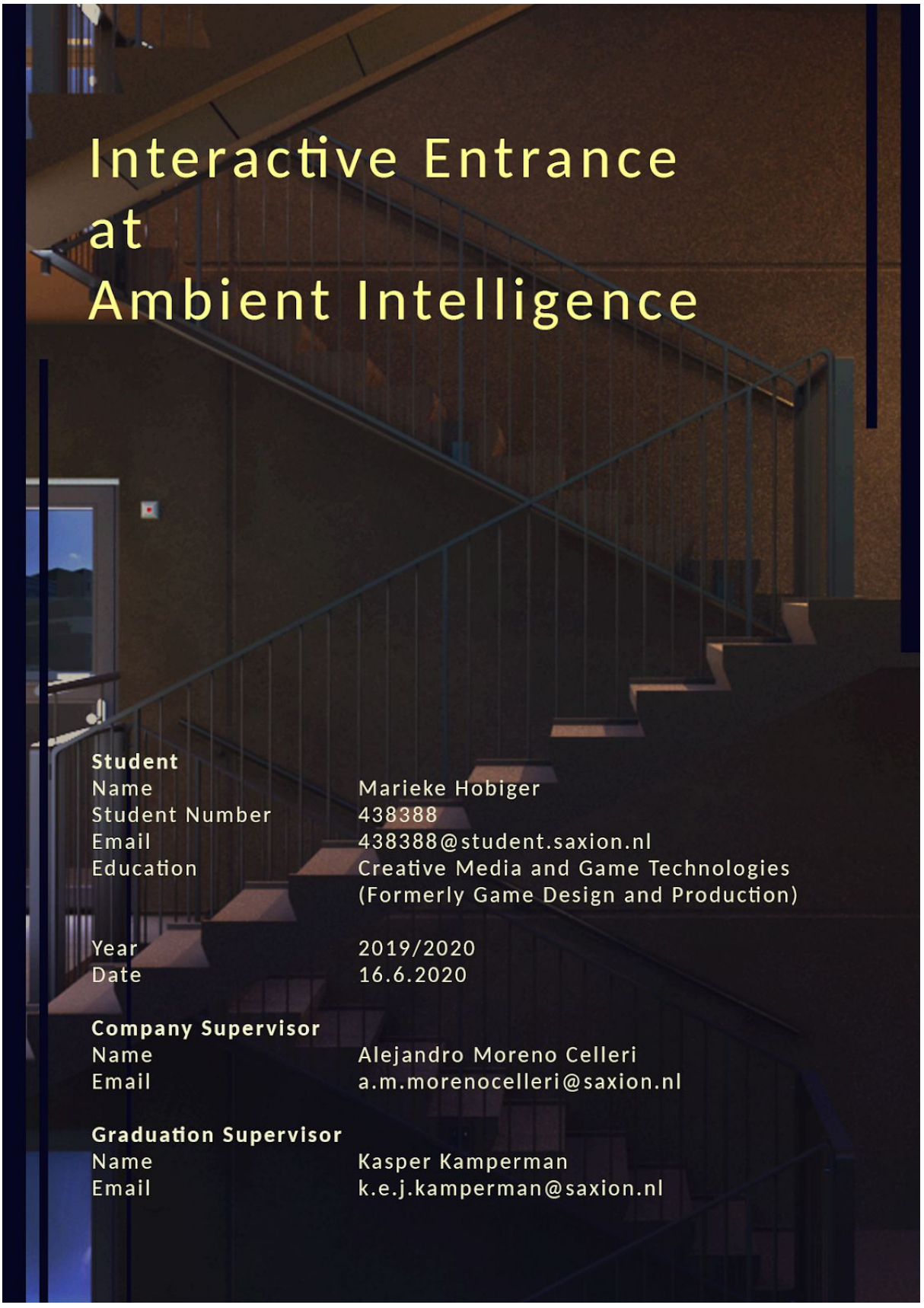

Interactive Entrance at Ambient Intelligence

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Abstract

This thesis is about the project “Interactive Entrance at Ambient Intelligence” provided by the research group Ambient Intelligence at Saxion University of Applied Sciences. This thesis researches how to develop an installation which uses interactivity with projected images to attract students to the research group Ambient Intelligence in the Epy Drost building.
The main research purpose is to produce an interactive installation which will solve the issue of students not being aware of Ambient Intelligence’s existence and their available internship and graduation projects.
During this research, the CMD methods and an agile development approach were utilised to answer four subquestions. These are about (i) necessary technological aspects, (ii) what Ambient Intelligence wants to present, (iii) researching methods of influencing the target audience behaviour, and (iv) creating a design that understandably portrays AMIs wishes.
The process researched was successfully tested with a selection of students, and predictions have been made that detail how students will interact with the installation once it is installed. By utilising attention-grabbing visuals, unconventional methods of advertising and the clear communication of a message, all testers have proven to demonstrate the intended behaviour of understanding what the installation wants to convey.

Preface

Four years are over. It is amazing how fast time has passed. It seems like it was yesterday that I moved to this city. There were trial and tribulations but looking back it had been a fantastic time that I will surely miss it when it ends.

First of all, I would like to thank Alejandro Moreno Celleri for his endless support during this graduation phase. I'm thankful for his ideas, feedback and patience.
Furthermore, I want to thank Ambient Intelligence, especially Danny Plass, for allowing me to work on this project with them. I appreciate their work and efforts in making this last study phase a pleasant experience for their graduation students like me.

I would also like to thank Kasper Kamperman, who was my graduation coach, for his support in the graduation process. Without his detailed feedback and explanations as well as his active involvement and availability for questions and recommendations, this thesis would not have been possible.

I'm very grateful for the members of the "On Time" team who have become great friends of mine over the years. These past four years wouldn't have been the same without them. I will always cherish the memories we made together, and I wish for our friendship to continue even after we go down different paths.

Lastly, I want to thank my parents who always find time to help me and support my work, despite their busy schedules, and who are there for me when I face trials that I can't conquer on my own.

Marieke Hobiger
Gronau/Enschede, June 2020

Table of Contents

1. List of Abbreviations

AMI	Ambient Intelligence
CMD	Communication and Multimedia Design
CMGT	Create Media and Game Technologies
MoSCoW	Must have, Should have, Could have, Will not have
ASI	Architectural Surface as Interface
MOSES	Mobile Sensing for Safety
AIOSAT	Autonomous Indoor & Outdoor Safety Tracking System

2. Glossary

Blob Tracking	A way to recognise and track regions of a digital image with similar properties compared to their surroundings.
CMD Methods	A compilation of different methods created by the Communication and Media Design department of the Amsterdam University of Applied Sciences to teach their students different types of research.
Croquis	A quick drawing or sketch done in only a few minutes or seconds.
Depth Camera	A camera that can differentiate between fore-, middle- and background by utilising a different RGB colour system than regular cameras. This can be used for object recognition. (“Beginner’s guide to depth (Updated),” 2019)
MoSCoW	A system to sort features of a project by priority.
Projection Mapping	The process of projecting something onto any uncommon surface, turning any 3D object into a display. Projection Mapping is commonly used in advertising, concert, theatre, gaming, computing or decoration. (Jones, n.d.)
Render Farm	A service that offers the customer a strong computer power that is above the customer’s available equipment and supports their project with faster render times.
Anti-Poaching Project	The “Anti-Poaching” project was about the development of a tracking system to protect animals that face the threat of being illegally hunted.
MOSES/AIOSAT Project	Both “MOSES” and “AIOSAT” are about the tracking and protection of rescue workers using GPS. While “AIOSAT” focused on the technical perspective, “MOSES” concentrated on the practical implementation for firefighters.
Saxion Qualtrics	An online application that allows for the creation and distribution of professional surveys.

3. Introduction

Imagine, every day you are working in a crowded office. But despite your efforts, nobody is aware of your existence. This has been the reality of research group Ambient Intelligence (hereby referred to as AMI) for a few years. They have fewer students who apply to cooperate with them compared to other research groups that are working in the same building.
Results of a study done to explore this phenomenon revealed that many students are unaware of AMI's existence (Kel, 2019). A previous graduation project illustrated the reason for this: AMI is not visually represented at Saxion and needs to advertise its group and work to become visible to the students working in the building (Kel, 2019).

In consequence, this graduation project aimed to create an interactive entrance for AMI's office area on the fourth floor of the Epy Drost building. This interactive entrance should appeal to students, attract them to the research group and inform them about their work.

This report will outline the different aspects that had to be considered for creating an interactive entrance as well as document the research done about the topic. Additionally, it will provide a summary of the design, the creation process and the outcome of the project.
The first half of this report will offer a comprehensive overview of the conditions the project was based on. It will provide information about (i) the client and his reason for the project; the details of the project, (ii) like the conditions of satisfaction and the agreed deliverables, (iii) the problem definition and research questions and finally, (iv) the methodology to answer each question.
The second half of this report will focus on the theoretical background of the overall aspects of the project. It will present in-depth answers for each subquestion by presenting achieved results. Finally, the main question will be answered, and recommendations will be given for future steps in this project.

3.1 The Client: Ambient Intelligence

The client is the Saxion research group Ambient Intelligence. In collaboration with students, teachers and researchers, AMI does multi-disciplinary and demand-driven research on how to integrate technology into everyday life and how to make environments smart.
The group focuses on three research lines: "Connected Embedded Systems", "Applied Data Science", and "Augmented Interaction". The team of AMI is made up of 25 members who are of varying disciplines and overtake the roles of researchers, teachers, lecturers, and project managers at Saxion.
In this project, Alejandro Moreno Celleri, who is a CMGT teacher at Saxion, is acting as the direct contact person from AMI. He participated in regular meetings about the project and was included in the decision-making process.

3.2 Reasons for choosing Ambient Intelligence

I had turned to Saxion for their offered graduation projects after difficulties with a different company have led to an abandonment of cooperation for this graduation phase.
Among the projects that Saxion offered was the project "Interactive Entrance" by AMI. I decided to pursue this project because it had a greater focus on my discipline while still allowing me to learn new skills such as Projection Mapping.

3.3 The Client's Reason for the Project

In 2019, Daphne Kel graduated at Saxion with her thesis "Ik zie ik zie wat jij kan zien" (Kel, 2019). She created an advisory report for AMI detailing reasons for their overall low visibility among students compared to other research groups at Saxion. The proposed steps that need to be taken to improve their visibility can be found in Appendix 12.3.
One reason, Key (2019) pointed out was is the lack of visual appearance in Saxion facilities. She proved this with a survey where only 13%, of 178 asked students, displayed previous knowledge about the existence of AMI. Based on these results, the client concluded that to improve their visibility, a visually enticing entrance area to their office was required.

3.4 The Assignment

The official name for the project is “Interactive Entrance at Ambient Intelligence”. It is about creating an interactive installation at the entrance of the office of research group AMI on the fourth floor of the Epy Drost building.
The goal of this entrance is to attract the attention of students to the research group and its work. By using futuristic technologies, research contents of AMI shall be presented in an interactive way to students passing by their offices. The final concept was to create an interactive installation that utilises projectors and a depth camera to play animations related to and referencing AMI when students are nearby the office. Additionally, the lockers located in the entrance area are incorporated into the installation using Projection Mapping to create a digital poster. The aim is to raise the awareness of the students towards the group to increase their curiosity to approach them.

3.5 Conditions of Satisfaction

The client is satisfied with a finished design and a functioning prototype of the application. As they want to continue to work on this product after this graduation period, they require proper documentation about the concept, the project structure and recommendations for future steps to be taken. This documentation is going to be handed over to the client after the graduation period has ended. The full list of the approved priority rating and content to be delivered can be found in Appendix 12.4.

3.6 Stakeholders

Since this project wants to promote interaction between the research group AMI and the students of Saxion, the concerned parties are AMI as the client and the students of Saxion as the target group. Saxion is also a stakeholder as they provide the requirements for this graduation assignment. Finally, the building administration for Epy Drost is also a stakeholder, as they have to approve any alterations made to the public office area.

3.7 Limitations/Scope

Limitations in space at the entrance area
One is the restricted space in the entrance area. It is rather small, with office doors opening to the outside. Additionally, multiple objects are placed in the entrance area, which are not allowed to be moved, according to building administration. These include lockers and a display cabinet. The walls are also not allowed to be modified in any way. These restrictions have to be kept in mind for designing the final product.
Because the entrance is located near multiple open working areas, possible music or sound effects used in the product should be kept as low as possible to prevent any disturbance of workers on the fourth floor.

Limitation by required approvals
AMI has already ordered equipment, such as projectors and depth cameras. This equipment was previously approved by the building administration to be installed at the office. During brainstorming sessions, it has to be considered what other modifications are allowed by the administration and what are not.
In addition to that, the limited budget for the project should also be considered for ordering new equipment online.

Scope and allocations of expertise
As this project is carried out by a student of the study programme “Creative Media and Game Technologies” (formerly, “Game Design and Production”), whose main expertise is the design and art production, the focus of this project is an artistic one. Any complex programming tasks are primarily carried out or supported by experts in the research group AMI. Additionally, project ideas, including topics like machine programming, will not be taken into consideration, even if they are topics researched by AMI. This decision was made due to the dissociation of these topics with the artistic focus of this study.

3.8 Project Deliverables

The final product was planned to be a prototype that can be installed and tested and therefore, can be further expanded and polished by future students working on the project. This prototype should be intractable. It also has to indicate its relation to AMI and inform students about what they are doing. It should act as the first step into a direction that increases the student's engagement with the research group.

4. Problem Definition

As a consequence of AMI's lack of representation, not many students are willing to collaborate with the group for their research or to support their projects. This fact heavily limits the research outcome of AMI compared to other research groups at Saxion. This graduation assignment will develop a way to increase the awareness and engagement of Saxion's students with the research group by improving the physical presence of AMI at their office entrance.

5. Main & Sub Questions

5.1 Main Question:

Based on the problem definition the main research question of this project is:

> "How to develop an installation which uses interactivity with projected images to attract students to the research group Ambient Intelligence in the Epy Drost building?"

5.2 Sub Questions:

To better understand the main question and gain an overview of all relevant aspects, it is broken down into four subquestions that needed to be answered individually. The results of every subquestion will form the base for the conclusion.

1. What technological features are required for this installation and how to implement them?
2. What does Ambient Intelligence want to advertise about themselves?
3. How to encourage focused attention of students in a public space?
4. How to successfully communicate what Ambient Intelligence is about through the art style and design of the installation?

6. Methodology:

During this graduation project, the main methodological approach was a qualitative one. Research was performed in from on an observational and interpretative study rather than a quantitative numerical or statistical analysis. The reason for this was the focus of this project on the installation of an interactive product. The analytical approach detailing the statistics about the engagement before and after a successful installation would be more appropriate for a follow-up project after all steps of Kel's plan (2019) have been implemented by the research group and Saxions facilities.

To properly develop the product, data about similar projects was collected by literature review in libraries, online archives of published journals, dissertations, reports and articles, informational websites and educational videos. Additionally, surveys and interviews will be conducted. Literature was screened by focussing on the following content and themes.

1. ***What technological features are required for this installation and how to implement them?***
   This subquestion intended to find out more about the technical aspect of the project. This included research about projection mapping and object recognition with depth cameras. The results of this research helped set up the final scene and to create a functional application.

   1.1 Method
   Several different CMD methods were used to answer this subquestion.

   1.1.1 Best, Good & Bad Practices
   Projection Mapping was a previously unknown topic to me. Therefore, I researched best practices, potential software and an appropriate workflow to close this knowledge gap. In doing so, I helped prevent running into problems and supported efficient production.

   1.1.2 Literature Study
   For interactivity, depth cameras were researched to understand how to work with them. This knowledge was acquired through an online literature study. This was necessary to identify how to execute object recognition with them.

   1.1.3 Expert Interview
   Despite the initial decision of avoiding engineering-focused tasks, external factors led me to complete scripting tasks. To be best prepared for this, an expert interview was conducted with Yvens Rebouças Serpa, who is a teacher in Engineering. The interview was conducted over Microsoft Teams, where he helped to find a useful entry point into the topic of programming. He guided by giving tips about the pending tasks and recommended workflows and literature.
   Holding this interview was more efficient and led to better results than collecting crucial information through a literature study.

   1.1.4 Prototype
   During production, a high fidelity prototype was created to test the interactivity of the installation on usability and user experience. Before this, a program was bought that functioned as a low fidelity prototype. This was used as a proof of concept before moving forward in production.

   1.1.5 Usability Testing
   Originally, the final deliverable prototype was supposed to be tested at Saxion by observing students interacting with it. Due to the Coronavirus pandemic, it was impossible to perform this test. A small-scale testing environment with all necessary precautions to avoid any spread of the Covid-19 virus was created to overcome this limitation. In this setting, people being invited to test the interaction were asked to express their thoughts openly. This information was collected and properly documented. In particular, specific ideas being repeated by different people gave fruitful advice about what parts need to be adjusted to achieve the desired product.

2. ***What does Ambient Intelligence want to advertise about themselves?***

AMI is a large research group with many different members and research lines. It was essential to clarify what explicit content the group wanted to advertise. This subquestion focused on the identification of the projects AMI wished to present. This research was also necessary as the installation is located in immediate proximity to their office. Therefore, the product also has to be appealing to them.

2.1 Method

2.1.1 Survey

The main method used to gather knowledge here was through surveys among the members of AMI. This strategy was appropriate regarding the time frame of the project, as it allowed a focus on other aspects, while the survey was being conducted. Through the survey, members of AMI were directly involved in the contents that should be displayed. The first introductory survey included questions about the wishes and opinions of the group members concerning the current status of the entrance. It also sought to analyse the overall favourite projects by AMI. The second feedback survey was structured as an update questionnaire. Here, ideas and concepts were presented to the research group so that they could voice their opinions and vote for their favourite designs. It also allowed them to offer general remarks about the development process.

2.1.2 Requirements List

The results of the survey were compiled into a comprehensive asset- and requirement list. It contained all necessities concerning the different aspects of the project. This summary was useful to clarify confusions about exact details during the project. This ensured that the intentions of AMI were realised correctly and that the end product is to their satisfaction.

3. ***How to encourage focused attention of students in a public space?***

This subquestion intended to make sure that the attention of students to the installation is ensured. This was important as the students are the target audience, and the final aim is to reach and encourage them to contact the research group. Therefore the installation needs to grab their attention in a busy school setting to prove its functionality in attracting students.

3.1 Method - Literature Study

To achieve this goal, different studies on public behaviour and how to advertise brands to a general audience were reviewed and analysed. This information was mainly collected by searching in reliable online sources and doing literature study.

4. ***How to successfully communicate what Ambient Intelligence is about through the art style and design of the installation?***
   This question intended to find design patterns and methods that communicate specific thematic ideas. These design patterns were used as a basis for producing the final design that reflects the feelings and associations of AMI. It also included the reflection about being not overbearing or overwhelming for the audience.

4.1 Method

4.1.1 Literature Study

The psychology of advertisement design was explored to address this subquestion. This was done by a literature study of studies and online resources. Here, successful advertisements and design patterns, as well as methods to communicate a brand message, were collected. These patterns helped understand what design elements are perceived in what way. This knowledge was used to transfer the intended contents of AMI successfully to the user through the final design.

4.1.2 Ideation

An ideation phase was used to create multiple iterations of ideas. This was necessary to present many different possible concepts to the client. This iteration helped work towards a final design.

4.1.3 Co-Reflection

In co-reflection sessions, concepts were weighed against one another until the final idea was chosen. The method of co-reflection was used to involve the client early in the design process. The sessions included Alejandro Moreno Celleri, who is the direct contact partner at AMI, and Danny Plass, who is also a member of AMI and offered to be partially involved with the project.

4.1.4 Concept

The final concept was developed and presented to the client. This was an important step to lay out the cornerstones of what the final product was intended to be.

4.1.5 Quality Review

The overall visual quality of the produced content was reviewed by the client, peers and experts. For this, the content was sent to different people related to CMGT, and their feedback was collected. At the near end of the graduation phase, the pre-final pieces were revealed to the involved project members to receive their final opinions and feedback. The client got the chance to address last-minute concerns about the product - still with enough time to incorporate them.

4.1.6 Survey

This last survey served as an additional replacement measure for the large in-person usability testing. It was intended to uncover whether the user perceives the product as intended and how this installation influences the representation of AMI from the students' perspective.

7. Theory

7.1 What is Projection Mapping?

For this project, a technique called Projection Mapping will be employed. Projection Mapping is the process of projecting something onto any uncommon surface or when projecting from uncommon angles, turning any 3D object into a display. This is commonly used in advertising, concerts, theatre plays, gaming, computing or decoration. (Jones, n.d.) Examples of Projection Mapping can be found in Appendix 12.5.

7.2 Workflow for Projection Mapping

There are multiple approaches to Projection Mapping. However, a general workflow can be applied to all of them. This workflow starts with observation of the location and canvas. Afterwards, the concepting and designing phase of the product is followed by installing the projectors and calculating their angle and direction to create a digital recreation of the installation space. Then the content needs to be mapped to fit the canvas. This is important so that the material is projected in a way that is not distorted for the audience. When this is done, the product can be rendered (Panda, n.d.)

There are many other softwares for projection mapping available, apart from Resolume Arena as mentioned above, for example, tools like Touchdesigner, Arkaos GrandVJ XT. or VPT. Despite some of them being of free use, they all aim for more complex projection mapping projects than the one intended. For the sake of this project, a video effects editing program such as Adobe After Effects will suffice.

"After Effects" is a video editing software by Adobe which is commonly used for visual effects. This program allows for the most comfortable manipulation for projection mapping as well as a real-time preview mode through which the content can be directly adjusted to fit the object it is being projected on.
When projecting onto a simple surface using this software, one best practice recommended by Contag-Lada (2018) is utilizing corner pins. By enabling the real-time preview in After Effects, the digital image can be aligned to the canvas using these pins. The images will be transformed according to the perspective of the viewer. He recommends using a grid structure when laying out the initial projection mapping as it avoids any possible distortion caused by an incorrect ratio (see *figure 1*). (Contag-Lada, 2018).

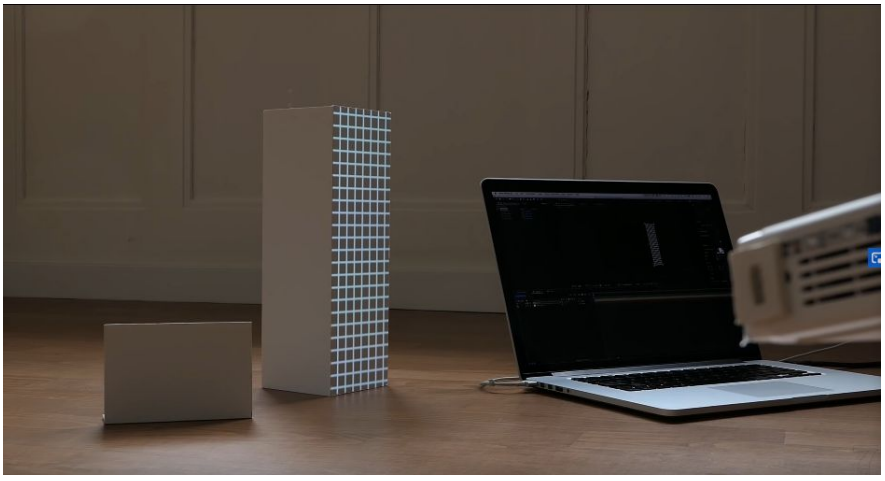

Figure 1. An exemplary set up of a simple projection mapping. Adapted from “3D Video Projection Mapping Tutorial” by P. Contag-Lada, 2018, Retrieved from https://www.youtube.com/watch?v=w4DrWoHo7y4&list=PLNGDdR0ZGaI7uF3sb5kSLDeBreBW4RW6I&index=2&t=0s

7.3 Interactivity with Screens and Projections

The interactivity with the installation comes from utilizing an Intel Depth camera for object recognition. This is fundamental for building an interactive installation. Examples for this can be found in Appendix 12.6.

7.4 What is a Depth Camera and how to use it for Object Recognition?

A depth camera has a multitude of applications. One of these is object tracking in 3D spaces (“Use Cases,” 2020). This is due to the three different types of modules that are combining their input into one depth image. These modules are a typical RGB camera, an infrared camera and an infrared laser projector. The output of all three modules creates a depth image (see *figure 2*) that is utilized for depth processing and movement tracking (Tadic et al., 2019).

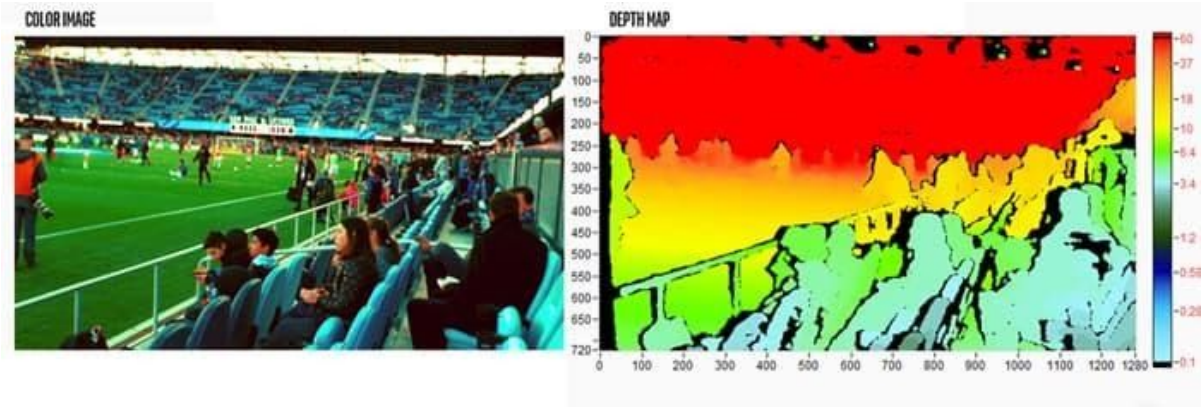

Figure 2. Difference between standard cameras (left) and depth cameras (right). Adapted from “Beginner's guide to depth (Updated) – Intel® RealSense™ Depth and Tracking Cameras”, 2019, Retrieved from https://www.intelrealsense.com/beginners-guide-to-depth/

This technology can be used for blob tracking, which is a process where a computer recognizes a group of pixels of an image as an object. Once it has identified the object, it can track its motion for a specified amount of time (Delee, 2020). Combining blob tracking with the object recognition technology of a depth camera would allow to create a program that recognizes passersby of the installation and trigger an event as a result.

7.5 General Attention Patterns

The average attention span of humans lies at eight seconds. This is because the brain cannot process all information surrounding them. Frequent smartphone or computer users have great difficulty staying focused on one piece of media at a time, therefore lowering their attention span significantly (Borreli, 2015).
The attention of humans can be broken down into three levels: (i) the centre of attention which leads to focused interaction with their surroundings, (ii) the periphery of attention which is the subconscious interaction with their surroundings (for example habitual actions or behaviours that do not require the full attention), and (iii) the unintentional attention which leads to an implicit interaction usually triggered by something unexpected and an exterior input that one has no direct control over (Bakker & Niemantsverdriet, 2016).
What humans can focus on depends on the contrast of emotional intensity. Humans can unconsciously recognize objects surrounding them. For example, passive glances can already outline objects, and familiar voices travel to our ear faster. Therefore, focusing on something is a conscious decision. What is most important is decided by monitoring the context of a situation.
Our ability to gain focus is dependent on the efficiency of neurotransmitter molecules. These molecules refresh every few hours and are efficient in the morning. Therefore, it is easier for humans to concentrate on complicated tasks in the morning, compared to the evening, after they have already been active the entire day (Sylwester & Cho, 1992).

7.6 How to encourage Attention

There are multiple ways to attract and focus attention. The senses have to be engaged by maintaining an interest curve. The interest curve can be targeted by presenting entertaining content, doing the unexpected, and bringing across ideas in a concrete and relevant way (Briggs, 2014).
Attention should be considered as a spotlight; it is object-based, which means there is a higher response to visuals. Generally, it can be said that visuals which dominate the visual cortex usually also dominate other regions of the brain (Mather & Sutherland, 2011).

To encourage attention, interest needs to be created. This was tested in a large scale experiment by Kim & Lee (2016) and published in the International Journal of Design (2016). Their test was built on the principle of using an architectural surface as an interface (hereby referred to as ASI). This meant that exhibition pieces were spread out onto walls, floors and ceilings in varying positioning and scale. The unusual movement of the visitors to see all exhibition pieces stimulates the processing of information and leads to a better acknowledgement of the pieces presented. To test this theory, they compared an exhibition with traditional placement of information to an exhibition that utilized ASI. The one using ASI sparked a much higher situational interest, and visitors engaged more actively with their environment and displayed a better memory of the information. The visitors also remembered where each exhibition piece was located in the room. This can be explained by the unusual placement stimulating (Kim & Lee, 2016).

The simplest of attracting attention to an interactive piece is when people are already interacting with it. Be it by accident or choice; additional people will be pulled to interact with it. This is called the "honeypot effect". Should this effect not work, a standby person that invites passerby to interact could also be employed (Müller et al., 2012).

7.7 How to advertise to Students

Studies have revealed that most college and university students are not perceptive to regular ads. They do not interpret them as authentic and are more likely to oversee and ignore them ("What the Data Says about Marketing to College Students", 2016).
Instead, when advertising to students, it should be something unique, something that does not take much time and complimentary. Transferring information in that way increases the chance of grabbing and maintaining their attention ("Creative Ways to Advertise to College Students - OnCampus Advertising", 2014). Another way to gain their attention and make them invested in an ad is to promote something they will care about (Griggs, 2012).

7.8 Psychology in Design

7.8.1 Design Choices based on Psychology

It is crucial to understand how people think and react to certain situations being presented to them in an advertising context. Without knowledge about these simple principles, it becomes significantly more challenging to draw in an audience. An article by Mineo (2017) has listed ten of those psychological principles.
One important principle is the so-called "verbatim effect". It describes the phenomenon that people will most likely not remember the details of what someone has told them but instead remember the general sense of the topic. Therefore, information needs to be delivered short and precise (Mineo, 2017).

7.8.2 Successful Design Patterns in Ads

Psychology can also be used to refine the design of an ad. Simple tricks can lead to steady improvements in effectiveness and appeal.
The researcher and author, Kolenda (2018) has compiled 27 tricks on how successful advertisements are structured. Some offer essential insights on how to structure content in the final design.

1. For images and graphics, it has been proven that the brain processes content when the images are on the left while the text is located on the right more easily. This is because the content on the left visual field is processed by the right hemisphere of the brain, which controls the visual cortex (Bourne, 2006). Therefore, it is recommended to display images on the left to increase its processing time (see *figure 3*).

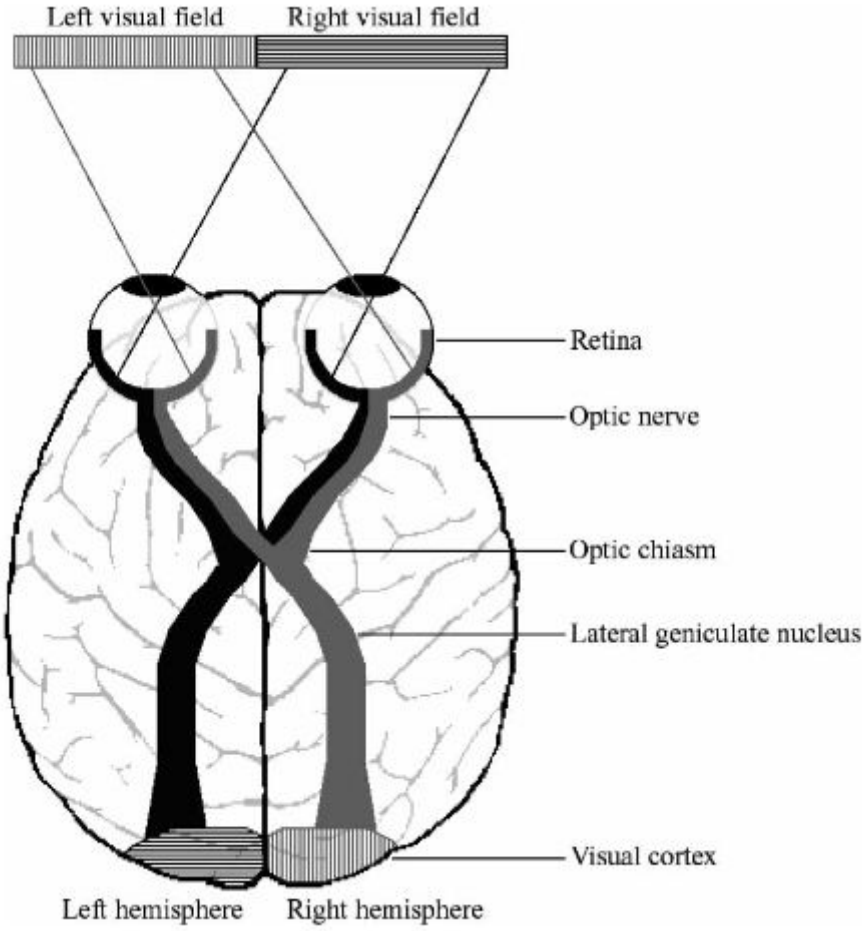

Figure 3. Processing of visual input. Adapted from “The divided visual field paradigm: methodological considerations”, by V. Bourne, 2006, Psychology Press, p. 374, Retrieved from http://www.statsart.com/PDF/Bourne_06_Laterality.pdf

2. Humans tend to look for the eyes of another person when they encounter each other. This behaviour comes with the tendency to follow other people's viewing direction. Featuring humans that look at the product or headline (see *figure 4*) increases the attention towards the product or article (Kolenda, 2018).

Figure 4. Effect of repositioning the gaze towards a headline. Adapted from “27 Advertising Tactics Based on Psychology”, by N. Kolenda, 2018, Retrieved from https://www.nickkolenda.com/advertising-psychology/.

7.9 Communication of a Brand

There are many ways in which a brand can be communicated, but generally, it can be broken down into the two following aspects. On the one hand: Be sure it is known whom to advertise for and who will be the targeted audience. On the other hand: Know what the brand wants. What are the core values, and how can they be reflected in the design? It is important to be flexible and fully understand the niche the company is operating in. Association with topics related to the brand or the product are essential factors for considering the design ("10 ways to communicate a brand effectively", 2013).
According to Lee Yohn (2017), there are nine different types of brands. These types, which were prominent in the context of this project, are the following:

1. The innovative brand, which aims to produce futuristic products by using the latest and most progressive technologies.
2. The value brand, which offers a standard quality for affordable prices.
3. The style brand, which focuses on aesthetic appearances and feel of their product rather than what they are supposed to achieve.

Practical questions to ask during the design process are: "What do I want my audience to know when they walk away from my design?" and "What do I want to accomplish with this design?" (Shivka, 2018).

8. Results

8.1 What technological features are required for this installation and how to implement them?

8.1.1 Production

8.1.1.1 Projection Mapping

After researching software and best practices, a prototype of the projection mapping was created using Adobe After Effects. Unfortunately, this prototype could not be tested with the lockers, due to the Covid-19 lockdown. Instead, I created a video that fitted onto the door of my apartment. For this, the workflow detailed in chapter 7.2 was applied. This visual prototype was used for testing the general functionality of projection mapping, which worked out successfully (see *figure 5*).

Figure 5. Prototype Projection Mapping.

8.1.1.2 Object Recognition

A critical aspect of the final product was interactivity. The idea here was that only with a person lingering in the installation area the wall and ground would play a “breaking” animation, allowing the person to "look" into the other side of the wall which should be digitally recreated. This interactivity was realised by utilising the object recognition feature of a depth camera (“Use Cases,” 2020) and combining it with blob tracking (Delee, 2020).

As this was an engineering task, it got support by my supervisor Alejandro Moreno Celleri, who researched a program that would enable the blob tracking. The program is called "Blob Tracking with Realsense" from BlackBox Realities (see *figure 6*).
With this program, the final set up was continued. This mainly concerned the activation of the correct animations when an object was recognised.

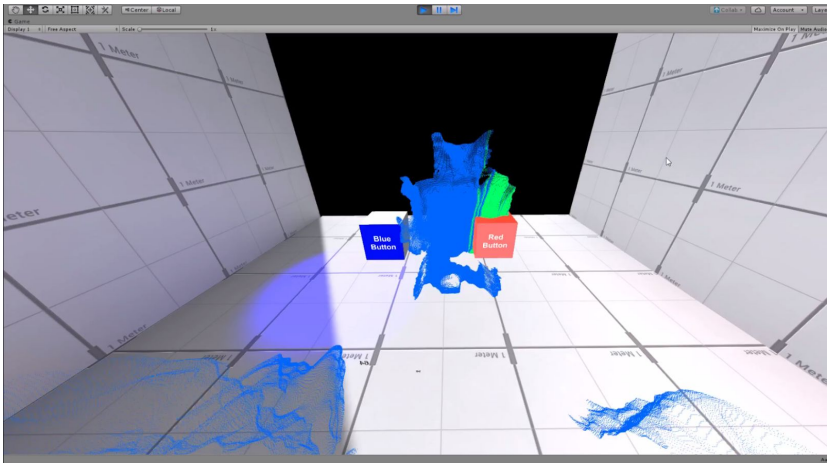

Figure 6. Purchased Prototype Blob Tracking in Unity.

For this, I sought out the help of an engineering teacher at Saxion: Yvens Rebouças Serpa. We discussed the details of the scene and how to realise them. He gave helpful advice on how to spawn the animations when a blob was triggered. Further, he explained a timer function that delays the character animation. He also detailed how to avoid lags by the system. He also commented on best practices and workflow tips. A detailed overview of the results of the interview can be found in Appendix 12.7.

For the final scene, any redundant assets were removed from the purchased scene. Only one collider was maintained to trigger the animation. This collider was increased in size so that the recognised blob would not miss it (see *figure 7*).

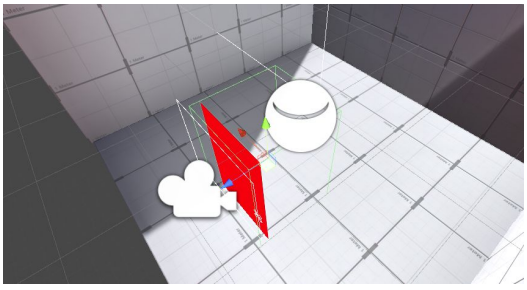

Figure 7. Set up of the final scene, Red plane and green box are the trigger area.

A video player for the idle animation and the character animations were added to the scene (see *figure 8*). Afterwards, a script was created that triggered the correct character animation as soon as the collider detected a tracked object. A timer was designed to avoid having the character animation play every time someone quickly walks past the installation.

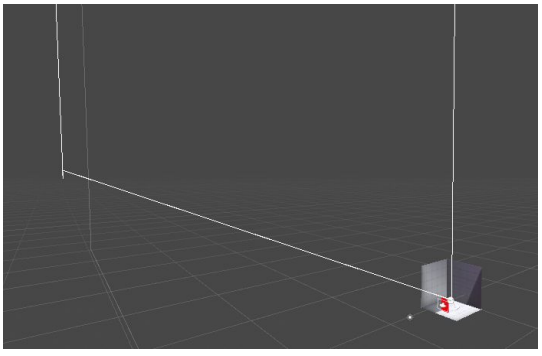

Figure 8. White lines indicate the canvas that plays the animations.

The finished scene was tested for functionality. Bugs were fixed by myself, with occasional input from a fellow engineering student.

8.1.2 Survey

A small testing session with only five people was organised instead of the initially planned testing.
This in-person testing was held with five people. Each of them was asked to interact with the temporary installation I had set up in my apartment. They voiced their thoughts while interacting and filled out in the same survey that was sent to online participants.
The overall opinion on the installation was positive. However, some complications arose while interacting with the installation. All users waved their hand in front of the camera to trigger the animation. Thus, the trigger did not work correctly, as it was resetting the timer every time they exited the collider.
Moreover, the timer function was perceived as a systematic error by four participants. This is because the prompted interaction inaccurately recreated the surprise effect that is originally intended. Three testers expressed fear of “deactivating” the animation if they were to not move out of the projection’s way once the animation triggered.

8.2 What does Ambient Intelligence want to advertise about themselves?

8.2.1 Introductory Survey

The first survey ran from 26.02. until the 12.3.2020. 12 out of 25 people completed this survey. All of them were current members of the research group AMI. The survey can be found in detail in Appendix 12.8.

In the survey, the members were asked what project of their group they are the proudest of. The aim was to identify projects to translate into characters for the animations. The question did not mention this intent. Instead, it aimed to receive unaffected answers to influence the character design. The "Anti-Poaching" project was most frequently mentioned with a total number of three votes (see *figure 9*). The projects "MOSES" and "AIOSAT" were both rated with two votes. As they display similarities in their research content, their votes were combined, giving them four total votes. The characters related to these projects are rhinos and firemen.

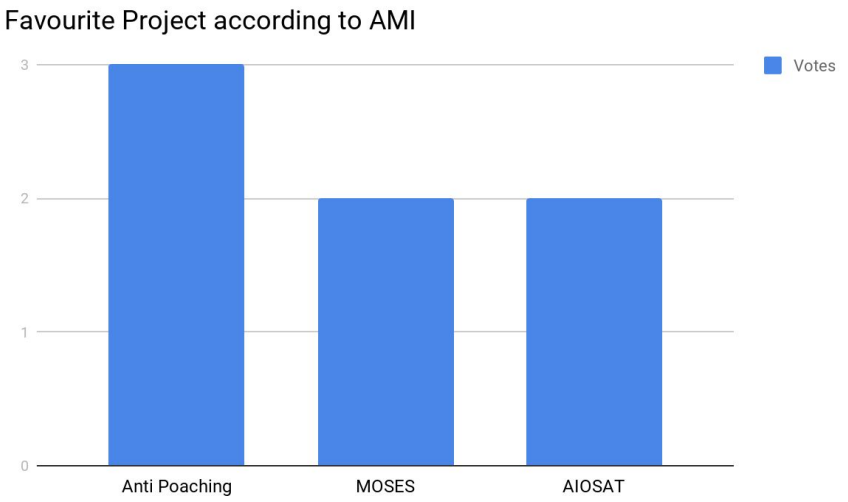

Figure 9. Highest ranking projects by AMIs votes.

The next question aimed to receive the general opinion of the members about the current status of their entrance. The distribution of votes is depicted in figure 10. In the range from 1 ("Strongly dislike") to 10 ("Strongly like"), the median of the rate distribution is 4. This indicates a rather unsatisfied view on their entrance. They described it to be "unassuming and boring". They also commented that the lockers in the area were "useless" and "take up too much space".

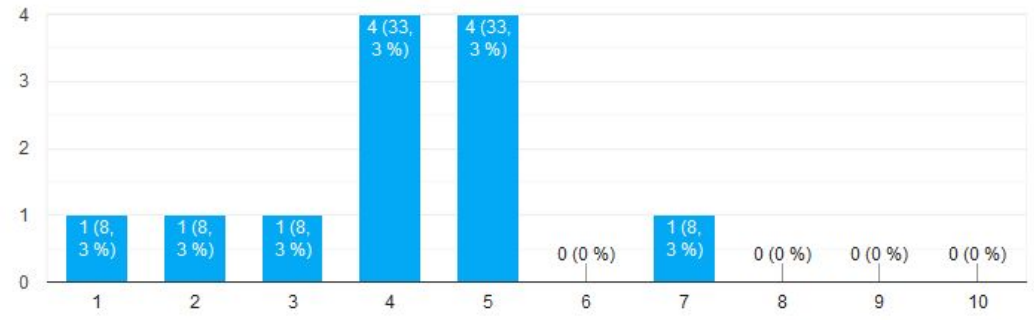

Figure 10. AMIs opinion about the entrance within the range of 1 (" Strongly dislike") to 10 ("Strongly like").

The last part was about collecting their wishes for the installation at their entrance. The majority mentioned that the entrance should inform about AMI, as it can be seen in figure 11. Concerns about

the entrance becoming “too disruptive” were also voiced. For a more detailed examination, see Appendix 12.8.

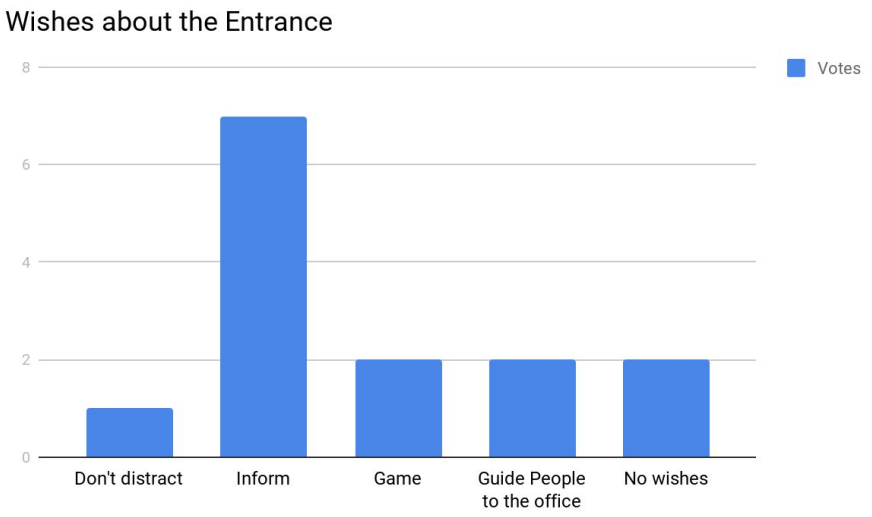

Figure 11. AMIs wishes about the main purpose of the entrance installation.

The results from this survey were analysed and compiled in a requirement list (see *figure 13*). This list recorded all specifications to keep in mind during the next steps of the project.
The MoSCoW rating was based on the results of the survey and approved by the client (see *figure 12*).

Asset	Details	Deadline	Subproduct	Status	MoSCoW	Notes
Horse			P 1+3	To-Do	Could Have	
Beaver		10.4.	P 1+3	Done	Should Have	
Muskrat			P 1+3	To-Do	Could Have	
Elephant		24.4.	P 1+3	Rigging	Should Have	AntiPoaching Project (choosen by AMI)
Rhino		24.4.	P 1+3	Done	MUST HAVE	AntiPoaching Project (choosen by AMI)
Fireman		24.4.	P 1+3	Done	MUST HAVE	MOSES Project (choosen by AMI)
Wall Breaking Animation		8.5.	P 1+3	Done	MUST HAVE	
Idle Wall Animation		8.5.	P 1+3	Done	MUST HAVE	
Ground Breaking Animation		8.5.	P 1+3	Done	MUST HAVE	
Horse Animation			P 1+3	To-Do	Could Have	
Beaver Animation		1.5.	P 1+3	To-Do	Should Have	
Muskrat Animation			P 1+3	To-Do	Could Have	
Elephant Animation		1.5.	P 1+3	To-Do	Should Have	
Rhino Animation		1.5.	P 1+3	Done	MUST HAVE	
Fireman Animation		1.5.	P 1+3	Done	MUST HAVE	
Stairs		5.4.	P 1+3	Done	MUST HAVE	
Railing		5.4.	P 1+3	Done	MUST HAVE	
Staircase_Wall		5.4.	P 1+3	Done	MUST HAVE	
Staircase_Ground		5.4.	P 1+3	Done	MUST HAVE	
Staircase Door		5.4.	P 1+3	Done	MUST HAVE	
Floor_ConcreteWall		5.4.	P 1+3	Done	MUST HAVE	
Floor_ClassroomWall		5.4.	P 1+3	Done	MUST HAVE	
Floor_Ground		5.4.	P 1+3	Done	MUST HAVE	
(What is placed on the third floor)			P 1+3	Waiting for School Access	Should Have	
Staircase_Wall_Texture		10.4.	P 1+3	Done	MUST HAVE	
Staircase_Ground_Texture		10.4.	P 1+3	Done	Would Have	
Floor_Wall_Texture		10.4.	P 1+3	Done	Would Have	
Floor_Ground_Texture		10.4.	P 1+3	Done	MUST HAVE	
Icons		15.5.	P 2	Done	Should Have	Information Board can be worked out as design document only
Icon Backgrounds		15.5.	P 2	Done	Should Have	
Background		15.5.	P 2	Done	Should Have	
Information Boxes		15.5.	P 2	Done	Should Have	
Highlight Animation		15.5.	P 2		Should Have	
Information Box Animation		15.5.	P 2		Should Have	

Figure 12. Asset list and MoSCoW rating based on AMIs votes.

Requirement	Product	Details	Summary
APA Compliant	Bachelorthesis	Download a plug in to manage resources + implement sources	
Graduation Dossier	Graduation Dossier	Graduation Report (thesis)	
		Company Advisory Assessment	
		Professional Product	
		Reflection	
		Final Presentation	
Interactivity	Final Product	Interactive Through Object Recognition	
AMIs wishes	Final Product	Inform about AMI	
		Guide to AMI office	
		Improve Visual Appearance of Entrance	
		Keep Entrance Interaction Optional	
		Don't Disrupt (by f.e. loud sounds)	
		Provide all assets, code + documentation for continuation of the project	
		Show off AMIs work	-Anti Poaching Project -Diversity of Projects -AIOSAT/MoSeS

Figure 13. Requirements List.

8.2.2 Feedback Survey

The second survey ran from 7.4. until the 16.4.2020. The survey aimed to receive the feedback of the AMI members about the concepts that had been produced. For this, they were shown stylesheets which are made up of online researched images (for example, see *figure 14*) and mock-ups (see *figure 17*) and were prompted to give their opinion and reasoning.
Ten people participated in this survey. Unfortunately, an error occurred in the Google Forms database, and three answers were deleted with no option for restoration. After careful consideration, the survey was not redone, and production was continued. For further surveys, Saxion Qualtrics was used instead. The full survey results can be found in Appendix 12.9.

The first part of the survey was about the idle state of the wall (see *figure 14*):
60% felt neutral about it. Nobody disliked the idea. Misunderstandings about the underlying metaphor were given as reasons for voting with “dislike” or “neutral”.

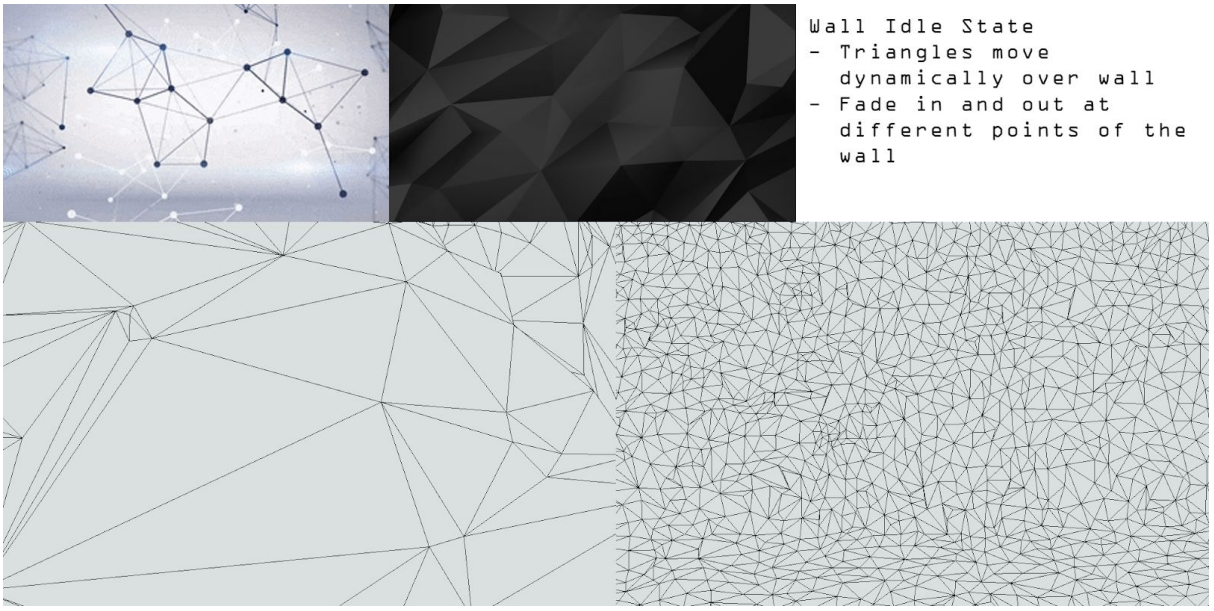

Figure 14. Stylesheet + Description of the idle state.

The next part was addressed the animation of the breaking wall and ground (see *figure 15*): 60% liked the idea, 20% were neutral about it, and 20% disliked it. Inconsistency with the idle animation and an aggressive feeling were given as reasons for voting “dislike” or “neutral”.

Figure 15. Stylesheet Breaking Wall + Animation.

The character stylesheet was the next design presented (see *figure 16*): 70% liked the design, 20% were neutral, and 10% disliked it. A fear of appearing too childish was given as a reason for voting “dislike” or “neutral”.

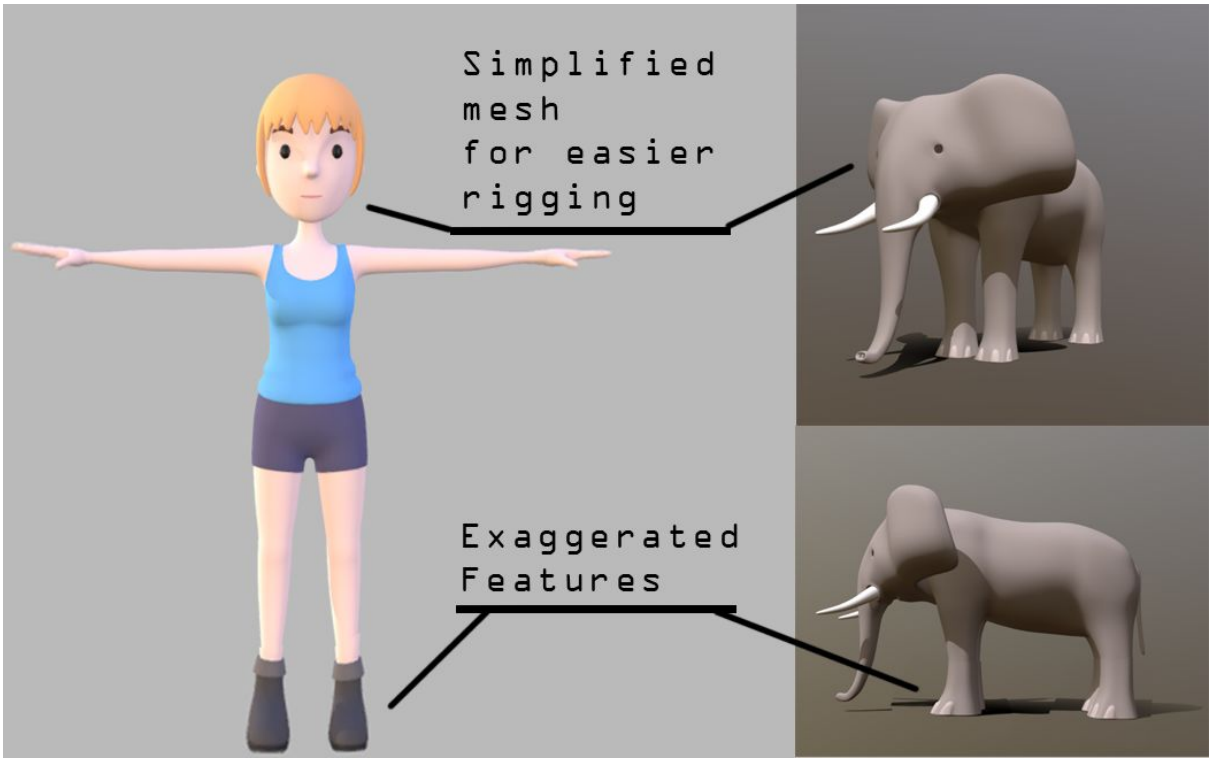

Figure 16. Character Stylesheet.

The final part addressed possible designs and content for the information poster.
A strong desire to streamline the presented information was voiced by the members.
They also chose their favourite design from a list of mock-ups. Their preferred design was “1A” with a majority of six votes (see *figure 17*). Additionally, some mentioned that Saxion has a corporate design that this has to comply with.

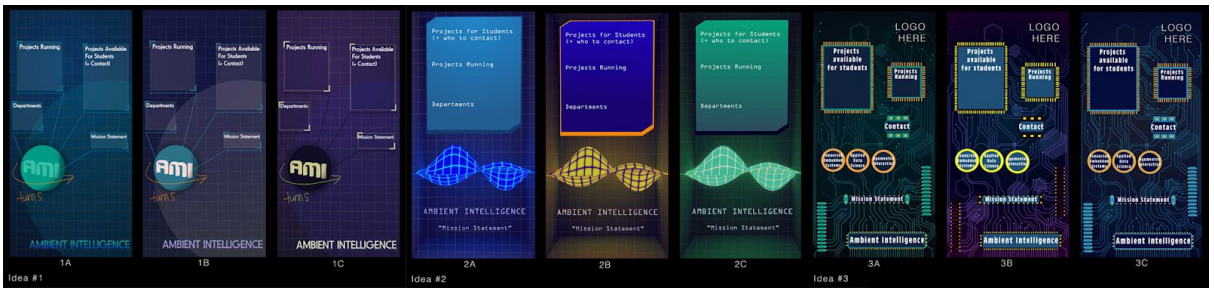

Figure 17. Final Information Board design.

The second survey ensured that the client's will on how they want to present themselves was not lost during the ideation phase.
Based on the results regarding the stylesheets, decisions to adjust the concepts were made. This included the breaking animation which was adjusted to be more consistent with AMIs themes of innovative technology, and appearing less aggressive.
The chosen poster design was further developed based on Saxion's design rules, and the information was reduced.

8.2.3 Feedback Presentation

On the 26.5., AMI scheduled an update presentation for their graduation students during their monthly group meeting. In this meeting, AMI was updated about my project. The content presented during this meeting included early prototypes of the animation (see *figure 18*), the finished character models and the chosen mock-up design of their poster.
After the presentation, positive feedback was voiced, clarifying that everyone was in favour of the latest design decisions. Feedback was expressed about the animations and requests specific to the “Anti-Poaching” animation were made, which was included in the final animation.

Figure 18. Prototype Staircase Animation.

8.3 How to encourage focused attention of students in a public space?

The interactive installation aimed to attract the attention of the students. For using a visual stimulation, it had to be considered that the attention span of humans is expected to be short. In particular, humans with increased exposure to computers- like the students of digital studies that the client wants to address - have been shown to have an attention span of roughly eight seconds (Borreli, 2015). Additionally, studies have proven that university students are not perceptive towards regular ads as they are not convinced by them. Consequently, they tend to ignore them ("What the Data Says about Marketing to College Students", 2016). Thus, students have to make a conscious decision to pay attention to an advertisement (Sylwester & Cho, 1992).

To encourage the attention of students successfully, the installation should create a strong visual trigger which dominates other visual stimulations regions the brain to improve the memory (Mather & Sutherland, 2011). By presenting unanticipated and entertaining content, an interest curve is maintained that should not be broken. (Briggs, 2014).

The ideal time to activate the installation is in the morning as students have just woken up and might be more receptive for the stimulus of the installation (Sylwester & Cho, 1992).

A study has also proven that the placement of multiple pieces using ASI creates a situational interest that increases the attention and engagement with the pieces. It also helps people remember the pieces' physical placement in a 3D space, increasing the chance of recollection of the office's location (and by extension the office) again at a later time (Kim & Lee, 2016).

As it is free and offers a minimal obstacle for students to engage with, it maintains their attention compared to regular ads ("Creative Ways to Advertise to College Students - OnCampus Advertising", 2014). Lastly, the poster displays information that is of value for the students since it is about potential projects to participate in. Because of this, they will be more likely to be receptive to the advertising methods displayed (Griggs, 2012).

Generally, it can be predicted that despite all the systems to get students to approach the installation, the most common interaction will be the implicit interaction. Passersby of the installation might linger in the installation area to take in the idle animations when suddenly, the character animations start. Surrounding students might choose a focused approach to interact with the installation and trigger the same effect (Bakker & Niemantsverdriet, 2016). This effect is called the "honeypot effect" and is useful when attracting new people (Müller et al., 2012).

If the existing knowledge is professionally implemented during the concepting phase, the interactive entrance area of AMI might become a platform that successfully attracts the attention of the students to the research group.

8.4 How to successfully communicate what Ambient Intelligence is about through the art style and design of the installation?

8.4.1 Production

In the following chapters, the results of the artistic process are described (for all steps, including all iterations, see Appendix 12.10).

8.4.1.1 Concept

The final concept was decided based on several ideas that have been iterated in different co-reflection sessions during the ideation phase (see Appendix 12.10.1). They were chosen as they fulfilled the requirements that were established in the Introductory survey. The three projectors being available were expected to be positioned facing the ground, the wall and the lockers (see *figure 19*).

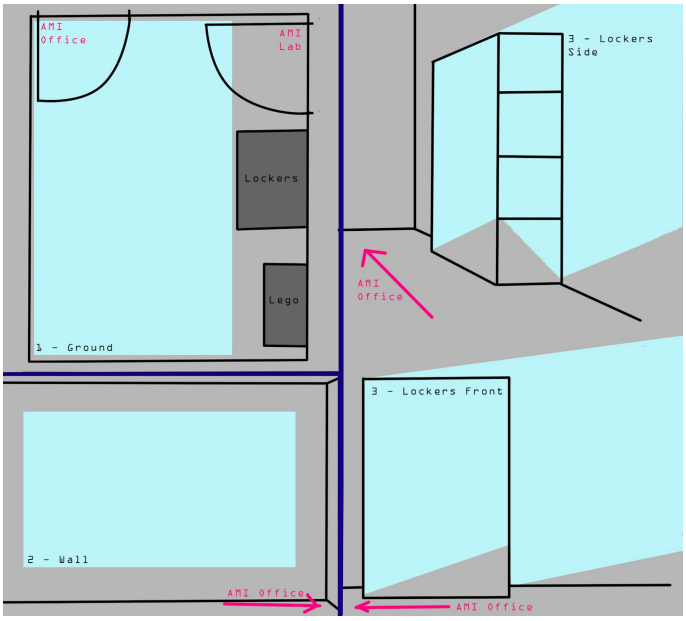

Figure 19. Set up of the entrance area and the projectors. 1 = floor plan, 2 = frontal view wall, 3 = perspective view (up) and frontal view (down) lockers.

The final concept was separated into two categories: the wall/ground projection and the locker projection. To the wall/ground projection, the final idea included an idle animation on both wall and ground, which breaks up when someone walks past. The passersby will then look into the digitally recreated room behind the wall, where characters related to AMI will appear and reference their respective projects. The character choice was based on the Introductory survey (see chapter 8.2.1). The locker projection will hold a board with necessary information about AMI's current available projects students could work on.
To ensure tonal consistency, I compiled illustration from the popular image-sharing website Pinterest into an Inspiration board. Based on this board, a stylesheet and a moodboard were created (see *figure 20*). The style of the environments should be photorealistic to properly leave the impression that the passersby are looking into another room.

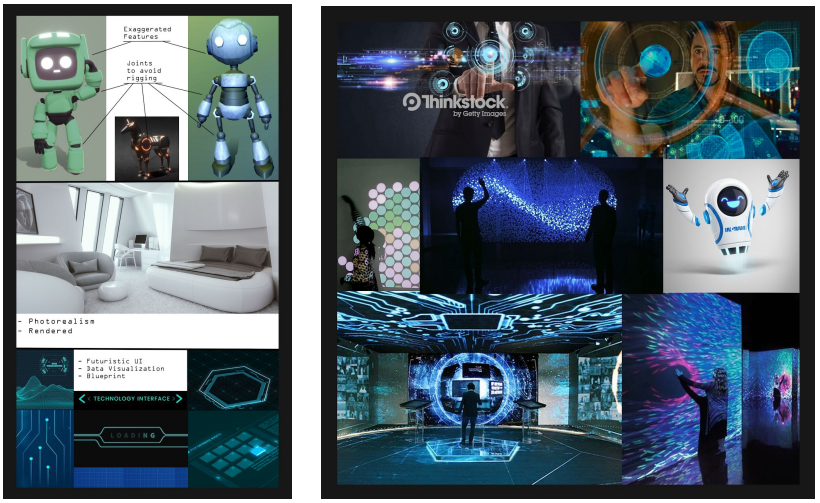

Figure 20. Stylesheet (left) and Moodboard (right).

8.4.1.2 Modelling/ Rigging

For the characters, I first sketched out their designs and translated them into model sheets to ensure a smoother production. The characters were initially planned to follow a ball-jointed structure. However, after creating a visual prototype, the decision fell in favour of rigging the character, since the ball-jointed technique contradicted the stylistic requirements. This result was forwarded to AMI and was evaluated positively. However, remarks given in the feedback survey were implemented into the final design, such as more mature colours to avoid appearing too childish. Based on this, the characters were modelled and rigged (see *figure 21*).

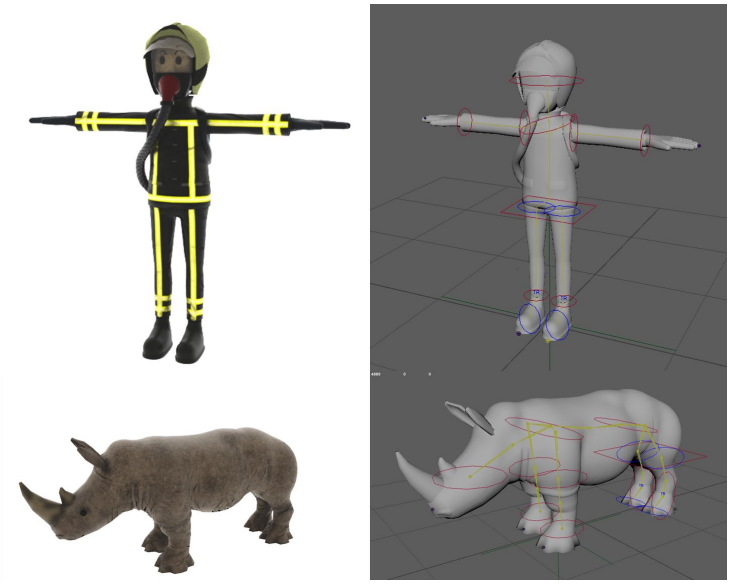

Figure 21. Finished Models and Rigs of Fireman and Rhino.

8.4.1.3 Character Animation

Before animating the rigged characters, animation references were researched. A running reference for the firemen was found online (see *figure 22*), while the walking reference for the rhino was self-produced based on a video (see *figure 23*).
The decision for the placement of text and the characters in the animation was based on research results (see chapter 7.8.2).

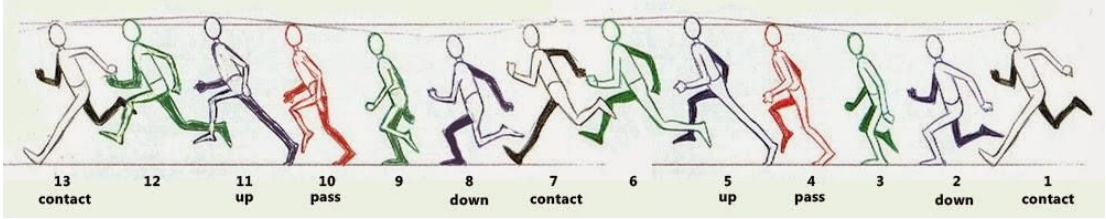

Figure 22. Human Run Cycle. Adapted from "Run Cycle" by Anivic, 2015, Retrieved from http://victorportfolioblog.blogspot.com/2015/05/run-mike-run-my-run-cycle-was-animated.html.

Figure 23. Rhino Walk Cycle.

The intermediate animation stages were presented to Taco van Loon, a teacher at Saxion who is specialized in 3D animation (see full feedback in Appendix 12.12) and in a presentation in front of AM. Both settings provided fruitful input and ideas for improving the animations to become more engaging and interesting.

All animations were rendered. As my equipment was not suited for rendering in high quality, the help of a cloud render farm called "RenderNow" was utilised for one animation after approval by the client. The remaining animations were rendered in the XR lab at Saxion, using a high-performance PC, which I remotely operated.

8.4.1.4 Idle Animation

An idle animation was created to provide an engaging backdrop while the character animation is not triggered. This aimed to preserve the surprising effect. The animation was prototyped using a frame-by-frame method in Paint Tool SAI (see *figure 24 (left)*). It was later recreated in the Plexus plug-in of After Effects, as the prototype was unsatisfactory (see *figure 24 (right)*). Three iterations (see Appendix 12.10.5) were made and presented to the client. After receiving positive feedback, the animation was included in the final installation.

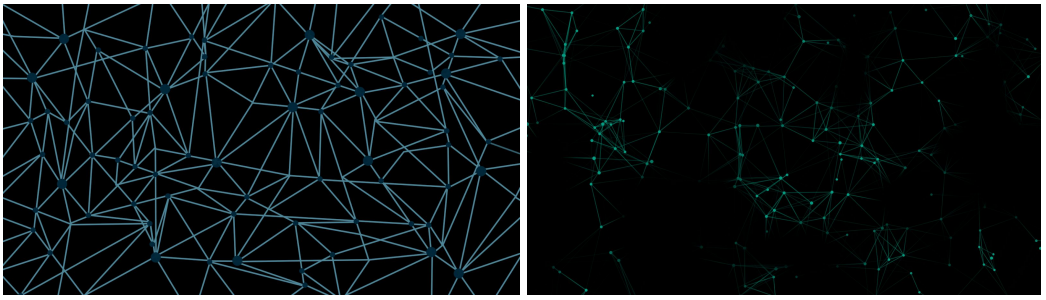

Figure 24. Frame by Frame Animation using Sai (left) vs Plexus Plug (right).

8.4.1.5 Environment

The environments were modelled, textured, and rendered out in Autodesk Maya. The models, colours, and dimensions were based on reference pictures taken by Danny Plass. The goal was to accurately recreate the staircase and the third floor of the Epy Drost building (see *figure 25 + 26*). The environments were modelled as precisely as the reference pictures allowed.

Figure 25. Finished Staircase Environment.

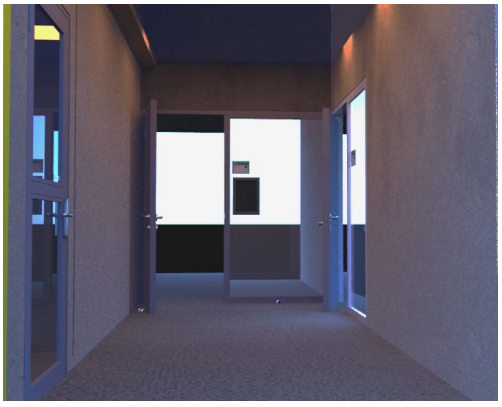

Figure 26. Finished Third Floor.

8.4.1.6 Poster

In preparation for the production, I created 40 sketches, from which nine were elaborated and presented to the client. After collecting feedback, three were realised into substantial designs with colour variations. In the feedback survey, the favourite one was chosen and later adjusted according to the survey results. The content was fine-tuned in consultation with Dr. ir. Wouter Teeuw (lead professor of AMI) and Ir. Irene Sijgers (project manager at AMI). The content was tweaked based on the research results described in chapter 7.8.1. The final design is shown in figure 27.

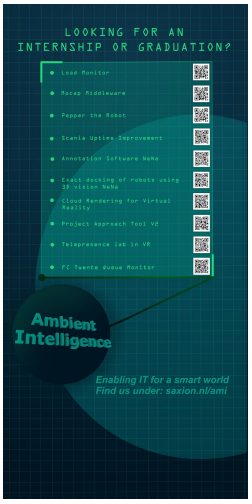

Figure 27. Finished Locker Design.

8.4.2 Testing Survey

With the finished prototype, a final test was performed. Due to the Covid-19 lockdown, a small in-person test session replaced the large-scale test that was originally planned. In addition to the practical test, a survey was conducted using Saxion Qualtrics. The material was sent to several people, who are not involved with AMI, to obtain independent feedback. The full survey can be found in Appendix 12.13.

In total, 15 people in an age range of 18-34 years participated in the test (eight of them between 18-24, seven between 25-34 years) reflecting the assumed age range of Saxion's students.

The survey was split into three parts.
The first part addressed the current representation of AMI. At first, testers were asked about their opinion about AMI's webpage, logo, and the current design of the entrance area (see *figure 28*).
The majority perceived AMI's brand as a "Value Brand" (Lee Yohn, 2017) with an associated feeling of "being down to earth and practical" (30% of the votes, *figure 29*).
The perception AMI wanted to achieve was to be understood as an "Innovation Brand" (Lee Yohn, 2017) that stands for the "production of futuristic products with the latest technology" (Lee Yohn, 2017). However, the respective category obtained only 16.28% of the total votes (see Appendix 12.13-Q4).
The survey revealed that the majority perceived AMI both "boring" and "interesting", with equal votes of 26.47% respectively (see Appendix 12.13-Q5).
In the next question, participants were asked if they knew about the offered projects based on their current presentation. 66.67% answered with "No". Main reasons mentioned were "missing information on how to contact the group" and "missing descriptions of projects that were researched at AMI".

Figure 28. AMI's current representation: website, logo + current entrance.

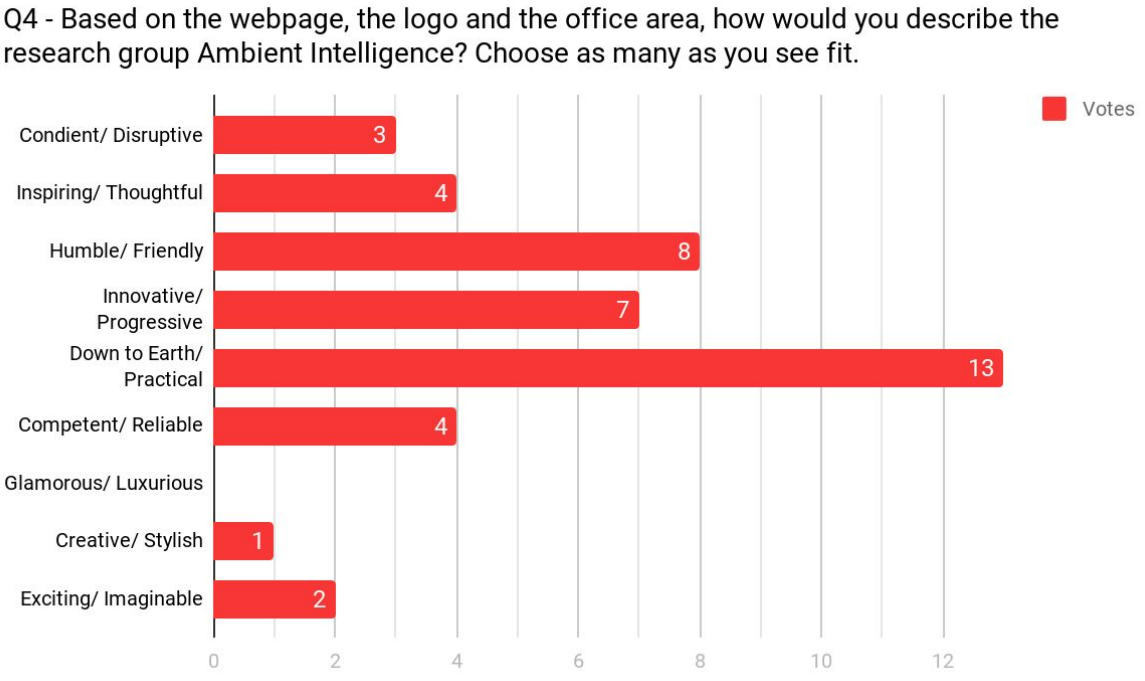

Figure 29. Tester opinion on the current representation of Ami.

The second part addressed the product. First, testers were asked whether they liked and understood the produced content.

The idle animation was presented first. This was evaluated positively: 53.33% enjoyed the animation "a great deal". The remaining votes of 46.67% were equally distributed between "liking it a moderate amount" and "liking it a little". Nobody disliked or felt neutral about it. When asked what feelings they

associated with the animation, 36.67% chose “Futuristic”, 36.7% chose “Curiosity”, and 26.67% chose “Creativity”.
The next question addressed the information poster. Here, the responses were mixed. The highest number of votes with 40% was linked to “liking it a moderate amount”. The second highest with 20% was “liking it a little”. 13.33% voted for “dislike a little” and “dislike a moderate amount”, respectively. The size of the font and the general layout of the poster were criticised. Although there was specific criticism of the design, the content of the poster was understood by everyone.

The next question addressed the videos. The overall perception was positive with the highest rating at “liking the animations a great deal” (46.67%), followed by “liking a moderate amount” (33.33%). Nobody disliked the videos. Generally, the animations were described as “cute”, “funny”, and “engaging”. Everyone understood the content of the videos and what the characters represented.
The participants were further asked about their actions after experiencing the animations. 38.46% decided to engage with the contents of the information poster. 34.62% decided to enter AMI’s office to ask for further information. Lastly, 26.92% chose to google for more information about the group.

In the last section, participants revisited the first questions. After seeing the produced content for the new entrance, they reevaluated how they would rank AMI’s brand now: The highest-ranking received “Style Brand” (Lee Yohn, 2017) (19.05% of all votes). The second-highest ranking was “Innovative Brand” (Lee Yohn, 2017) (the intended purpose of this improved entrance) with 17.46%. Feelings associated with AMI were “Interest” with 32.50% and “Joy” with 25%. The previous highest-ranked feeling “Boredom” was reduced to 2.5%. Furthermore, 80% of the participants claimed to be aware of AMI offering projects for students based on the new content. Many listed the information poster as a source for their improved knowledge about this option.

Overall, the test demonstrated the success of the product being produced. Based on the results of the survey, it can be assumed that implementing the new entrance will probably lead to the desired perception change that AMI wants to achieve. It further showed that users of this installation would understand that they can contact AMI for internships or graduation projects. Apart from that, students will perceive that AMI stands for technological and innovative future after interacting with the installation. Although the information poster faced criticism that needs to be improved, the main purpose of the poster was understood, and its intentions were fulfilled.

In summary, the survey proves that the implementation of the researched material will help to improve the communication between AMI and Saxion’s students using innovative art style and design.

9. Discussion

In this graduation thesis, interactive technology was developed that should be installed at the entrance of AMI. This installation aimed to attract Saxion's students for the research group at the Saxion university.
To develop an interactive installation, multiple things have to be considered. In this thesis, four categories were researched concerning particular subquestions. The results of the research phase helped to define a structured workflow that transferred theoretical knowledge into practice, which ended up in the creation of an installable product that has already been successfully tested with respect to the overall aim of this project.
At the first stage of this thesis, all limitations, constrictions and prerequisites were properly documented to define the framework conditions for the project. This included the physical layout of the entrance with any present limitations, such as objects that were not allowed to be moved, including a large locker. Additionally, it listed the available technical equipment, the required skillset and the budget for the project.
Concerning the technology, there were three projectors, one sound system, multiple depth and 3D cameras and portable computer units. Research was done by reviewing literature and reliable online sources to make use of this technology. Projection Mapping and the functionality and applications of depth cameras were researched in more detail.
With the technique of Projection Mapping, the whole space available at AMI's entrance was utilized. This included the locker as a projection surface in the final installation. For this, the program Adobe After Effects was sufficient. As the lockers are a rectangular and simple object, there was no need for more advanced and expensive software.

Considering the multiple functionalities of depth cameras, I included object recognition to increase the interactive performance of the product. Initial plans to program everything with the help of AMI members was compromised by the Covid-19 lockdown, which made it impossible to share any equipment for testing. Thus, the program "Blob Tracking with Realsense" (“Blob Tracking with Realsense | Input Management,” n.d.) was used, which covered all necessary functionality. A professional engineer helped me set up the scene in Unity by giving feedback on how to approach scripting of a scene and how best practices for working should look like with version control and debugging.

The next step of the project included the decision about the presented content. As AMI consists of more than 20 members, it would have been impossible to interview everyone individually in a reasonable time frame. Instead, an introductory survey (chapter 8.2.1.) was conducted to collect general data on what the group's current opinion of the entrance was and how they wanted to change it. The outcome was clear: the current entrance was found "boring", and they wanted changes by presenting their research projects in an engaging way. This was intended to motivate students to approach the group. The survey results were further used to select the projects to be presented: "Anti-Poaching" and "MOSES"/" AIOSAT". These projects were translated into characters. Their choices, wishes and concerns were documented in a requirement list.

After settling the content, the next project phase addressed the way how to present this to students. The conception phase of the project was based on research about marketing strategies used in economy and literature reviews in neuropsychological and educational sciences (see chapter 7.5). Another study was included that highlighted the impact of the unusual placement of information to stimulate visitor's eye movements and of the formation of memorable impressions (Kim & Lee, 2016). Additionally, the morning was determined as the ideal time during the day to activate the installation (Sylwester & Cho, 1992).
As recommended in "Creative Ways to Advertise to College Students - OnCampus Advertising" (2014), the installation should be less time-intensive and free of charge and will be most attractive if it offers a specific value (Griggs, 2012).

Out of all ideas, the approach of using faked Augmented Reality was chosen as the most appealing one. Instead of only projecting a futuristic animation on the wall and ground of the entrance, a passive interaction should start whenever someone walks past the installation. For this, the depth camera recognizes the person, which triggers a virtual breaking of the wall that is accompanied by a view into

the next room. Here, an animation involving the characters from AMI-chosen projects would appear together with a slogan referencing these projects, where the characters look at the text to influence the passersby attention and redirecting it to the content (Kolenda, 2018). This unique animation aimed to catch the attention of whoever was walking past the installation.

In the next phase of the project, the final design of the product was elaborated. Features were defined, such as the design of characters, walls, and texts, with their respective colour, shapes, styles, fonts, and layouts. This was done in consultation with the group members of AMI at multiple points of the project who provided feedback and ideas through a feedback survey and presentation. Besides, the design had to follow the rules about the corporate identity design of Saxion.
Entering the production phase, the available three projectors were used to present the project content on all available surfaces: the wall, the ground and the lockers. The latter were utilized as projection surfaces of additional information, displaying the available projects at AMI with the respective project leaders. The amount of information was kept to a minimum not to overwhelm the observer (Mineo, 2017).

Unfortunately, due to the Covid-19 lockdown, the installation could not be set up at Saxion nor tested with many students on-location as originally planned. Instead, it was tested on a small scale setup with five users.
Based on research done during the project and on the outcome of the final survey and the small-scale testing session, the success of the installation can be estimated.
Theoretically, most of the students will interact with the installation by implicit interaction (Bakker & Niemantsverdriet, 2016). Also, the "honeypot" effect might attract students to the installation if they see others already interacting with it (Müller et al., 2012). Although the small scale in-person testing revealed some problems, it also opened-up perspectives on how to improve the product for its future application. These recommendations were compiled in this thesis, together with all information about the workflow done in this project. This will serve as a guide for future steps of AMI working with the installation.
Finally, the testing survey confirmed that the overall concept and the produced content achieve the intended effects to increase the motivation of the target audience to contact AMI. Still, this has to be tested on an extensive student survey if the Covid-19 lockdown is over.

10. Conclusion & Recommendations

“How to develop an installation which uses interactivity with projected images to attract students to the research group Ambient Intelligence in the Epy Drost building?”

Developing an installation for the research group AMI is a complex project. It includes many aspects that need to be kept in mind. To ensure this, frequent feedback needs to be collected.
After this, extensive research should be done into understanding the target audience and how to produce for them. As well as understanding the available technology and how to combine it to build an installation. Based on this, concepts are developed and presented in reflection meetings with the client. After the ideation phase and many iterations of the idea, the production of all art assets and technological features is started. The production is being done with consultation of the client, giving input and feedback at all points to ensure an end product that is to their liking. In the final step, the installation is tested with students to confirm the functionality of the final installation.

The testing had revealed that the product can be expanded with the help of qualified engineers. All participants of the usability testing tried to activate the character animation by waving their hand in front of the camera. Therefore it is recommended to implement such gesture recognition in the future to allow for a smoother experience on the user’s end.
This gesture recognition can also be combined with the digital poster to allow for navigation through multiple pages. That way, each project can be represented in more detail, possibly with pictures or videos. It would also reinforce AMI’s affiliation with futuristic technologies.
Additionally, the current installation has only four animations involving two characters. If the research group wants more variations in their displayed content, they can hire a student who is skilled in animation to adjust more of their projects into this digital formula.

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