested once, by the holder of the first highscore (225). I began to take account and mention the highscore to players who got visibly competitive, and it worked greatly to motivate them. I am not sure if this would have an effect of similar strength on students, but it suggests displaying a leaderboard somewhere on the playground might boost user motivation. Overall, “Buzz“ was very motivating and attracted the largest groups of players. The aesthetics played a big role in attracting guests, and children engaged, showing almost immersive behaviour. They refused to

stop after reaching a high score, which made it even more depressing when score reset due to a bug. There was definitely competition in the interaction, for instance expressing: “I want 100!”, including a case of score stealing (a father lifted up his son, in order to steal his score). There was even one case of a high score being stolen and successfully given back (by ducking and jumping on each other), which I perceived as surprisingly mature of such young children. The overall high score of the day was 777, the highest score held by an adult 377. I witnessed several times how parents got bored of the system and wanted to continue their tour but the children were not willing to stop. Each time someone engaged for a longer time I tried to warn them of the systems limitations (score reset and accidental score switch). The reactions were along with sad, small children, overall still very positive. The game inspired many questions about system, algorithms, scripting language. I observed several users trying to drag their player indicator by swiping the floor with their feet, tossed themselves on the ground to catch (which makes them undetectable), or jumped on bees. Other behaviour included trying to select the bee with just one foot, a lot of sliding across the playground, and disappointment on score reset. Players jumped, played, and screamed with full engagement.

8. Conclusion

Through developing the games, planning the evaluation and interviews, and comparing the response and interaction times of passers-by over the week, whilst paying attention to daytime and events or project work, I was able to develop prototypes which influence and steer the behaviour of passers-by through soft nudging.

Compared to prior research, my findings support some claims of the papers consulted concerning the Honeypot Effect: the easy transition between active playing and passive spectating was proven effective through the semi-active interaction on “Uncover“ during the covert research, and observations on the OpenHouse visitors. The importance of freedom of choice, as outlined by Morrison [10] through the act of creating personal and unique meaning, was proved effective to some extent according to my prototype observations. Furthermore, the competition and visual elements introduced in the “Buzz“ prototype yielded higher levels of engagements compared to the other games, which was suggested by prior research in digital gaming as well as during the expert review. However, my findings also diverge from certain guidelines found in my sources. For instance, the familiarity aspect of the cyberculture-related content in “Vote“, which was meant to trigger passers-by emerging identity, did not prove as effective as expected, at least not in the way in which it was implemented.

After conducting the research, I conclude that competition, visual and auditory feedback are very effective in attracting passers-by attention, whilst high difficulty and complicated teamwork are not. During my observations, the sound effects and monitor display were often more effective in making the passer-by aware of the game than the visuals of the game. My research suggests that the overall behavior of passers-by on the system differs for different ages, which might influence the game and design choices. The game most liked by passers-by was “Buzz“, which archived strong positive reactions, engaged users

in playful and active interaction, and generated some long term interaction. “Uncover“ yielded overall positive reactions, engaged interaction, and got the most long term interaction users involved. The overall reactions on “Vote“ were indifferent, the interaction seemingly stale and no long term interactions were observed.

Summarizing the research and test results, it can be suggested that the target group plays a key role in determining what games or content perform strong in terms of attracting attention, largely influences system specifications and can also determine the most efficient timing of runtimes. Suppose the DesignLab prefers to attract guests, which often include families with children, which have more time to explore the system and are generally more eager to engage: In order to yield the highest amount of passers-by interaction, the system should support more than 4 players and always be set to a lower detection height for children. Visitors have less spectator shyness, more attention should be paid to the games fairness, furthermore a new system or otherwise improved visibility with more options might be a profitable investment. Students or young entrepreneurs however tend not to engage in groups larger than 4, their height will be picked up without problems, and they generally do not mind the fairness of the game. Visibility however is still a major factor of engagement which became a problem, since the percentages of passers-by merely noticing the game in my research was very low (Fig. 26: 24-33%). I expect that some of those were subsequent encounters but I think that there was still a significant portion of passers-by who might have interacted and were never aware of the system. This also left my observations with fewer usable results than if it would have been performed with some kind of improved visibility. Students seem to show more spectator shyness than guests, and games would have to be designed for multiple encounters in order to preserve similar amounts of engagement. Otherwise, with access to the coding framework, the system is sufficient for learning students which work with the interface.
In order to increase the Honeypot Effect of the system an improved visibility is key for all target groups, otherwise bystanders will only see people jumping around and not understand why or that there even is an installation. This also influences the relation of users to spectators, because they know that the spectators cannot see what they are doing, which could result decreased but also in increased confidence, depending on the interaction.

My overall impression is that the interactive floor system in the DesignLab works well as testing platform and during developing stages of the game, but since visual feedback is very important for noticing, it becomes is difficult to make players aware of the system. Investing in a white floor for the whole room could yield significant advantages in visibility at lower costs than investing in a new entire system. The interaction of passers-by can be observed efficiently through covert research, observing the passer-by in his natural setting without disturbing his interaction, keeping count of passers-by, the ones which noticed the system and comparing the observations between different prototypes. I conclude that careful prototyping, if based on established theories, design principles, guidelines and models may be used to some extent to design interactive floor systems which attract passers-by in semi-public space. However, based on comparing responses of the three games which have been observed, a much more significant factor which user motivation depends upon seem to be visual elements, which must be clearly visible for passers-by to notice them. Passers-by can be motivated to play with interactive floor systems most effectively through visual feedback and satisfying design, auditory feedback and competition.

9. Discussion

When running the system, situations would occur in which the system crashed and some kinects falsely turned off, which would warp the calibration of players. This could however be resolved by a restart of the system or recalibration. Events, university projects, tours, staff, and entrepreneurs leads to a lot of passers-by who have either seen and interacted with the game already or have no time to stop and interact. Projects and events additionally leads to different noise levels and more light due to the entrances having to be accessible. Furthermore, there are several other installations on display on the playground, which effectively distract passers-by from the interactive floor, but also attract bystanders to the area.

While testing the games for the first few times, the earlier noted problem of visibility and orientation of the projection became apparent, as dark colours were almost not visible and the orientation of many elements did not seem to be practical considering the general direction of passers-by when entering the playground. The main limitation of my system is that the floors visibility from the two main entrance points is bad, and the projection is only visible from a steep angle, therefore passers-by would have to look straight down to notice it. Figure 19 -21 show the games in daylight from their best point of visibility (Figure 1, direction 1). Similar to Mark Blijleven's remarks during the expert interview, I suggest to layer the playground floor with white material, and furthermore implement a wall painting or lasercut of the playground label, similar to the labels of other rooms in the DesignLab. Also, many people walk whilst looking at their mobile phones, which might enforce a downwards-directed field of view and increase the possibility of them noticing the projection.

After the dark elements had been reworked with light and contrast-rich design and the orientation was corrected accordingly, the sound levels had to be altered to match the general level of noise in the area. I tried to make the sound subtle yet audible, in order not to irritate people who use this area for mobile calls, tours, or other general conversations. However, the sound level of the games was difficult to universally match to all situations which took place on the playground, therefore I suggest to implement a sensor which listens to the surrounding sound level and adjusts the volume of the sound effects accordingly. Especially tour guests or people on mobile phones, who sometimes stay on the playground for a long time, should not be in any way annoyed by the sound effects, and the game functions such as the ones in "Vote" should not be activated by accident.

Another suggestion would be to place a larger monitor on the desk and have it display the players coordinates together with their ids and potential additional information, since passers-by seemed to be interested in it even when it just shows a camera view, and visitors of the OpenHouse were very interested in the calibration view. Users of the system could play with their coordinates and understand the functions and what is happening, find their player id and explore how they are being tracked. This could be valuable for the university if they want to aim at explaining technology in an interactive manner.

Further refinements of the games could include adding a leaderboard to "Buzz", which displays the highscores of the day. The fact that users are able to swap scores could be removed, or redefined as a further functionality and game mechanic. Furthermore, a cyberculture or internet meme related background selection could be implemented in "Uncover", in order to assess the familiarity and content preference of passers-by on a more engaging game.

My observations suggest that long-term engagement might differ between interactive artworks and games: “Uncover“ yielded the most long-term interaction, which occured in the afternoon (Fig. 26 and 27), by what seemed to be a semi-engaged audience with shared focus. This could suggest that there is a potential undiscovered categorie of target users of interactive floors, which play passively and are more likely to engage in long term interaction. “Buzz“ seemed most attractive for long-term interaction on Monday morning (Fig. 26 and 29), with fully engaged and actively playing users. This could be accounted to the increased appeal of the games novelty, or to the fact that passers-by are more awake and therefore more active as compared to the late afternoon hours. This was hinted at to some extent by Morrison et al.: “...we observed participants who comprehended the work—often after a period of speculation, and more engaged interactors (those invested in an embodied way and committed themselves both to the space, and to the interaction afforded there)” [10, p.51]. This can also be accounted to the implication of triggers for the Honeypot Effect, which included Wouters et al.’s [19] suggestion to aim for easy transitions between active and passive roles, which allowed for easy commencement and termination of the interaction.

Interactive floor playgrounds are appearing more and more in semi-public space, for instance hospital waiting rooms, zoos or museums. This thesis aims at serving as a guideline for designers of such systems and as a way to improve or modify existing technology to serve specific purposes through the implementation of creative skills and insights. The strongest recommendation that can be drawn from this work is to aim for maximal visibility of the projection, as the floor is never at a natural view angle, but largely more noticable if users are able to see it from far away. Furthermore, the target group is key when adjusting tracking specifications, and must also be paid attention to when tailoring the content and type of game. The specific surroundings of the interactive floor can yield large differences in behaviour, which should not be left unaccounted and should best be prepared for in advance. Finally, I suggest the option of a look behind the scenes through position monitoring as a highly effective method in order to get passers-by interested in the system and its underlying functions.

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Appendix

1. Research Proposal

Research Proposal: Graduation Project Bachelor, Creative Technology

Title of the project	Come play with me!
Principal researcher	(BA student) Enyo Ahovi, s1702890 r.e.ahovi@student.utwente.nl
Researchers/research assistants	Supervisor: Robby van Delden, r.w.vandelden@utwente.nl Graduation Semester Coordinator: Richard Bults, r.g.a.bults@utwente.nl Programme Coordinator: Eric Faber, e.j.faber@utwente.nl
Department responsible for the research	Human Media Interaction (HMI)
Location where research will be conducted	DesignLab University of Twente, Hengelosestraat 500, 7522 Enschede, Niederlande
Short description of the project	The goal of the project is to attract passer-bys in public spaces, specifically on interactive floor system in the corridor leading to the Design Lab. 3 prototypes are envisioned: 1. A voting interface where users can 'upvote' their favorite content. 2. A collecting game where users have a personal score and can compete on a leaderboard. 3. An floor display which uncovers a background when users walk over it. Those prototypes collect data on the users position (1,2,3) and publicly display an interpretation of this data (1,2).
Expected duration of the project and research period	Project duration: February 2018 - July 2018 Research period: (10-15:00) April 23th - April 27th 2018 April 30th - May 4th 2018 May 7th - May 11th 2018
Number of experimental subjects	Specific number unknown Estimated around 700 subjects: 20 - 50 passer-by's on a regular day up to 70 passer-by's when DesignLab events occur
EC member of the department	Dr.ir. Dennis Reidsma (EWI, HMI), temporary chairman

Questions about fulfilled general requirements and conditions

1. Has this research or similar research by the department been previously submitted to the EC?
Uncertain.

2. Is the research proposal to be considered as medical research?
No.

3. Are adult, competent subjects selected?
Yes, we only run the system on days that competent and adult subjects are present, based on the events in the DesignLab. If kids are using the system, parents will be asked for consent, otherwise we will refrain from making observational remarks. The selection of subjects happens by chance: We observe passer-bys in the university, thus we are envisioning mostly UT students and staff.
Participants are not aware of being subjects in this experiment, and even sometimes may never be aware of having been subjects in recordings of their behaviour, therefore proposals selection of subjects is difficult to indicate.

4. Are the subjects completely free to participate in the research, and to withdraw from participation whenever they wish and for whatever reason?
Yes, subjects can walk away from or around the interactive floor.

5. In the event that it may be necessary to screen experimental subjects in order to reduce the risks of adverse effects of the research: Will the subjects be screened?
No, screening is not necessary, the risks of adverse effects are very low and no exclusion criteria are made. Furthermore, we will refrain from flashy and epileptic triggering visuals.

6. Does the method used allow for the possibility of making an accidental diagnostic finding which the experimental subject should be informed about?
No, as far as we know the method does not allow for this possibility.

7. Are subjects briefed before participation and do they sign an informed consent beforehand in accordance with the general conditions?
No,
however we conduct standard HCI research where users are not disclosed the nature of the study in order to limit influences on their perception of the system, for example lightening the burden of participating in a study and having to spend extra time filling in surveys. I am primarily interested in passer-by's engagement with the system, which can't be researched by briefing and requesting consent from users in advance.
The expected procedures, discomfort, risk, duration, purpose etc., associated with the subject's involvement in the research are minimal and we don't impose certain behaviour.

8. Are the requirements with regard to anonymity and privacy satisfied?
Yes. No personally identifiable information is gathered and subject anonymity is guaranteed. Data obtained from research is not disclosed to third parties in any way that would make it possible to link the results or other findings with a particular subject. No video, audio or photographic data will be collected and pictures in the report will be staged, this way there are no adverse effects for the participants. The raw data collected includes the position over time and observational behavior remarks like motivation, excitement, immersion and familiarity (if they seem to know the system already or if it is their first time seeing it), and possible quotes of people whilst interacting, with anonymized demographics. Disclosure of processed data include the presentation and discussion in a GP colloquium and publication in form of an article to the University.

9. If any deception should take place, does the procedure comply with the general terms and conditions?
No deception takes place.

10. Is it possible that after the recruitment of experimental subjects, a substantial number will withdraw from participating because, for one reason or another, the research is unpleasant?
No. (There is no recruitment)
Due to its harmless nature and very low risk of any physical or psychological effects.
We are not including material which for certain groups of people is offensive or inappropriate for any number of reasons including but not limited to religious beliefs (examples include racial or explicit sexual photographs or films, use of alcohol and subjects alike).
For 24 hours after the research has ended the subject might decide that his/her data may not be used in the research after all. This will result in the observations on the subject will be removed from the research data and not be used in report and presentation.

Questions regarding specific types of standard research
11. Does the research fall entirely under one of the descriptions of standard research as set out in the described standard research of the department?
Yes, Department Human Media Interaction (HMI).

12. If yes, what type of research is it?
The research will be done human subjects, as covert research: This includes the observations of users with the researchers status not made clear to the user.
The study will observe user behaviour on three Lo-Fi prototypes and draw conclusions in order to improve the next generation systems. The raw data collected includes the position over time and observational behavior remarks like motivation, excitement, immersion and familiarity (if they seem to know the system already or if it is their first time seeing it), and possible quotes of people whilst interacting, with anonymized demographics. The three envisioned LoFi prototypes include a display of an aesthetic background which a user can uncover by walking across, a voting interface ranking different contents and a collector game with personal score.
(Subsequently to the LoFi evaluation, the requirements for the HiFi prototype will be set and a new research proposal will be submitted)

DMP-light questions

13. Data type

The information collected by the system includes player position (ID, xpos, ypos, zpos).
The data is sent as a string over udp to a javascript that forwards it to a game PC, from where it can be copied and sent to an IP address. Researcher observation are written down manually and will only be done on interaction, but keep track of how many people pass by.

14. Scope of data collection

Each prototype is tested for 5 work days between 10 and 15 o'clock, and data will only be collected when system is running. The observations provide the most insights for analysis, however the raw position data can be used to support conclusions drawn from them.

15. Data handling

Managing processed data:
Main Researcher: Enyo Ahovi, s1702890, r.e.ahovi@student.utwente.nl

Access processed data:
Supervisor: Robby van Delden, r.w.vandelden@utwente.nl

Access to the final report, including extracts of processed data is public,
and will be presented to:
GP Examination Committee
Graduation Semester Coordinator: Richard Bults, r.g.a.bults@utwente.nl
Programme Coordinator: Eric Faber, e.j.faber@utwente.nl

16. Data coding

The observational and position information gathered is not personally identifiable and subject anonymity is guaranteed. Raw data obtained from research is not disclosed in any way that would make it possible to link the results or other findings with a particular subject.
The unity script storing the raw position data is not protected, neither is the javascript which the position data is send to.

17. Data storage

Copies of the javascript and observation files will be stored on the main researchers laptop and shared via the student account with the supervisor. All data saved is processed and anonymous.
Data that is not part of the resulting GP report and presentation will be deleted upon finishing the report (before July 6th 2018).

18. Data sharing

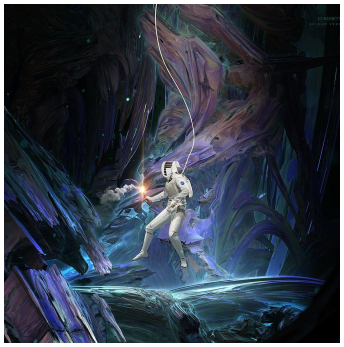
Processed data will be shared over the official UTwente email accounts. Publications of the data include the presentation and discussion in a GP colloquium, a GP report and potentially an article to the University.

2. Visual and Auditory Elements

"Uncover":

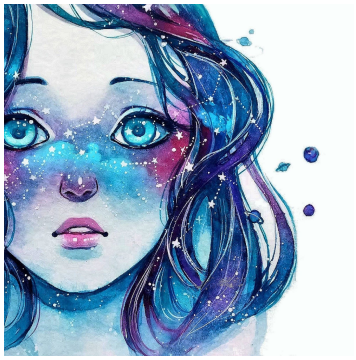
Black Hole in the milky way by Tanya Shatseva

Diamond Universe by Tattoooo



Curiosity by Kuldar Leement

Creative Space Illustration by Pescando Estrellas



Starred Freckles by Quinni

(appeared first on Nov 2014 on Paul Ryans tumblr)

Star Wolf and Rabbit Girl by Chiara Bautista

by R.E. Ahovi

"Vote":

[altered] PC icon by by Freepik (www.flaticon.com)

[altered] Console icon by Tools and utensils (shareicon)

[altered] Atheist icon by WikimediaImages

[altered] Religious icon by freepngimg

[altered] Webcam icon by Stock Image Folio

[altered] Tape icon by flaticon

[altered] Introvert & Extrovert icons by GrAl (shutterstock)

[altered] Peanut Butter from https://www.calve.nl/pindakaas/

[altered] Reddit Meme from Reddit

[altered] Twitter Meme by Teunkie

(pilot study, Fig. 7) [altered] Apple icon by pngtree
(pilot study, Fig. 7) [altered] Android icon by https://shocard.com/free-download/

"Buzz":

Banana Leaves Diagonal Pattern by Anton V. Tokarev

Bee Vinyl printed Sticker by ChimpStickers.com (IMA Agência Criativa)

Stage 4 Gigantic Beehive from the videogame Don't Starve Together (Klei Entertainment)

Game Icons, Players and Sounds:

Uncover Player: ColorFlare (unity standard asset)

Uncover Icon: [altered] Eye Art by Svenja Jödicke

Vote Icon: [altered] Check Mark icon (https://www.iconfinder.com/icons/49827/check_done_icon)

Buzz icon: [altered] Hunting butterflies icon by Freepik (www.flaticon.com)

Uncover sound

https://www.youtube.com/watch?v=XZBeNsrIZfM

Vote and Buzz release sound

https://www.youtube.com/watch?v=6jqrIIqfpSM

Buzz collect sound

https://www.youtube.com/watch?v=Yru-bpR-QAo

(all pictures altered with Adobe Photoshop CS3)

3. Observation Forms

Date _____ Time _____ - _____

Count *Total*	
- Observations	
- Comments	
Count *Notice*	
- Observations	
- Reaction	
- Comments	
Count *Engage*	
Time	
- Observations	
- Reaction	
- Comments	
Count > *3 min*	
- Observations	
- Reaction	
- Comments	
QUOTES	

UNCOVER

Is the game grabbing attention?	
Are bystanders drawn to the installation by the reaction of the users?	
Are certain images more popular than others?	
Do users notice the timer?	
Is the sound seen as annoying?	
Do people care if others are watching them?	
Do people use it together with strangers?	
Do people work together with strangers?	
Do people work together with friends?	
- Other Comments	

VOTE

Are instructions needed?	
Are certain options more popular than others?	
Do users care if others are watching?	
Do users vote a certain way if others are watching?	
Do users vote a certain way if others are not watching?	
How do groups behave?	
Do users make comments on how many votes something has?	
Do users show attachment to certain content and to what extent?	
Do people use it together with strangers?	
Do users interact with those strangers based on the game?	
Do users show in some way that they feel like 'operating a giant App'?	
- Other Comments	

BUZZ

Do people get competitive?	
Do groups get competitive?	
Are users proud if they reach a high score?	
Are users turned off by the low difficulty?	
Do users hey show satisfaction due to the design?	
Are users irritated by the sounds?	
Do users understand the nest function?	
Do users mind if other people are watching?	
Does user behavior differ when alone to when in a group?	
Do people use it together with strangers?	
- Other Comments	

4. OpenHouse Observation Form

"Uncover": Do users show aesthetic preferences?

"Buzz": Do users show competitive behaviour?

General Observations:

Is the game notable?
Is the game motivating?
What kind of questions do they ask?
Are there any notable quotes if users whilst using the system?
Other comments / general reaction

5. Expert Question Form

Which one do you think is the most effective game for my purpose? Why?

Do any of the interactions need instruction or guidance? How should they be instructed?

How strong are the following factors of my games at increasing user motivation and engagement?

	0 (weak)				5 (strong)
Game difficulty	☐	☐	☐	☐	☐
Teamwork	☐	☐	☐	☐	☐
Competition	☐	☐	☐	☐	☐
Visual Feedback	☐	☐	☐	☐	☐
Auditory Feedback	☐	☐	☐	☐	☐