BRINGING THE POSITIVE EFFECTS OF NATURE TO THE CITY

Urgle: The Urban Jungle Experience

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ABSTRACT

Urgle, the urban jungle design concept combines the tangible and digital to create a restorative break experience for office workers in Fellenoord. The interactive LED-flower string and light projection bring the concept of nature and its restorative capacities into the highly urban environment. Allowing office workers to transform the colourless and uninspirational place into a beautiful and interesting light jungle. Creating a space office workers want to walk during their breaks, a place to escape from work and revitalize. During the research, videos of the concept were shown, and interviews and questionnaires were taken to find out if digital or tangible transformation of the highly urban environment can establish the restorative effect of nature on office workers. Although the light string was perceived better than the current environment, with the addition of digital projection participants thought they would experience restorativeness. Supporting abstract nature as a tool to transform the urban environment for better vitality.

Keywords

Restoration Experience; Urban Environment; Digital Augmented Reality; Office Vitality; Research Design

***Urgle**: Abstract nature for the city*

INTRODUCTION

Most people spend a considerable amount of time working. For many, it is part of an everyday routine. Going outside and taking a walk during the lunch break, is not always part of this routine. Some office workers do not even pause their work while eating lunch. From interviews that were held with office workers (Appendix III), it has become clear that these people need an extra motivator to go out. This could be a social aspect, like their colleagues, or an external aspect, like the prospect of an interesting activity.

Office workers in Fellenoord, a neighborhood in the center of Eindhoven, are l out of luck. Their offices are located in a strongly urban environment [32], where they are surrounded by buildings and roads and a park is too far to reach during a work break. In environments with more green space, people exhibit higher levels of activity and better physical and mental health [4,32,44]. Unfortunately, Fellenoord lacks greenery, making it a less than ideal place for taking a walk.

Although the environment does not encourage it, leaving the office for a walk is highly recommended. The Health Council of the Netherlands recommends that all adults spend at least 2,5 hours per week on physical exercise of medium intensity in order to stay healthy. This reduces the risk of diabetes, vascular diseases and mental illness, amongst others [15]. Moreover, taking a walk helps the office worker to escape from work for a little while, and to redirect attention and focus. This contributes to human restoration [18,20,33]. Being in nature, has a restorative effect on people, facilitating the reduction of stress, fatigue and attention restoration [18,20,33]. A walk during lunch break will not only benefit the office workers themselves, but it also results in advantages for companies and even cities to have healthy employees and citizens. A proper break actually improves productivity and reduces the chance of burn-outs and drop-outs [19,31,39].

However, during interviews with office workers (Appendix III), it became apparent that they often do not have the time to take a walk in other, more attractive, parts of town. Office workers are frustrated with the lack of green space within reachable distance in Fellenoord. They described the environment as not inspirational.
These problems are solved by Urgle, an urban jungle design concept that combines the digital and the tangible. This two-sided concept consists of an interactive light string and light projection. With Urgle, office workers are accompanied on their walk by engaging lights and growing vines. Their activity is rewarded with a light show, blossoming flowers and a personalized text. The aim of Urgle is to improve vitality by constructing a setting that is beneficial for mental and physical health. Urgle creates an interesting interactive experience where people can actively change their environment, making it a more beautiful and stimulating place to be. Transforming an otherwise colorless and uninspirational place into an area where office workers want to walk during their lunch breaks, an area where the benefits of nature can be brought to the city. Using a blended design that bridges the digital and tangible to create an adapted reality that brings the restorative capacities of the "jungle" into the highly urban environment.

Figure 1 Early Prototype of Urgle

RELATED WORK AND BENCHMARK

Restoration in the Urban Environment

No city is the same, so is no urban environment. Some urban environments contain more greenery than others. Fellenoord hardly has any greenery, but it has a high building density, and a lot of people live and work there. Therefore, it can be defined as a strongly urban environment [32]. This lack of greenery might not seem like a big problem, but urban green spaces do have important effects. Compared to an urban environment, the natural environments are associated with greater benefits and stronger positive effects on health and well-being [4,27,44,46]. Subjective recovery and vitality were measured to be stronger in forests than cities [44].However, the benefits of the natural environment are not limited to forests. They can even extend to urban parks and artificial man-made forests [46]. Which is a good thing as most cities cannot support forests, but they can offer other forms of greenery. An increase of greenery in the street view (e.g., trees, flower beds) even increase ratings of restoration likelihood [30].

"Restoration experience is the renewal of human capacities through exposure to nature." [33].

The renewal of human capacities is a crucial phenomenon for vitality and links to attention restoration, which has influence on recovery of cognitive fatigue and stress alleviation [18,20,24,33]. However, its effect is wider. Restoration experience is found to be negatively related to burn-out and positively to life satisfaction [39]. This shows that the renewal of human capacities has far reaching influences, not only short-term impact on attention, but also long-term consequences like burn-out complaints.

Since restoration is of such importance for health, it has been extensively studied and over the years instruments have been developed to measure it, based on either Stress Recovery Theory (SRT) or Attention Restoration Theory (ART)[33]. The measurements approach different factors and outcomes. While some measure actual restoration (e.g. POMS or RSS [33]), others are subjective.

These subjective measurements, include, amongst others, the perceived restorativeness scale (PRS) [18] and the restoration outcome scale (ROS) [25]. These scales are a self-evaluation of attention restoration. In literature these are most commonly used to compare existing environments, for example urban and forests [44]. For design, subjective measurements are actually a useful practice, to research user opinions to review or improve concepts[16]. Even though, the instruments for subjective restoration are highly suitable for this, it is not often used in this way. The highly urban environment could benefit from the use of PRS/ROS in design context to support the restoration experience.

Vitality for Office Workers

To perform tasks a person utilizes directed attention, which is the voluntary form of attention that a person uses to focus on, for instance, their job [33]. A sustained use of this leads to the exhaustion of the directed attention, which ultimately causes cognitive fatigue [19]. The exhaustion is not necessarily a problem, as long as it is regularly restored, which can be done by taking a break or interacting with nature [22,33]. When not restored properly fatigue leads to a number of problems, for instance regarding the ability to concentrate, which can lead to making big mistakes in work or annoyance with colleagues [19]. Not only fatigue, but also stress is a pitfall in offices, half of workers find stress common [34]. Thereby, around 50% of the lost working days is actually related to stress in the workplace [12,34]. Stress can have enormous impact on both psychological as well as physical health and organizational performance [3,12,27,31].
Fatigue and stress can have serious impact on an employee, influencing performance, motivation, job satisfaction and well-being[12,19,25,27,31,34].

Multiple studies have researched the relation between health, nature and their relation to workplaces. These studies have found some interesting results. With increased contact with nature, either direct or indirect, a decrease is found in perceived stress, fatigue, even health complaints and negative attitude in workplaces [2,19,26,31,33,43]. Thus, the proximity and availability of a green environment can have great benefit for office workers. According to Kaplan [19] this goes up even if the employee doesn't spend much time in the environment.

Other studies focused on the relationships between physical and visual access (e.g. photos/videos posters/ windows) to workplace greenery and health [5,17,31]. It seems that any exposure to natural stimuli, even surrogate nature, reduces both physiological as well as psychological stress.
These studies showed that fatigue, stress and failure to take breaks can have serious consequences for psychological, physiological health and influence social and work performance. Thereby emphasizing the importance for access to a green space near offices, even only visual access.
Although, all of these studies only focused on the connection to real natural environments and surrogates. Paintings or more abstract representations of nature have not been researched in this context.

Urban Space and Transformation

Adding art or installations to the urban environment is an often-done practice to brighten up or enhance the street scene and value. A static environment can be made more dynamic or interesting by form or interaction, which the municipality of Eindhoven attempts to do too. An example is the "Berenkuil", an intersection of tunnels full of street art. The tunnels used to be perceived as a dark maze, which the municipality solved by adding colorful murals, with great success [51]. It drastically changed the ambience making it a spot people want to be and visit. Just as people want to see glow, a popular festival where light is used for both form and interaction to create interesting art experiences. By tangible art like the sunflowers of Van Gogh, where people can experience and walk through the fake nature (Figure 5)[48]. Or digital, where projection mapping is a common practice and used yearly on the church [36].

Both installations are able to transform the urban space where it is exposed, with its lights. It is not new to project visuals like nature on buildings (Figure 3)[21,47], or the other way around, projections on plants (Figure 2)[37].

The intersection between technology and the tangible, digital and the real world is integrated more often. Augmented reality (AR), defined as the real-time enhancement of the physical real world through virtual computer generated information [11], has become more used in recent years. For example the game Pokémon Go[50], that merges the digital and the real realms on your phone. Virtual environments have even be used to enhance the way natural terrains are perceived by people, to make them aware of present greenery[42]. Even though the natural environment does seem to bring more benefits, a simulated environment is found to facilitate stress reduction as well [24]. Immersion in virtual nature settings has similar beneficial effects as exposure to picture or videos of nature [45]. Studies that made use of VR devices resulted in positive restorative effects, which were on the attentional fatigue and negative mood[11,14]. This suggests that digital nature can also be useful, proposing that AR could be utilized in cities to project nature and work restorative.

However, for the aforementioned art installations (Figure 3&5), the goal was not to bring nature or its benefits to the city. Even if they do visualize or use nature[21,37,47], like Grow (Figure 4) [41], that aims to direct attention on agriculture . Despite a different focus, they are still a good source for inspiration as they use light and aesthetics to capture attention. Which is exactly what natures need for its restorative effect to work effectively [19].

In conclusion, much has been researched and implemented in the past on nature, vitality and office workers, but it failed to connect and exploit the modern cities and technologies. Where cities have many highly urban areas and office workers, but limited access or possibilities for traditional nature, despite its importance and benefits. While there seems plenty of possibilities, given implementation of concepts in cities and studied effectiveness of surrogate nature (man-made, visual, virtual).

However, as mentioned there is a gab in knowledge when it comes to more abstract representations or to the use of digital augmented reality for an urban restorative experience. Thereby has this not been researched using the PRS and ROS methods. Making use of these instruments in design for new concepts can help quantify its effect and usefulness for people, like office workers.

Therefore, it should be tried to bring nature in an abstract, tangible and digital, way to the city. And researched if these actually are able to establish the restorative effect. If so, it would support a new way of transforming urban environments for better vitality.

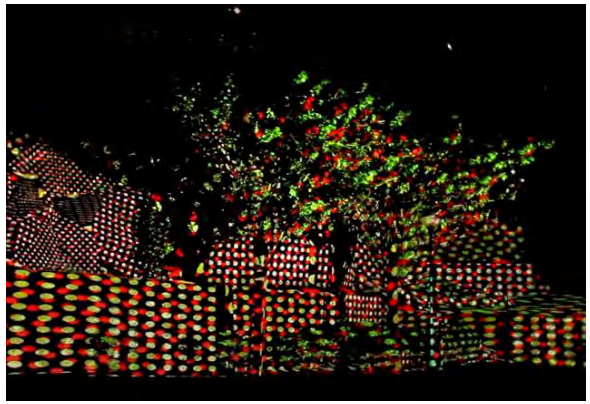

Figure 2 Lights of nature - Oscar & Gaspar

Figure 3 Footprint - Vrijdag

Figure 4 Grow - Roosegaarde

Figure 5 Sunflowers of van Gogh – Vrijdag & Yeliang

DESIGN PROCESS

Project Scoping

This project started off with a general direction inspired by a design brief on urban vitality. This direction was chosen as it seemed like an opportunity to work in a yet new field that matches personal desires and interests. It gave the possibility to work on the outdoor urban environment, which in turn offered an interesting opportunity to tackle both vitality and sustainability.

A brainstorm and literature research were preformed to further scope the research. This helped to find opportunities and identify and select key concepts (Appendix I), which further defined the direction to take. The three key concepts: physical human vitality, urban environment and sustainability were defined with literature and combined into one term: "smart sustainable cities" [6,7]. With this scope in mind further brainstorming was done to find relevant technological interventions and user interactions. The relevant concepts that were identified were data driven designs, (digital) augmented reality and interactive behavioral interventions (Appendix I).

Following this identification of the relevant key concepts and points of interest, a design challenge was identified that touches on both vitality and sustainability. The city is an urban environment which inherently contains less greenery than a rural environment. Research has shown that a lack of greenery has consequences for physical, mental and environmental health [1,4,26,40,42, 30].

The impact on physical health being that people tend to have less physical activity in urban environments [32]. The impact on environmental health is caused by the heat island effect, where temperatures are considerably higher in the urban environment than in the vegetated, rural surroundings [1]. The impact on mental health constitutes of the fact that people do not experience the beneficial effects of greenery regarding stress alleviation, attention restoration and fatigue in the absence of green spaces [4,27,44,46].

The next step in defining the scope of the design challenge was to further narrow down the location setting. It was desirable to select an actual location in Eindhoven, that would allow for a targeted research and design. The lack of greenery in the research area should be prominent, so that the final solution can address the challenge that this creates for mental, environmental, and physical health. Therefore, it was determined that the location needed to be within a highly urban environment, within the city center of Eindhoven and not near any green spaces (Appendix I). In order to select the location, exploratory observational research was conducted in four locations within the center district of Eindhoven that satisfied these three criteria (Appendix II). During a window of ten minutes the passersby were turfed, to estimate the amount and type of traffic. Subsequently, during another ten-minutes time window, observational notes were taken on cyclists and pedestrians passing by. Information was gathered on the possible purpose, age, apparent boredom, and the attention paid to their surroundings.

Figure 6 The Kruisstraattunnel in Fellenoord

The three locations that were closer to the city center were quickly dismissed as they provided less opportunities for improvement than Fellenoord (Figure 6). There were already a lot of decorations and people walking for leisure. The location of Fellennoord was selected, as there was a lot of traffic flow and diversity in the type of passersby. People did not seem engaged or pleased by the surroundings which indicated that there is potential for improvement.

After the initial exploratory observational phase, it became apparent that the scope of the research had to be further narrowed down. The holistic approach of incorporating both the concepts of sustainability and vitality for all those living in the urban environment did not allow for a clearly defined design challenge. Therefore, it was decided to redirect the focus of the research solely to vitality in the highly urban environment of Fellenoord. In addition, a specific target group was chosen: office workers. The exploratory observational research in combination with desktop research showed that there are a lot of offices and office workers in the Fellenoord area. This is a target group that could potentially benefit greatly from more greenery.
With this the target group in the research statement changed from locals into office workers.

Exploration

With this problem statement, it was still needed to research if there was an actual need for a design concept to improve vitality in Fellenoord for office workers. Fellenoord is an interesting environment with potential to be improved, but does it also have a target group that have wants and need for it to be improved? To find this out more targeted research was necessary directed towards the specific group: office workers in Fellenoord. Initially, semi-structured interviews were conducted by approaching people on the street, asking if they were office workers (Appendix III.a). A couple of office workers that worked in Fellenoord were interviewed. However, due to the COVID19 pandemic, many offices were closed, and very little office workers could be approached. Social distancing further diminished the opportunities to find office workers willing to be interviewed by a stranger. The lack of

people in the streets also created an unsafe environment for me and after having experienced a few cases of harassment another approach was chosen. To supplement the interviews an open conversation was held with colleagues at my own workplace, which is an office. The data from the interviews was processed into categories and color coded to negative and positive expressions (Appendix III.b) Hereafter, personas were created to further empathize with the target group. Goals, frustrations, and a day planning were made according to these characteristics (Appendix III.c). This provided a much better understanding of the target group and location. For example, the assumption that this highly urban environment would benefit from greenery was confirmed by the stated frustration with the lack of greenery.

Ideation

The 100-sketch challenge was done to get the ideas flowing (Appendix IV.a). From this a few good ideas were highlighted, and another round of sketching was done. From this second round of ideation, the best ideas were identified and ranked by looking at what problem it would tackle for the personas and by defining pros and cons of these ideas (Appendix IV.b). The green transformation, later renamed to Urgle (urban jungle) was chosen as it solved multiple frustrations, had potential to improve vitality and connected with my professional vision and identity. This two-sided concept consists of a plant gantry in the lighting poles and a tunnel projection using digital augmented reality (Figure 7 and 8). This is meant to create an urban jungle experience and transform the highly urban space into a green environment. By adding plants to the street and an interactive projection in the tunnel. When people walk past, the vines will follow them and for each person a flower will blossom.

The two sides of the concept offered an interesting research direction. It was chosen to focus on the experience and benefits of real versus digital greenery for office workers walking by. Perhaps the reported effects of greenery on physical, mental and environmental health [30] could be achieved in cities through real and digital transformation of the environment.

Non-linearity of the design thinking process [28] was very much present during the project. The base of the concept stayed the same, but it underwent changes due to feasibility constraints, the need for stronger links between target and concept, and prioritization of the research. Each change in concept affected the research and vice versa.

One of the changes of concept was substituting real plants with artificial ones. Developing a prototype with actual plants was not feasible within the scope of this research project. By choosing to implement real plants the research focus would have inevitably shifted to selecting the right type of plants, irrigation methods, and the design of a construction that allows to attach these plants to lighting poles. To study the impacts of greenery on physical and mental health, it was not necessary to have real plants. The only requirement for the plants was that they are tangible so that the research would be able to compare the tangible and digital. Therefore, real plants were substituted by abstract flowers (Appendix IV.c). This did imply that the impacts of greenery on environmental health, namely the effect of vegetation on alleviating the heat island effect, was not considered in the design challenge anymore.

The idea of a plant string around the lighting poles was preserved but adapted to be a LED string with flowers made of recycled plastic. This offered an even stronger link between the digital aspect, the tunnel light projection, and the tangible aspect, through the elements of light and interaction. Whereas previously only the aesthetics connected these two aspects of the design concept.

Finally, the connection between the design and the target group needed to be strengthened. The fact that this research is focused on office workers was not yet discernible in the concept. This would've been a missed opportunity as digital augmentation perfectly offers the possibility for something personalized. A brainstorm was held and after a discussion with some coworkers one idea was chosen and implemented in the new design concept.

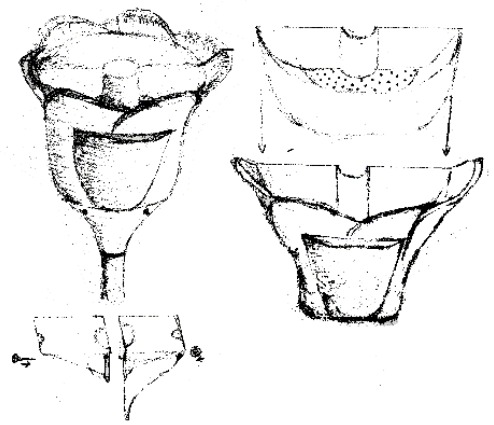

Figure 7 Drawing of the planter from the plant gantry

Figure 8 Drawing of Urgle in context

Prototype

Tangible

The first prototype made was a small-scale model of the street, to get a feeling of what it would look like in the context (Figure 9). Using clay, two plant pots were created, one inspired by an existing plant pot with watering system (Figure 7 and 9; Appendix V.a) and one on an even smaller scale for the street model. At this stage, it was still the idea to work with real plants, and *Hedera Helix* was used as it is an easy year-round green climbing plant that grows quickly [49].

Digital

To get a feeling for the augmented reality part of the concept two digital prototypes were made. One made in Processing 3, where vines were programmed to follow the mouse and with a press of the button a flower would blossom (Figure 10; Appendix V.b). The other prototype used an Arduino Uno and two proximity sensors, one to measure x and one for y. The input was used to map the location of an object, which created the output of a square following this movement digitally in the program Unity (Figure 11; Appendix V.c). These prototypes showed the possibility to map and track movement, which could be used to create visuals of vines and flowers following an object.

The idea was to eventually create a full life-size prototype. The concept started off with the idea to make it experiential by actually implementing it in the street or by creating an experience room. However, executing this = would've been very costly and time consuming and was therefore not feasible within the scope of this research project. A life-size prototype would've required proper sensors to accurately track the movement of passersby, high quality beamers, and the creation of an entire flower installation. Therefore, other ways to prototype the design concept were explored. Brainstorms were held on the implementation and possible execution of prototypes and research set-ups. The possible prototypes explored were a scale model, a room in a lab, using VR, or making a video. For the research set-up, decisions were made between quantitative versus qualitative approaches, studying physical vitality versus psychological vitality, and a 'within participants' or 'between participants' approach.

Several quantitative methods to measure the restorative effect are described in literature [33]. It was decided to use quantitative methods that focus on subjective measurements. The perceived restorativeness scale (PRS) [18] and restoration outcome scale (ROS) [25] were selected to study the restorative effect. It was chosen to use both PRS and ROS, as the application of these scales in a design context has not been found in literature. Therefore, it would be interesting to be able to compare the outcome of the two different scales.

From the decision to focus on restorative scales and use the PRS and ROS questionnaires, it followed that a video would most likely be able to support the research. Using surrogate nature has been applied before in literature [5,17,31,38]. Compared to a real-life prototype, this method relies on the imagination of people. With this, it is not possible to measure the actual restorative effect of the design concept. However, it is still possible to measure their opinion on it.

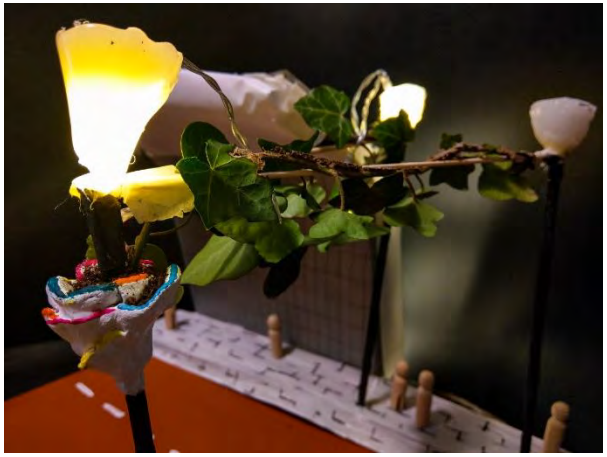

Figure 9 Physical small scale Prototype

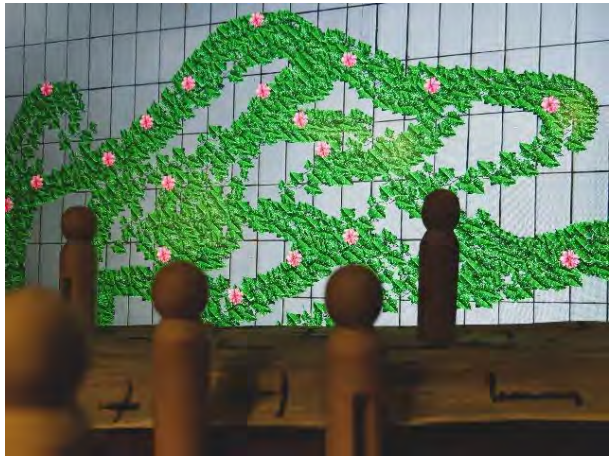

Figure 10 Digital Prototype with Processing

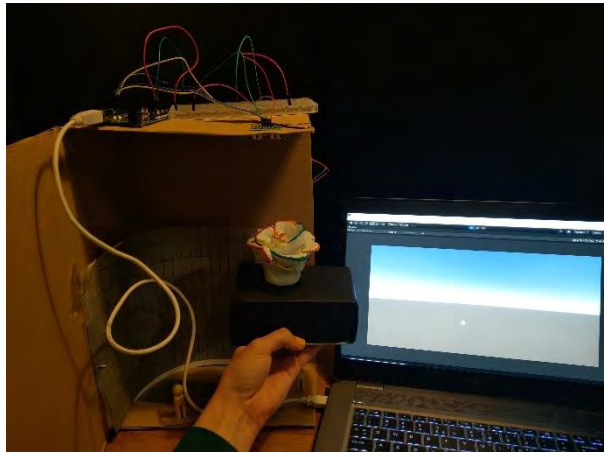

Figure 11 Digital Prototype with Unity and Arduino

URGLE

Design of Urgle

Urgle combines the tangible and the digital to improve the urban environment and create a restorative break experience for office workers. The tangible object is a string of interactive LED-

flowers that respond to passersby. When walking by green lights follow them, leading the way and playfully accompanying people on their route (Figure 14). Curious people that approach the string and interact with it by moving around, waving or dancing, are rewarded with a colorful lightshow (Figure 13). This experience is extended in a dark tunnel brightened by a projection of plants and text. The projection is interactive too and responds to passersby in multiple ways. Firstly, vines are created that follow people as they walk. Thereby pedestrians themselves create the patterns of the wall art (Figure 15). Secondly, when the passersby stop to take a closer look, they will be rewarded with a flower. When they interact and move around the projection will respond. The flower will blossom into an even bigger flower and change color (Figure 16).

For office workers the wall has a special feature. Colleagues can submit sentences like jokes, compliments, or questions (Figure 16 & 17). Offices and employees are given the opportunity to connect to a network where they have access to an application that allows them to send input for their colleagues that will appear on the wall.

All they must do is state the colleagues name and the company and select the input. The input can be chosen from a list, containing, for instance, jokes, compliments, motivational or inspirational quotes or customized input. When an office worker interacts with the projection, they will receive a sentence, either one that was submitted by their colleagues or one that is automatically generated. The digital aspect of Urgle will know which employee approaches due to a WI-FI connection that is established with the office workers' mobile phone. Urgle compares this information to a database and projects the desired sentence.

This concept is targeted towards office workers in Fellenoord and is specifically designed to be implemented in the Kruisstraattunnel (for the digital projection) and the adjacent street (for the tangible LED-strip).

The demonstrator consisted of three videos, for which scenarios and storyboards were made (Appendix VI). The first video presented the current situation: gray, not inspiring, and without plants. The second video showed an office worker encountering the tangible concept of the LED flower string and their interaction.

Figure 12 Visual of the two sides of Urgle out of context

Figure 13 Colorful light string in context

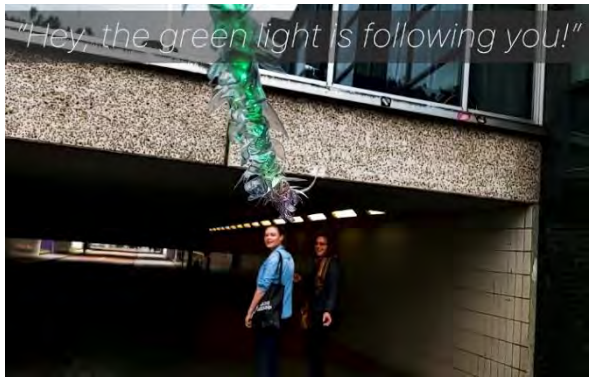

Figure 14 Passersby stop to look at the wall

Figure 15 Passersby interact with the light string

The third video showed the office worker in the office sending input to Urgle and going for a walk to interact with the digital and the tangible concept.

Underlying Design Principles

Although the design consists of two parts, the tangible and digital, they are strongly connected through light, form, and interaction.

Firstly, the LED string as well as the projection involve light. The colorful display of light is surprising, stands out in a street view and gets people's attention. In addition, the light has the added benefit of providing a safe feeling in the street. Secondly, both the tangible and the digital aspects are meant to resemble nature and mimic nature's effects on mental and physical health. Finally, both the tangible and the digital aspect of Urgle contain several interactive elements. In both aspects of the design passersby are accompanied on their walk. This has multiple functions; it draws the attention of pedestrians and creates a connection between the user and the design concept as the users' actions directly affect their environment. In addition, users are rewarded when they actively engage with Urgle. This stimulates people to increase their physical activity. Big, unusual movements trigger a spectacular light show in the tangible part of Urgle, and a beautiful flower projection in the digital part. Where the first element of interaction was designed to capture the attention of passersby, this element is designed to hold their attention for a moment. This playful experience enables the office workers to redirect their attention, and truly take their mind off work. The digital aspect of Urgle offers an additional form of interaction that is only aimed at office workers by projecting ever-changing and customizable texts.

This introduces an element of surprise that keeps the office workers interested and will incentivize them to return. The personalized texts establish a stronger connection between Urgle and the user. Moreover, it also facilitates the connection between office workers as it offers a way for colleagues to interact with each other.

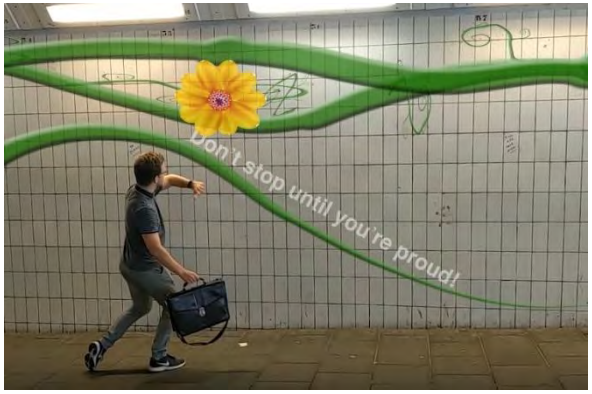

Figure 16 An office workers' interaction with the projection

Technology and Realization

The tangible aspect of Urgle consists of the abstract flower lights that interact with passersby. These are made of recycled PET bottles that are attached to a LED strip that is controlled by an Arduino Uno with proximity sensors. Sustainability was prioritized in the material selection, hence the decision to use recycled PET bottles.

The PET bottles were cut into pieces, molded with fire, and glued together to create the form of flowers and leaves. These abstract plants were then attached to a LED strip to create the illusion that the transparent flowers radiate light. Two proximity sensors were attached to an Arduino Uno. The two sensors initially were configurated to check two planes, but eventually only the input of one sensor was used to determine the presence of an object. Thus, if someone is near the sensor, a LED light show is triggered (Appendix V.d). A small RGB LED string was used for the prototype. It would have been preferable if the led string was much bigger in length and width to create a more immersive experience. However, this was not possible with the financial means and technology available for the project. Therefore, this was resolved by filming the prototype in angles that create an illusion in size (Figure 13 & 14).

The digital aspect of Urgle, is meant to be a projection of light on the tunnel wall, which would make use of sensors to map movement and have the visuals respond to the interaction. However, the actual demonstrator is a video of the concept. This video is shows what Urgle would look like when executed. The video was filmed using an HTC U12+ and edited with Adobe Premiere Pro. Adobe After Effects was used to create the animation layered on the video, which shows the projection on the tunnel wall. It demonstrates what the projection would look like and how it would behave.

VALUE PROPOSITION

The target group of the design concept is office worker. This makes them the first and foremost stakeholder. An improvement in vitality is of enormous value. The concept motivates them to stop working, leave the office, escape their environment and enjoy a walk. This not only stimulates them to be physical active, but also is it aimed to work restorative and be beneficial for mental health. Taking a moment to relax, refocus, and clear the mind helps to reduce fatigue, stress and restore attention[18,20,33]. Deprivation can be very unpleasant, leading to annoyance with coworkers, making mistakes or even burn-out complaints[19,39]. Therefore does taking a break help to improve mental,

social and physical health and well-being, which is important for every office worker personally[2].
The health of an employee is something valuable for an employer and thus companies. Fatigue and stress can influence an employee's performance, motivation, job satisfaction and well-being [12,19,25,27,30,33]. Low job satisfaction often leads to drop-outs and half of lost working days is related to stress [12,34]. An employee that has time in their break to relax and restore attention, will thus be able to concentrate and perform better [19,30,36]. Lots of companies have office wellbeing plans precisely for these reasons. Prioritizing this improves employee satisfaction, and all in all higher productivity and reduced drop out actually saves money for a company.
Another big stakeholder in this design concept is the city. The concept is meant to be located in a public area, therefore the city is involved in multiple ways. Urgle creates a fun experience, but it also makes the tunnel and street more beautiful. Thus, having aesthetical value which is desirable for the city. People will be more likely to want to visit a nice-looking place and it is something they can promote the city with. Thereby, the concept makes use of lights, it brightens up the tunnel which potentially has the consequence that the feeling of safety improves. It makes it a more pleasurable place to be, which is especially important and hard to achieve in dark area's like tunnels[51]. The earlier mentioned benefits for health also have an influence on the municipality. Health care is expensive, if initiatives like this can help reduce any chance on illness by improving vitality, it is of great value for them. Having something that can transform the streets, bring nature to the city without structural alteration is unique. The alternative would be to renovate the street to contain more greenery, which is a costly and moreover impactful investment.
Furthermore, those more indirectly involved are all the passersby and everyone that lives nearby. The idea behind the concept is that the light follows everyone that passes by. Even when you're not an office worker you will encounter the wall with its playful interaction where they change the environment through movement. For office workers there is more to the concept, but even if they're not one there is the interaction with the light and growing jungle. Which changes the environments function and aesthetics.

Even though it is now specifically designed for Fellenoord, it could be something that can be installed in other areas. There are a lot of offices located in highly urban environments where office workers could benefit from a concept that will stimulate them to have an active lunch break. A way to take care of their body and well-being.

ETHICAL CONSIDERATIONS

Designer's intention

Often the highly urban environment is seen as static, blend and gray. A place that has no or little room for creativity, change or, in the case of Fellenoord, beauty. Using design to change the environment can open up the possibilities for so much more. A place without plants can become green. A place that is gray can be lit up by light and color. A place that is boring can become interesting, restorative and help with vitality. Urgle could be a place to go to, to escape work, bring you into a fun interactive experience to take your mind away, which works restorative. An inspirational environment to return to. But it also brings the concept of nature into the city, the lights will help increase sense of safety and aesthetical value of an otherwise dark and lurid place like a tunnel.

Potential unethical situations

Transforming a place for a secondary use can have consequences. If the tunnel becomes a hub, it might be harmful for the traffic movement and safety. It is now solely a place of traffic flow, if people stand still there and a lot of people do this it could holds up traffic, or people walk on the street and get hurt. Urgle requires a function of the street which it is not currently meant for, which is the point, but can have consequences.

Urgle makes use of projection and LED lights. Both items unfortunately require energy. The concept had sustainability in its eye while developing, but energy is a precious recourse, therefore it could be questioned whether the use of energy is justifiable. Perhaps if green energy can be generated. Another important issue with the light is that they should not be too bright or cause any harm for people sensitive to light (e.g., people suffering from epilepsy).

The digital aspect of the concept let the phones of employees connect to the network to know their presence. This connection requires a database, thus potentially holding sensitive data, of when what employee is at the tunnel and on the input. Therefore, this requires thoughts on cybersecurity and safe storage of data. Furthermore, the free input for quotes can potentially be harmful (Figure 17). This should either be really well monitored; in which case the free input is limited, or when it's freer it could have the unintentional consequence that people use it for unkind messages, bullying or dirty sentences.

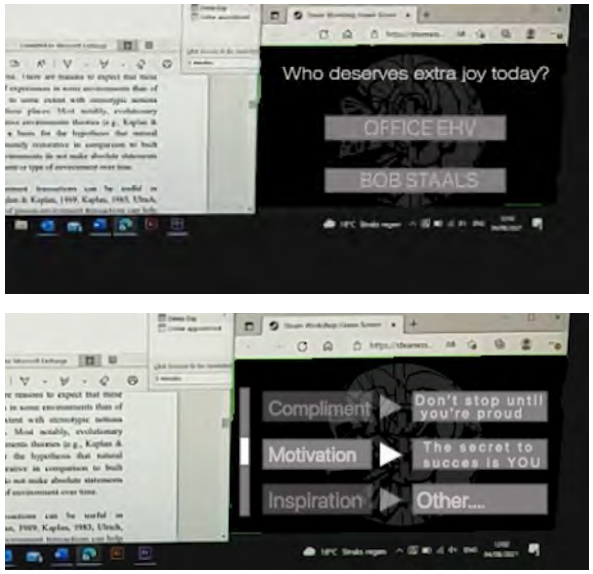

Figure 17 Input for personalized text

METHODOLOGY

Design of the research

Urgle in concept shapes the environment to contain digital and tangible interactive elements and tries to bring the positive effects of nature into the city to improve office worker's vitality. It is known that nature has this restorative effect, however the question is whether it might also be possible to achieve this in an urban environment by abstract representation of greenery using modern technology. Is only real nature able to achieve this effect on office workers, or can something tangible but abstract, like the LED-flowers, have the same impact? Or even one step further: can the addition of digital augmented reality help the cause? The aim is to find out what office workers think of a concept like Urgle in the city, and whether it could contribute to the restorative effect by answering the following research question:
Can digital or tangible transformation of the highly urban environment establish the restorative effect of nature on office workers?

A mixed method approach was chosen, where both qualitative and quantitative data is collected. For the quantitative data, two proven questionnaires where used. The PRS (perceived restorativeness scale[18]) and ROS (restoration outcome scale [25]), which participants answered by the 7-point Likert's scale [29]. The qualitative data was obtained in semi-structured interviews.

The methodology of the PRS was changed by removing questions 23-26 as these questions measured the factor legibility, which is not studied in this research project. By removing questions related to legibility, which were not relevant for the research objective, the length of the questionnaire was shortened. Limiting the length of the questionnaire was important to make sure that the study fit within the time-frame available for this project.

Participants were presented with videos of the urban environment and the design concept. Therefore, the quantitative research measures what office workers imagine is the effect and not the actual restorative effect. This data will help understand the attitude of participants towards the concept. The qualitative data, the interview, is conducted to get insights that may help explain the results of the questionnaires.

Participants

For the qualitative research six participants were interviewed. This amount generates sufficient data given the mixed method that utilizes not only quantitative but also qualitative data gathering. The participants were required to have experience working in an office setting, as the target group of the concept is focused on office workers. None of them actually worked in the area of Fellenoord. As described above, because of COVID-related constraints, it was not possible to conduct 30−45-minute interviews with passersby in the streets or in offices in Fellenoord. Thereby, since the study relied on the participants imagination of the influence of the design concept and the scenario, it was not a problem that they did not work in that area. The subjects were Dutch office workers, 2 female and 4 male, aged between 23- 56. All participants signed an informed consent form for both participation and recording of audio during the experiment. This was done to well document the interviews, which were transcribed later.

Material

Some sessions were held online, during these sessions Microsoft Teams was used to communicate, and others were held in-person. The research included videos that were presented on the laptop of the researcher or in the cases of remote sessions on the participants laptop via a YouTube link. The adjusted PRS and ROS questionnaires were conducted on laptop through google forms (Appendix VII). The researcher had a separate printed document with the interview questions (Appendix VII) and the audio was recorded using a mobile application. The consent forms were handed both printed and online, to enable all participants to sign them or take a copy if desired. Any notes taken were done on the printed interview page or in a notebook. All transcriptions, raw data, consent forms and videos can be found in the supplied folder of this report "\Final Research".

Procedure

The participants were asked to watch three videos followed by a questionnaire that was filled out after completion of each of the videos. For the second and third video a semi-structured interview was conducted. Each session began with a short explanation of the study and what was expected of the participant, followed by signing of the consent forms (either an online document or a paper version) and starting of the audio recording.

First, the participants were presented with Video 1 of the ordinary street, with a duration of 2:11 min. Thereafter, they were handed the 23-item questionnaire (Appendix VII), which was filled out using an online form. At the beginning of the questionnaire the participants were asked the following:

"Think about the video you just saw and image yourself being in that place. Imagine it being the environment around your office, where you work everyday. Pleas answer the questions according to your perception of it. Think about what you would feel, see or do if you were there."

This practice was repeated for Video 2, of the tangible concept (duration: 2:44 min.) and again for Video 3 of the digital and tangible combined concept (duration: 5:40 min.). After the first completion of the questionnaire the participants were only asked if they had any questions or comments. However, after the second and third completion, aligning with the second and third video, a semi structured interview was conducted, see table 1 for clarification on the procedure.

First part	Second Part	Third part
V1 + Q1	V2 + Q 2 + I 1	V3 + Q3 + I3

Table 1 The order during the session
V=Video, Q = Questionnaire, I=Interview

Data Analysis

For the analysis of the quantitative data Stata and Excel were used. Some data had to be transformed as some questions were asked negatively within a factor with positive questions. Thus, the Likert-scale had to be inverted for those. To get a better insight in the data, the answers of all participants, the mean and standard deviation per question were summed per video and a factor analysis was performed (Appendix VIII). The factor analysis gives insights in correlations, helps familiarize the data and can be used to check if the four factors of PRS and the ROS scale were observable. This data was thereafter interpreted and visualized in graphs, boxplots, and bar charts; these were made using Excel.

The qualitative data was handled in MAXQDA. To understand the data better, codes were identified and analyzed (Appendix IX). The factors from the questionnaires were used as codes and identified in the qualitative data, to get a better insight in the participants view on what they found important. Thereby were emerging topics coded as well as the load, which weighed if statements were positive or negative.

RESULTS

Quantitative data- Factor Analysis

The factor analysis that was performed on the questionnaire data set gave significant results that were in line with expectations. As two scales were combined in one questionnaire, the PRS with four factors and the ROS, one would expect the questionnaire to contain five factors. The first step for this factor analysis was to check the assumptions for the entire dataset and separately for the data on the PRS and ROS. It is important that items correlate, but not too highly. If they're too highly correlated, they do not uniquely contribute to explain the data matrix for the scales. They need to be related, yet provide unique information to the factors, therefore too much overlap is not desirable and should be checked before the factor analysis. The correlation matrix (Appendix VIII.b.i) and Bartlett's Test (Figure 18) had good results. For all test the p-value was significant (0.000) (Appendix VIII.b.ii). The null hypothesis is rejected, and the values are intercorrelated enough to run the factor analysis. Figure 19 shows the result of the test that was performed on the complete dataset. The the first five results have an Eigenvalue that is larger than one whichmeans that there are five factors identified. The results of the three factor analyses that were performed confirmed each other. The factor analysis performed on only the PRS resulted in four factors, the factor analysis on ROS resulted in one factor and the factor analysis of the complete dataset confirmed that there are indeed five factors (APPENDIX VIII.b). Therefore, combining two scales in one questionnaire did not lead to any disturbances as the factors were still seperately identifyable.

```
Chi-square          =          2791.497
Degrees of freedom  =               378
p-value             =             0.000
H0: variables are not intercorrelated
```

Figure 18 Bartlett's Test of sphericity

```
Factor analysis/correlation                    Number of obs    =         18
    Method: principal-component factors        Retained factors =          5
    Rotation: (unrotated)                      Number of params =        130
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	17.28675	14.69743	0.6174	0.6174
Factor2	2.58933	0.78403	0.0925	0.7099
Factor3	1.80530	0.51126	0.0645	0.7743
Factor4	1.29404	0.21175	0.0462	0.8206
Factor5	1.08229	0.28107	0.0387	0.8592
Factor6	0.80122	0.06300	0.0286	0.8878
Factor7	0.73821	0.10801	0.0264	0.9142

Figure 19 Factor Analysis Results

Graphs

Now that the factors were found to be observable, the data of the two scales were visualized as well as the data per factor of the PRS (figure 21-27). The boxplots show the five-number summary per video, for each time the participants filled in the questionnaire.

In the ROS and PRS boxplots (figure 21 & 22) the measured restorative outcome of the scales can be found. What is imediately notable is that the graphs are highly resamblant, although they do have differences. For example, for video 2 and 3 the PRS scale's (figure 22) median is slightly lower and for video 1 it's higher, compared to ROS(figure 21). Moreover, video 2 of PRS scale has a remarkably large variance. This could be explained by the boxplots of PRS' factors. Where it can be seen that the factor 'Being Away' has quite a high median of 4,83 and a maximum of up to 7, while on the other hand there is "Coherence" with a median of 2,71 and a minimum of 1.

For both ROS and PRS, the lower and upper quartile of video 3 are between 5 and 6. The variance is smaller than for the other videos. Therefore for video 3 it can be said that participants were more homogenous in their answers.

In all graphs, there is a clear increasing trend present between videos. For video 1, the median ranges from 1,77 to 2,88, indicating that the participants disagreed. Thus, on the Likert's scale participants disagreed and therefore do not believe that a restorative effect would occur in the current environment. For the second the median varies from 2,71 to 4,83, however for most graphs it lies around 4. This indicates that the participants are fairly neutral. Lastly, for the third video the median roughly lies around 5,5, without "Coherence" that is. A 5,5 on likert's scale is translated to in between 'slightly agree' and 'agree'. This means that the participants think that they would experience some restorativeness. This increase in mean between videos is visible in almost

all graphs. It tells that the current environment scores the lowest for restorativeness and the blended concept with projection and LED is better perceived.

From the boxplots on factors (figure 24-27) it can be seen that 'Fascination' was agreed upon the strongest of all videos and all factors, with a high median and little variance. This indicates that fascination plays a major role in the perception of the videos by participants. This could also be found in the interview results where fascination was mentioned far more than the rest, 73 times, and thereby most often positively (table 2).

As mentioned before, the plot of the factor 'Being Away' for video 2 is quite interesting. This factor scores highest, here people slightly agree. Which is different from the other factors, where participants were neutral.

Most notable is the range, which differs from 'highly agree' to 'disagree'. Whereas in general the variance is much smaller, indicating that participants saw more eye to eye. The generally positive view, that is the relatively high median for video 2 and 3, is again also notable in the qualitative results (table 2), counting 18 positive mentions.

Above all, The most interesting result of the four factors is 'Coherence'. For 'Coherence' the results for all three videos were roughly the same: the participants (slightly) disagreed. This breaks with the aforementioned trend of increasing agreement that is visible in all other data. The qualitative results on 'Coherence' even show this divergence. For the other factors the load was between 67-77% positive comments and 23-33% negative comments, whereas for 'Coherence' it was inverted, with 29% positive comments and 71% negative comments (figure 20). The divergent results for 'Coherence' might have skewed the PRS boxplot. Therefore, a boxplot of PRS without 'Coherence' was made, to be able to asses this effect. This boxplot (figure 23) resembles the ROS even more, both the median and deviation is much more similar. Eventhough the variance of the factor-boxplots can differ quite a lot, the mean answers per video are very similar for each participant (APPENDIX VIII.d), indicating that participants over all answered quite unanimously. Here too the trend of increasing agreement per video, is clearly visible. From table 2 it might seem that participant two had a less strong opinion, however this is not necessarily true. The audio file of this session was lost and not transcribed, therefore this file is shorter and less was coded.

The tables containing the mean and standard deviation per video per question that were created in Stata were visualized in a line chart (Appendix VIII.c). This was mainly used to familiarize the data and find directions for further analysis, e.g. the abnormality of "Coherence" was first seen here.

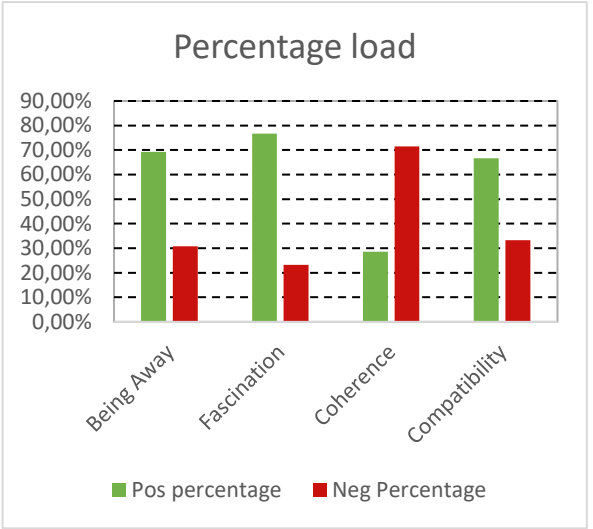

Figure 20 Histogram of the percentage on occurrence of negatively and positively loaded comments

		Positive	Negative											Positive	Negative
		P1	P1	P2	P2	P3	P3	P4	P4	P5	P5	P6	P6	Total	Total
Being Away		0	3	2	1	7	1	5	1	2	1	2	1	18	8
Fascination		11	4	4	1	13	1	12	4	8	4	8	3	56	17
Coherence		1	2	0	1	1	1	0	2	1	3	1	1	4	10
Compatibility		1	4	1	1	2	0	6	0	1	0	1	1	12	6

Table 2 Coded relations of comment occurrence and PRS Factors from qualitative data

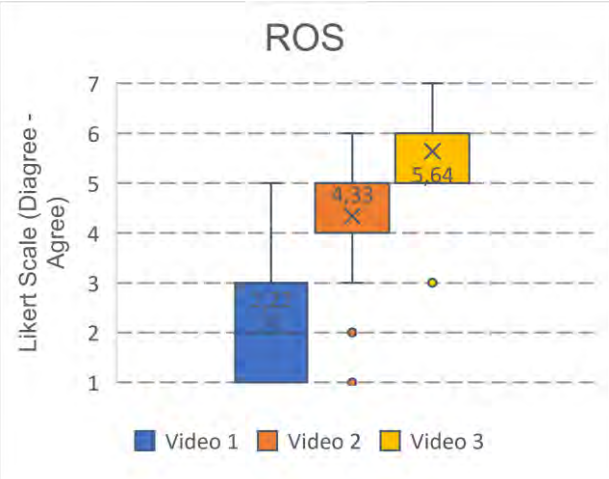

Figure 21 Boxplot on Restorative Outcome Scale

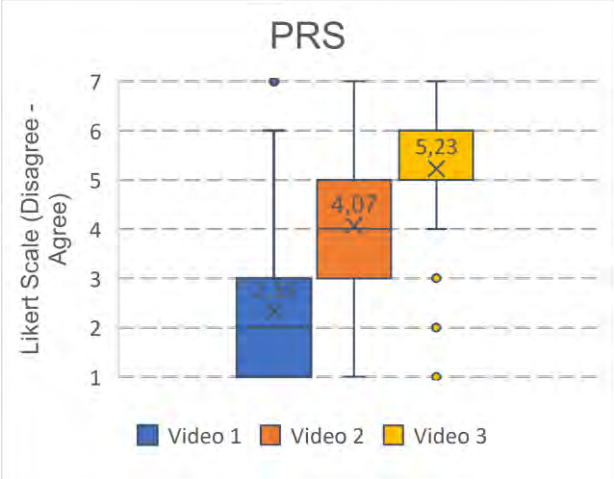

Figure 22 Boxplot on Perceived Restorativeness Scale

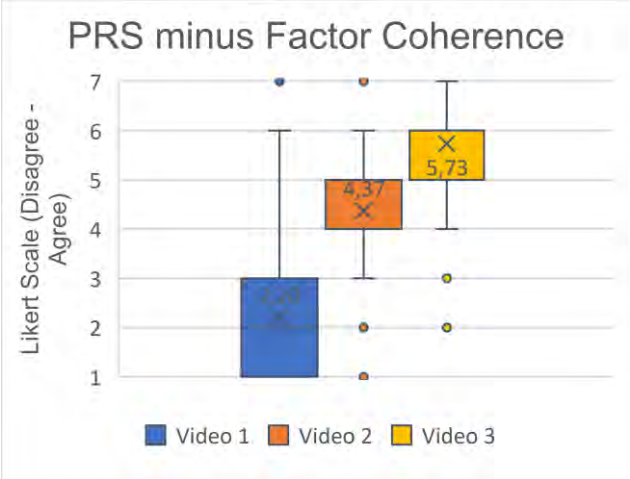

Figure 23 Boxplot of altered PRS scale

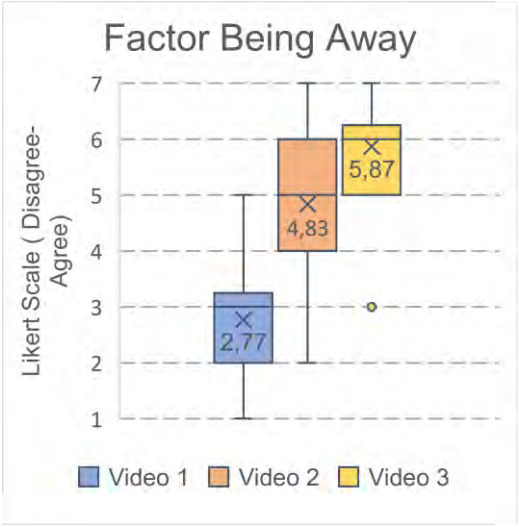

Figure 24 Boxplot of factor Being Away

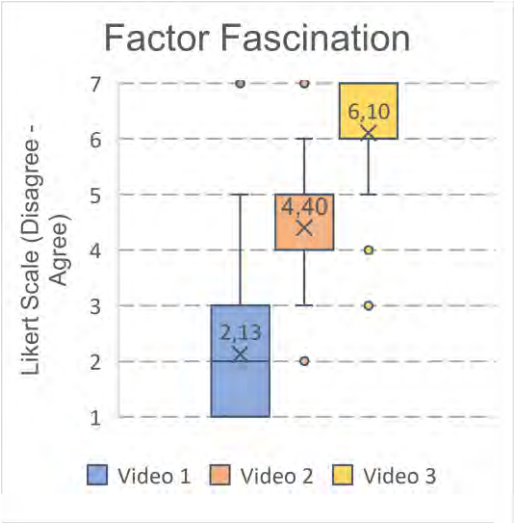

Figure 25 Boxplot of factor Fascination

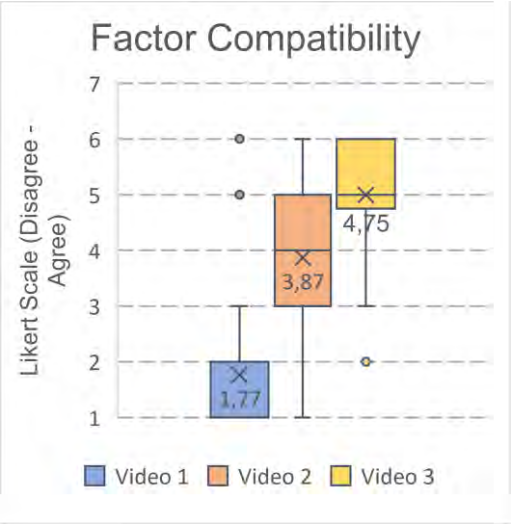

Figure 26 Boxplot of factor Compatibility

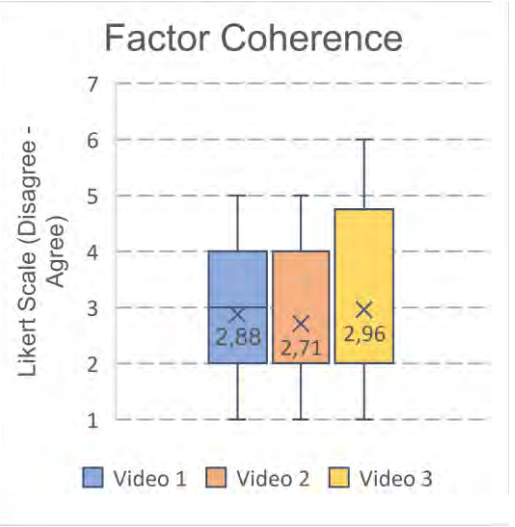

Figure 27 Boxplot of factor Coherence

The qualitative data

Although there was no interview after the first video, during the interviews, participants still mentioned the current environment and gave their opinion (table 3).

	Positive	Negative
Video 1: Current Environment	*"Graffiti in that performance on that spot. That's of course magically beautiful"(P1)*	*"the tunnels are incredibly stupid and ugly"(P1)* *"large bathroom tile wall, that's not really nice"(P4)* *"a colourless affair"(P5)*

Table 3 Quotes of comments on current environment

Most comments were negative, the only positive ones were directed at the existing grafiti. Participants were moderately enthousiastic about the second video containing solely the light string. A lot of positive comments were given, but doubt was expressed too (table 4). For example, they doubted that it would keep their attention: no one answered yes to this question. Eventhough two participants (P1 & P4) had concerns that the lights wouldn't be visible enough at day, all participants thought that it could get their attention. This potential lack of visibility during the day was the reason one of the participants did not see office workers as a target group for the design concept.

	Positive	Negative
Video 2: Light String	"It can very effectively brighten up such an environment." (P1) – *Fascination* "That's a nice distraction, especially if you're taking a break or going for a walk"(P3) - *Being Away* "This would be a way to change the subject. "(P4)- *Being Away* "surprise, curiosity" (P3)- *Fascination*	"plastic flowers are too far from nature. To give me a real association with nature"(P1) – *Being Away* "a very isolated thing"(P5)-*Coherence* "I see a little less that link with Officeworkers, it won't make you very happy during your break" (P1)- *Compatibility*

Table 4 Quotes of comments on tangible aspect

Interestingly enough, even though no one thought it would maintain there attention, all participants thought the concept could possibly help with their motivation to go for a walk if they worked there. However, for most there was a side note here: participants mentioned that they would most likely lose their interest after a while or something had to change in some kind of way.

Like who they are accompanied by:

"yes, just not for a whole week, just once then or twice or that you say, ow are you joining me then we can watch and then with another colleague again" (P6)

Or the concept:

"*Yes, then you walk past it every day to look at it ... it has to remain interesting by being different every time, then it is interesting, so distraction, so it clears your head and you come back with an empty head. Or at least a head that has been cleared and that does help with creativity, inspiration and motivation*" (P3)

During the interview after video 3, the full concept, participants were noticeably more excited. Not only did all participants wholeheartedly say yes to whether it would get their attention, contrary to the previous video, all participants believed it would maintain their attention. Although the reason behind this differed per person. Some were most excited about the interaction with the flowers, while others were far more focused on the questions or the quotes. Participants liked the personal touch from the text and the unpredictability of the interaction (table 5). Although participants 3 and 5 did emphasize that it would only maintain their attention as long as it changes. The participants were also far more convinced that this would help in their motivation to walk. The opinion of participant 2 differed slightly, they thought that it would contribute, but would not be the reason to go for a walk.

*"Then there is finally something to see there. Now, I wouldn't walk there just for fun, if you do something with lights it's already more fun to walk, but with a projection on the wall, if you can make it, then it is also nice to go for a walk there at lunch."(*P1)

	Positive	Negative
Video 3: Blended LED+Projection	"Could get my mind off work here for a while." (P5) - *Being away* "Fits Eindhoven .... it brightens up an environment where a lot of things stand still, but still a lot work and live"(P3)- Coherence "personal touch"(P4)- *Fascination* "Unpredictable"(P5)- *Fascination*	"I don't see that I'm going to enter for my co-worker and then see that on a tunnel. (P1)- *Compatibility (P2 said something similar)*

Table 5 Quotes of comments on full concept

While some participants doubted that they would actually submit anything (table 5). Others were really enthousiastic:

" *I would be like fifteen minutes in advance thinking about what I'm going to put on it today….. put them in the limelight today, something you can live up to too" (P4)*

However, P1 did not like the text at all, while P2 shared doubt regarding submitting customized input but did like the automatic question. Interestingly enough, P1 and P2 both mentioned the Pickwick tea bags, that contain questions. P1 used it as a reference to what they don't like, while P2 used it to explain that they are a fan of the concept. Opposing opinions were also found in other parts of the interview. For example in response to the question whether they would prefer just the projection versus the combination of a projection and a tangible element. 50% of participants liked the combination better, while the other half thought just the projection would be enough (table 6).

Only projection	Blended concept
"I don't think I'll go and look at the lights if there's a whole interactive wall"(P5)	"Yes, the combination is even nicer, then you dress it up even more that whole environment, but it could also work both solitary" (P1)

Table 6 Preference Projection vs Full concept

During both interviews it was asked if the concepts gave participants the feeling of being more in nature than in the original situation. While for the lightstring three participants did mention they saw flowers in it, no one actually got this feeling. The projection gave 4 participants the feeling of being in nature slightly or more than before, but still there was not a convincing yes.

Looking at the answers regarding the videos and concepts it is clear that the enthousiasm increased with the addition of the tangible design concept, and even more with a combination of a tangible and a digital aspect. Participants were notably more interested in a combination and all participants answered that they liked the third video best, which is in line with the trend of increasing agreement that was found in the quantitative data.

DISCUSSION AND FUTURE WORK

This research set out to answer *Can digital or tangible transformation of the highly urban environment establish the restorative effect of nature on office workers?*

The mixed method, collecting quantitative data through PRS and ROS and qualitative data through interviews has been most usefull in answering this question. As mentioned using these scales for subjective measurement in design context has not been found in literature and therefore it was set out to collect two scales and two types of data as to compare and verify results.

Both scales and quantitative and qualitative all showed a trend where: participants did not agree with the perceived restorativeness of the current environment; were roughly neutral on the tangible video; the full concept with digital augmentation received the highest score indicating that they believe they would experience some restoration. The results of PRS and ROS were found to be remarkably similar confirming each other. This seems to confirm the hypothesis that these instruments can be used in a design context.

Furthermore also the qualitative and quantitative data confirm eachother. The trend of increasing agreement regarding the perceived restorativeness scales over the videos correlates with the positivity of attitude of the participants during the interview.

The descriptive words participants used often indicated "Fascination"or an escape experience which is what the design was focused on. Trying to take office workers' mind off their work by presenting a surprising engaging experience that lets them redirect attention and transform the environment they're in. This design intention appears to be mostly related to the factors "Fascination" and "Being Away" of the PRS scale. This is visible in the results of the quantitative and qualitative data. The median of these factors are higher (figure 24 & 25) as is their occurance during the interviews (table 2). This indicates that the factors compatibiltiy and "Coherence" were not prominently present. These results could either be due to the absence of these factors in the design. In which case in further iterations the restorative effect might be increased through better implementation and consideration. Or it could be that the problem does not lie with the design itself, but in the presentation of the design. Suggesting that the presented videos perhaps were not able to convey the qualities of these factors. For instance, "Compatibility" refers to the relation with ones personality. This highly personal aspect might be harder to judge from a video. Furhtermore there is "Coherence" which refers not only to the concept but also to the entire surrounding environment. In contrary, "Fascination"and being away can be answered when given just a presentation of the concept in context, while "Coherence" might require a much more immersive experience to be assesed. As a video only shows the viewer what has been filmed, it is hard to imagine and asses a surrounding that isn't showed.

In reality it could be a combination of both a limitation of design and research. As the designers intention and implementation in concept did lack focus on these factors. This subsequently might have skewed the videos towards showing mostly the factors "Fascination" and being away. In further research implementation of the concept in real context could study this, as it would create a much more immersive experience thereby perhaps being able to measure the factors "Compatibility"and "Coherence" better.

Although "Compatibility"might be somewhat harder to judge than "Fascination"and being away. It seems participants were still able to do so. The mentioned trend is visible (figure 26) in data and the qualitative data also seems in line with the other factors (table 2).

What is really interesting is "Coherence". This factor in itself acts like an outlier when compared to the other factors. In the quantitative data the trend (figure 27) is not visible and from the qualitative data the results are even an inverse of the other factors, having way more negative comments than positive (figure 20). The theory that "Coherence" is an outlier in this research is supported by the analysis where "Coherence" was excluded in the data for the PRS boxplot (figure 23). This alternative PRS boxplot suddenly resambled ROS even more so. The reason as to why the results for "Coherence" are so divergent has not been found, also not during the interviews. Where the factor was not often mentioned, thereby not much data has been gathered on this. However the speculation that it was impossible to be assed by the participants, given the research method using a video, seems plausible. This would indicate that even though PRS has been used in literature with measurements of photos and videos [38], the instrument actually is not suitable to be used in this way. To substantiate this speculation research should be conducted, as the problem might also originate in the design and not the method. What might be a limitation of the research method employed is the fixed order in which videos were presented. This could induce a learning curve [35], as participants opinion could be related to the previously seen video. Although the order was chosen as is to first give participants a context since the study

relies on imagination. However during the interviews participants answered on their "feeling of being in nature", using terms like "more" when judging the third video. A word that is used to refer. Therefore there is a relation between the results and the order, but it can not be said with certaintly what its influence is on the results. To determine this the study should be repeated with randomization.

The aforementioned trend suggests that the likelihood of occurance of an actual restorative effect is higher for the full concept containing digital projections than it is for the tangible concept. In fact there even is a high chance that the solely tangible artifact does not contribute to the effect at all, as participants were roughly neutral in the questionnaires and moderately exited during the interviews. This might be due to the small scale the tangible aspect was executed in, but it is far more likely that on itself this concept just does not have the ability to keep attention. From the interviews it was found that it is able to get attention, but not keep it, therefore the aspect of keeping attention and remaining interesting might be of crucial importance for an urban concept to work restorative. Further research could try to implement the solely tangible side of this concept in a real context of a highly urban environment. To measure the level of importance of the aspect of holding attention for the restorative effect. Or to determine if the measured neutralness in this research is due to the scale it was executed in.

The PRS and ROS results on video 3 indicate that the participants think that they would experience some restorativeness. Thereby mimicing natures restorative effect in the urban environment eventhough the concept does not contain actual greenery. This shows that even implementation of abstract tangible and digital surrogates could be a good way to transform the urban environment without the need for structural changes.
Although this research does leave room for the question if form, i.e. nature-like visuals, influenced the results of the PRS and ROS. These scales are developed to assess the subjective restorative effects of nature[18,25,33]. However, when participants were asked they did not feel a strong connection between the concept and nature. They acknowledged the resamblence, but they did not get a feeling of "being in nature". Thus perhaps the significance of mimicking nature is independent of form, but it is more abstract like Urgle's presentation. Suggesting that it is not the woods, but it is the feeling of "being away", "fascination", "coherence" and "compatibility" people associate with this place. Thus implying that even with any other visuals the restorative effect could be achieved. Further research would be interesting to quantify the importance of form in the occurrence of the restorative effect by playing with aesthetical value and form .

While in some way participants seemed quite unanimous, e.g., the trend or the low variance that often can be seen in the boxplots (figure 21-27), in other ways opinions were contrasting. For example, when it comes to implementation of design choices. Exactly half of the participants think only the projection is enough, while the other half sees the added value of a tangible aspect. Some participants loved the personalized aspect of the text on the projection, while others disliked it. These results say a lot, as it seems to come down to personal preference. Not everyone will respond the same to certain elements of a design concept. Thus it might be desirable to consider factors like "Compatibility" more extensively, the truth is that it will be impossible to be fully compatible for all, which is also something to keep in mind for concepts like these.

Even though this research can not be regarded as proof that an actual effect will occur once implemented. The results from both the qualitative and quantitative research and the reoccuring trend suggest a positive likelihood that an restorative effect would occur with tangible and digital transformation of the highly urban environment. Thereby lying a foundation for further research in context.

Figure 28 Waving at Urgle's light string

CONCLUSION

Nature, vitality, office workers and their connection has been studied extensively. However, this has not often been placed in the context of urban environment, design and technological solutions. Even though a lot of offices actually are located in cities and design and technology are useful approaches to solve issues, like the frustrations of office workers with Fellenoord. Where its lack of reachable greenery and inspirational environment, affect their breaks. Taking a break and contact with nature both have been proven to have important restorative qualities, reducing stress, fatigue and restoring attention [2,19,22,26,31,33,43]. Therefore being of importance for office workers as stress is a common problem [34].

Urgle, attempts to connects these elements into an engaging restorative break experience. The urban jungle design consists of a tangible side: the interactive light string and a digital side: the transformative light projection. It was studied if this digital or tangible transformation of the highly urban environment can establish the restorative effect of nature on office workers. Through the presentation of videos and conduction of interviews and questionnaires (PRS & ROS) with six participants.

In the results participants were found to be quite unanimous and a trend was identified where participants did not think the current environment would be restorative, while the implementation of Urgle, with digital projection, was imagined to have some restorative effect.

Even though there is future research needed to prove its actual restorative effectiveness if it's implemented in the real environment. From this research it seems that the digital and tangible transformation of the urban environment by Urgle can have a restorative effect. This indicates that the effect, that has mostly been studied with actual plants, can be achieved by abstract representation. For the crowded highly urban environment that is not able to offer or be reconstructed to contain greenery. This could be the solution to supports a new way of transforming urban environments, using abstraction and technology, that could contribute to the health of office worker.

Figure 29 Coworker Bob with Urgles generated question

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APPENDIX I. First Phase Research

Brainstorm Interventions

Technological interventions:

- digital augmented reality –
  We define Augmented Reality (AR) as a real-time direct or indirect view of a physical realworld environment that has been enhanced / augmented by adding virtual computergenerated information to it - [11]
  do not solely want to go to digital augmented reality. Adding it or using it would be interesting, but I also want to create something tangible.
- gamification:
  Game as rhetoric : how to design people's collective behavior in crowdsourcing, influencing and motivating human behavior. [23]
  I could use this principle with augmented reality or embedding this into the real world to gamify and change behavior.

  [10]: other example of gamification.
  Pitfalls: often shortterm or in need of new people.

- data driven feedback (Smart watches)
  [8]Idea physicalizes data: how many people walk past: perhaps could build database behind that can keep track of how many people walk past/interact.

- Interactive digital/real environment – really like technology that bridges the gap

Sustainability interventions:

Improving Greenery
Helps reduce the heath island effect – creating a smart city that is data driven with more greenery – to motivate people to be physically active. perhaps uses digital augmentation to fill in gaps.

- Using data on running behavior to improve perceived greenery there – both augmented reality (making a crack in the wall beautiful) and real tangible (real greenery or something that influences/changes the real environment as well).
- Using sensors to measure people passing by and providing water spray cooling – this improves the conditions and pleasantness of the city. By creating a better environment for sports/movement, people might be more inclined to walk or run.

- Reducing energy
- Consumption
- Material use
  a. Something that **rewards** people for doing something good for the environment, cleaning up litter while you move. – This is probably already done many times can be lost with lit. (does not respond to that unconcious change I may want to go for)

Brainstorm Users:

User interaction:

- By engaging people
- Interaction – really like interactive environments
- Motivation
- More interesting
- More beautiful
- Rewards
- Adding a social aspect
- Punishment (not so interested in this)

I like **positive motivation** : creating nudges or easier circumstances or a reward system. I am mostly interested in tech that **changes behavior** – without the user actively trying (**slow behavioral long term change**). That's my guess why pokemon go didn't work, it was a hype, a short term impactful change, not something that enters a routine for most people.

Target group:

I am less interested in users that are already interested in moving and sustainability. -- [9] (this study focuses on mobility, but still showed me that my interest lies elsewhere)

More interested in the challenge of the society, with the urban environment the target group is every passerby. People that are both aware and unaware, motivated and not motivated.

(i) Not all users are motivated by environmental concerns - [13]

Initial Key Concepts

Key concept 1: Physical human vitality
Walking or Running
Key concept 2: Urban environment
This variable consists of five categories ranging from very strongly urban (1) to non-urban (5), and was measured at municipal level – Source: [32]

I chose for this method as urban environments differ in greenery it matters a lot if I focus on a park, which is less urban than a city center. Chose early on to focus on urban environment, to create a more narrow scope as I live in the city and am interested in environments in which vitality is naturally harder for people to achieve .

Key concept 3: Sustainability

- From literature both vitality and sustainability in the city benefit from a more green environment. – not digital

Which is a clear and interesting overlap – **heath island effect –** increasing temperature in cities, which can be reduced with greenery.

- *sustainable urbanism is concerned with the study of cities and the practices to plan. develop, and design them that focus on **reducing material use, lowering energy consumption, mitigating pollution, and minimizing waste**, as well as improving social equity and the quality of life* - [6]
- "smart sustainable cities" *Smart sustainable cities are depicted as constellations of instruments across many scales that are connected through fixed and wirelessly ad hoc and mobile networks augmented with **intelligence**, which provide and **coordinate continuous data** regarding the different aspects of **urbanity** in terms of the flow of decisions about the **physical**, **environmental**, **social**, and economic **forms** of the city* [7]
- ***Smart sustainable urbanism:** exploiting, analysing, and harnessing the ever–increasing deluge of the **data flooding** from urban systems and domains, and leveraging the resulting outcome in the transition towards **sustainable development**. Urban systems include built form, urban **infrastructure, ecosystem services**, human services, and administration and governance. Urban domains involve transport, traffic, mobility, energy, natural environment, land use, healthcare, education, science and innovation, and public and social safety* - [6]
-

[40]Literature on the value of sustainability. Interesting for the ethical point of view/designerly perspective.

- *Note from lecture: It is good to combine the key concepts to be more specific to create scope: "smart sustainable cities"*

Concepts that are not addressed (scoping)
concept 1: General outdoor or rural vitality
concept 2: Indoor vitality
Reasons:

- Self-reported mental well-being had positive effects outdoor, not indoor. Source: [32]
- I have more interest in outdoor environment change
- Urban vitality – the vitality of the city itself: social successfulness of city

Research Idea

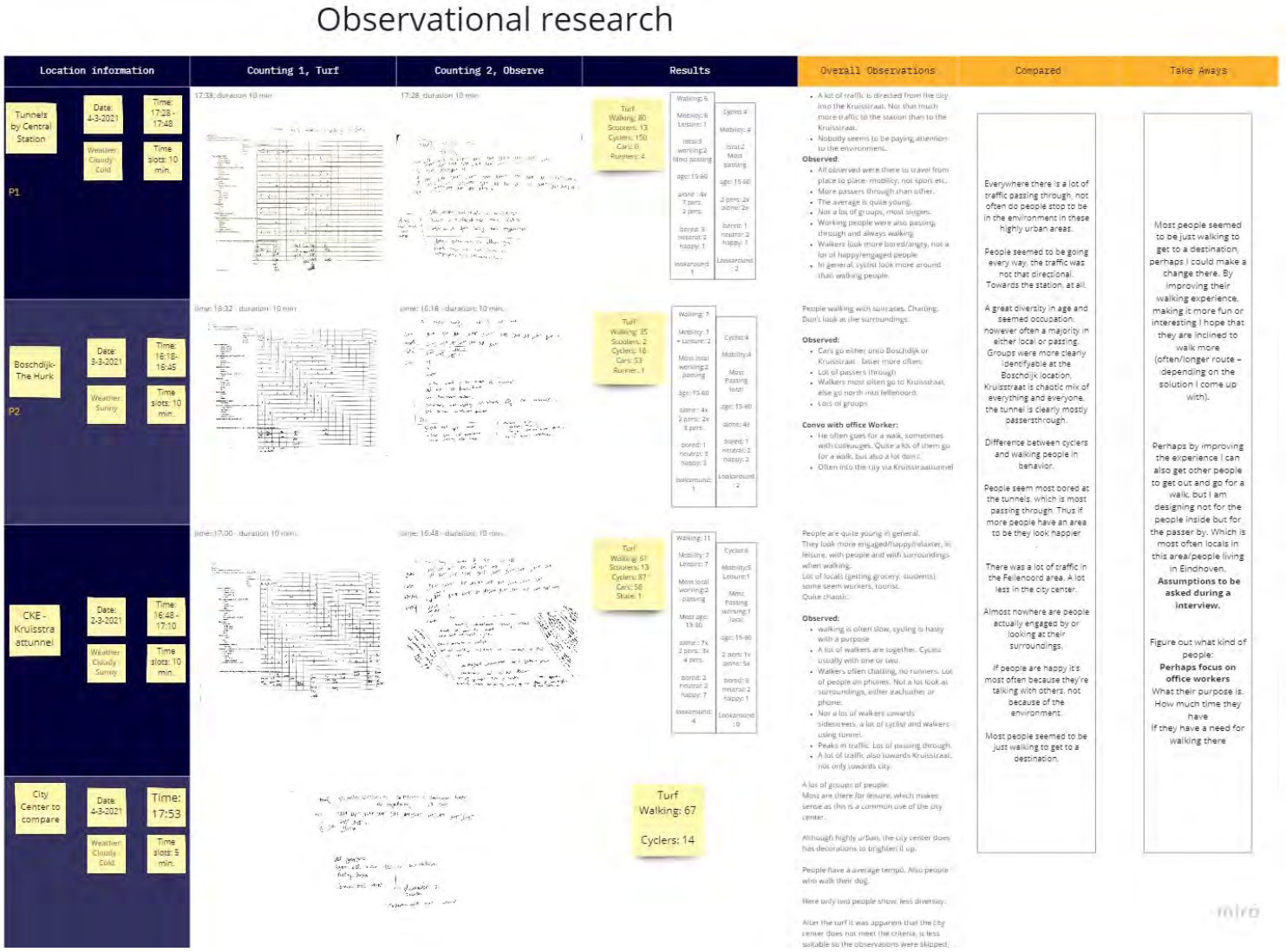
Possible gap: There is a lot of research on that greenery that already exists improves health – rural vs urban. What about changing the environment to be more green with technology. E.g. with augmented reality and the effect it has on physical activity with/without the augmentation.

I am exploring: Vitality in the highly urban environment
By means of: developing an embedded interactive technological intervention
so that/in order to: stimulating and improving physical movement (and greenery) to create a smart sustainable city

Target Idea	Location Idea	New Key Concepts	Research Idea
Choose to focus on people that live in the city and have to find their daily physical activity within the city, As I found in literature study that in greener/rural area's people are more easily active. It is interesting how I could influence locals. Perhaps this also has an influence on people that do not directly live there-this is something I can study when the time is there but my target is inhabitants of the local area (or people that are often here) as they are most affected by it.	Criteria: 1. I want a highly urban environment. In the city center of Eindhoven – meaning within the ring. 2. Not near a park – as people would most likely get their physical activity in the park then. There are places in Eindhoven where the parks are further away, from research physical activity here probably is lower, and thus I think the case will be more interesting/impactful on the environment and people here. Wants: Maybe a street that leads to the city center – such that people are more inclined to walk the distance instead of taking the bus or something. Not already beautiful, like berenkuil Perhaps Fellenoord:  •Close to the city center – The distance is walkable •There are a lot of offices there – thus a lot of people that would benefit from some activity for instance during their break. •There is no park nearby •I think (should check this in a study of course) that these people are not so inclined to walk as the environment around the offices is highly rural, close to a large road and thus not so attractive to walk in	Key concept 1: Physical human activity- vitality Walking * I want to focus on walking as it is something that (almost) everybody is able to do- it could even function as a replacement for other forms of mobility instead of taking a car or scooter or bus. Key concept 2: Urban environment – highly *This variable consists of five categories ranging from very strongly urban (1) to non-urban (5), and was measured at municipal level – Source:*[32] I chose for this method as urban environments differ in greenery it matters a lot if I focus on a park, which is less urban than a city center. Key concept 3: Digital augmentation Which is defined as *We define Augmented Reality (AR) as a real-time direct or indirect view of a physical realworld environment that has been enhanced / augmented by adding virtual computergenerated information to it* - [11]	Using digital augmentation to improve the walking activity of locals in the urban environment of Fellenoord in the city of Eindhoven. Question idea: How can digital augmentation improve the walking activity of locals in the urban environment of Fellenoord in the city of Eindhoven? □ What is improving: walking more / longer for instance by making it a more enjoyable experience is a way to achieve this. □ Locals is therefore not yet clear enough □ Fellenoord might not be clear enough □ Research could be : Make 1 solution and then see how it affects people and walking. Exploration of interactive augmented reality in improving urban hiking.

II. Exploratory Observational Research

(For readability, Images of datacollection and turf is additionally added as separate files in the folder "\Finaldeliverable_D_S_Vermeer\Explore-Observational research")



III. Exploratory Interviews.

a. Interview Questions

Semi- structured interview

Intro: Bedankt voor het meedoen met dit onderzoek. In dit interview wil ik een paar vragen stellen over wandelen in de omgeving. Het interview duurt maximaal 15 min en met uw toestemming zou ik graag de audio op willen nemen.

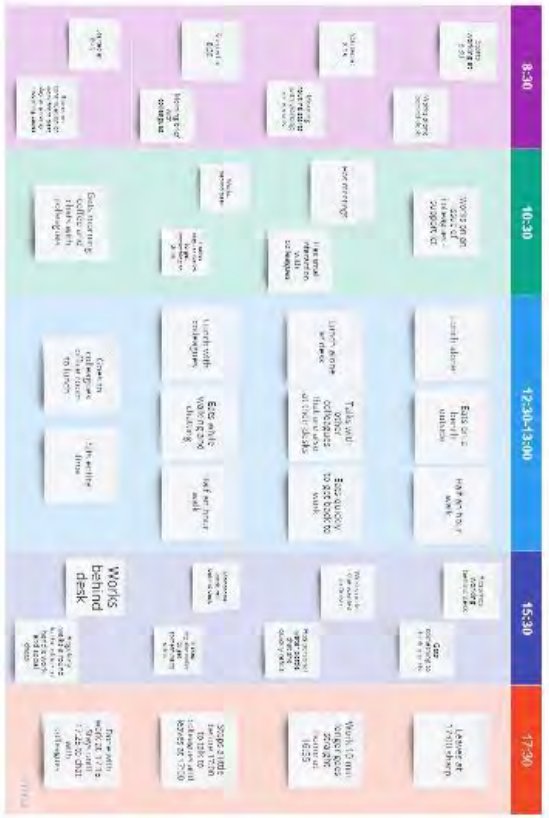
1. Demographic vragen:
    a. Age
    b. Reason of being in Fellenoord area—office worker Y/N
2. Do you ever take a walk in this area?
3. If they do walk:
    a. When? During work, after/before work, during the break?
    b. With what reason do you take this walk?
        i. For leisure, For activity/sports, For mobility?
    c. Do you walk alone or with others? With whom?
    d. Do you have a fitbit(or something like this)?
        i. How often did you take a walk:
            1. Last week? This week?
    e. Where do you walk –
        i. What area's
        ii. Where to
    f. Why here? → fun example?
    g. Do you look at your surroundings when taking a walk?
        i. What do you think of the surroundings here?
        ii. What could be improved?
    h. Would you like to walk more? → why (not)?
    i. Where would you like to walk- if you can choose? → Why?
4. If they don't walk:
    a. Why not?
        i. Are the good area's too far?
        ii. Too difficult or boring, unsafe?
    b. Is there an area where you would like to walk- if you can choose? Why?
    c. Do you look at your surroundings when outside?
    d. What do you think of your surroundings here?
        i. What could be improved?
    e. Would you like to walk more?
    f. Would you go for a walk if something changed?
        i. Why? What?
5. What do you like most in the city of Eindhoven?
    a. Why?
    b. What don't you like
    c. What do you miss?
6. What do you like most in this area (environment wise) ?
    a. Why?
    b. What don't you like
    c. What do you miss ?
7. Is there anything else you would like to mention?

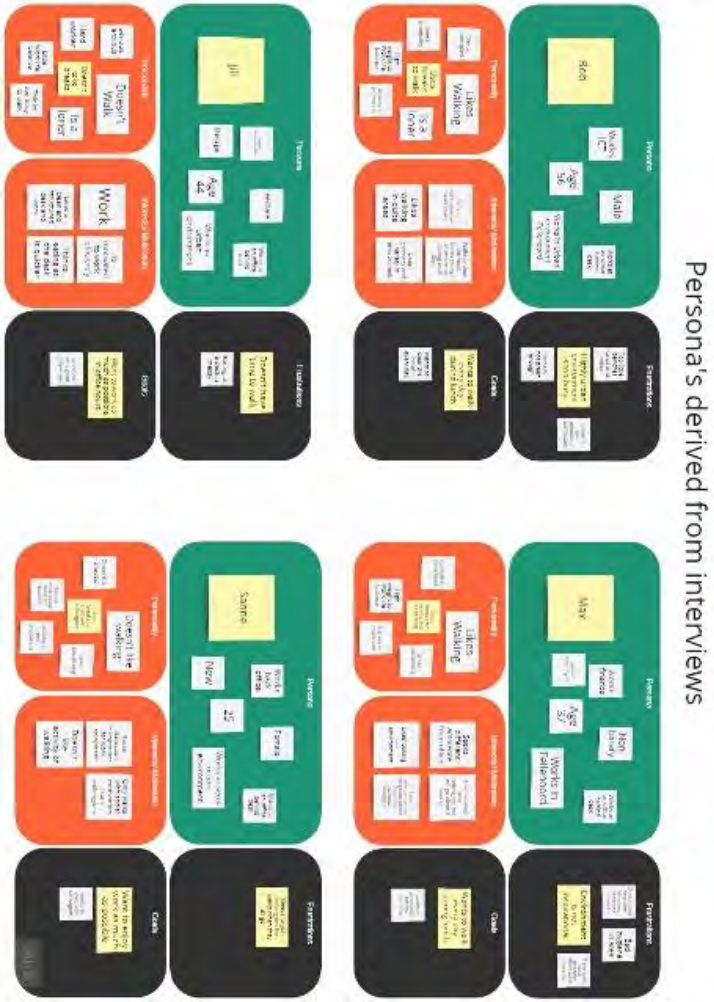
Thank you for your participation.

b. Results For readability, Images of work on results are additionally added as separate files in the folder "\Finaldeliverable_D_S_Vermeer\Explore-Interview research")

c. **Persona's**

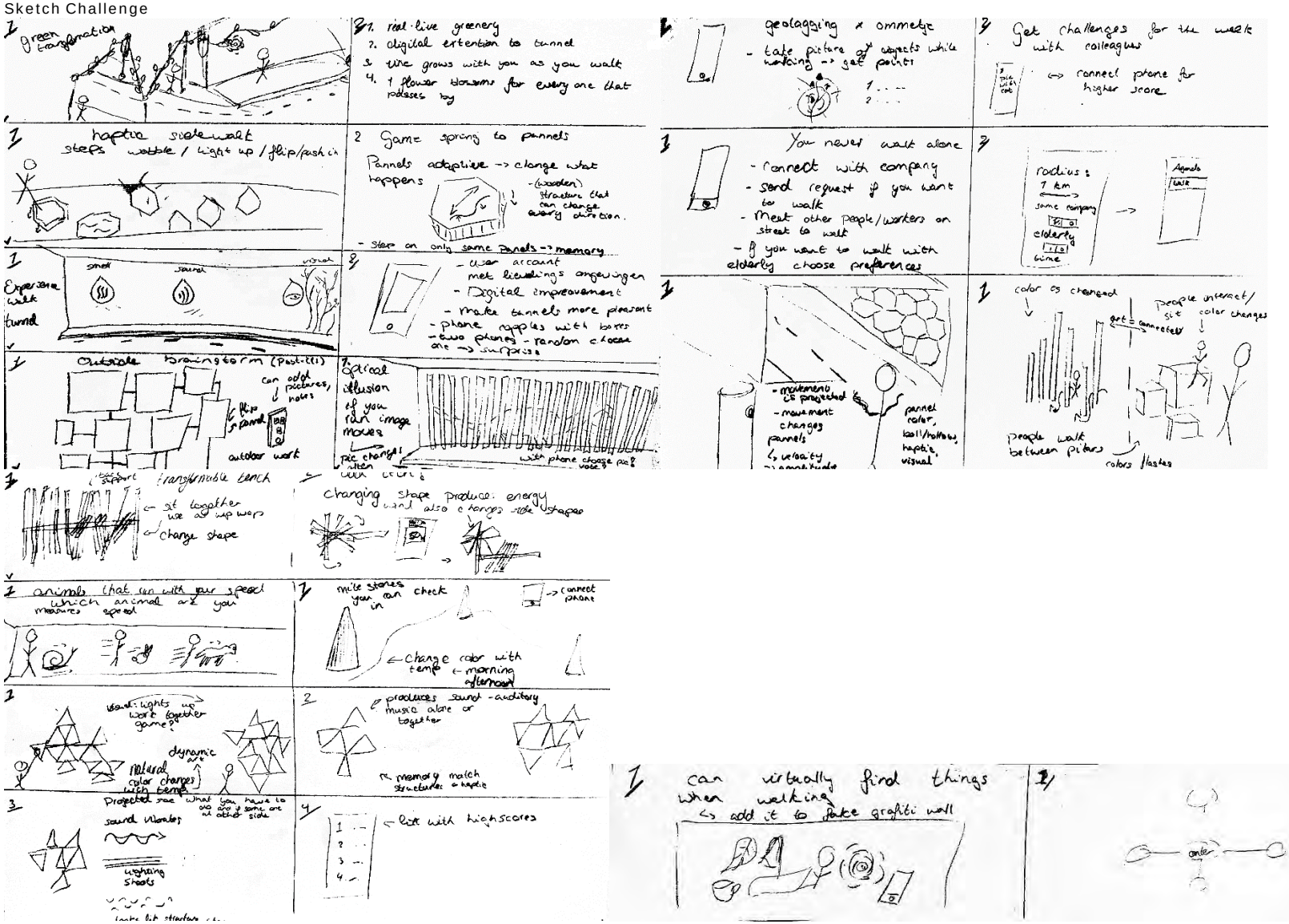
(For readability, Images of work on persona's are additionally added as separate files in the folder "\Finaldeliverable_D_S_Vermeer\Explore-Interview research")



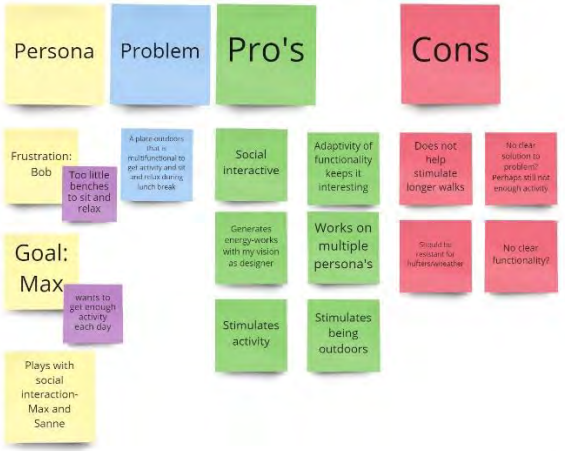


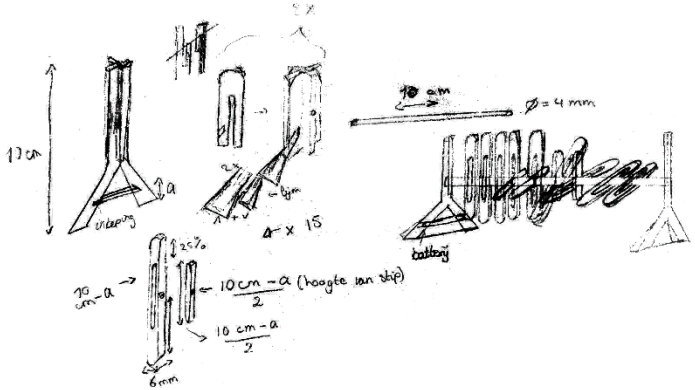
IV. Sketches.

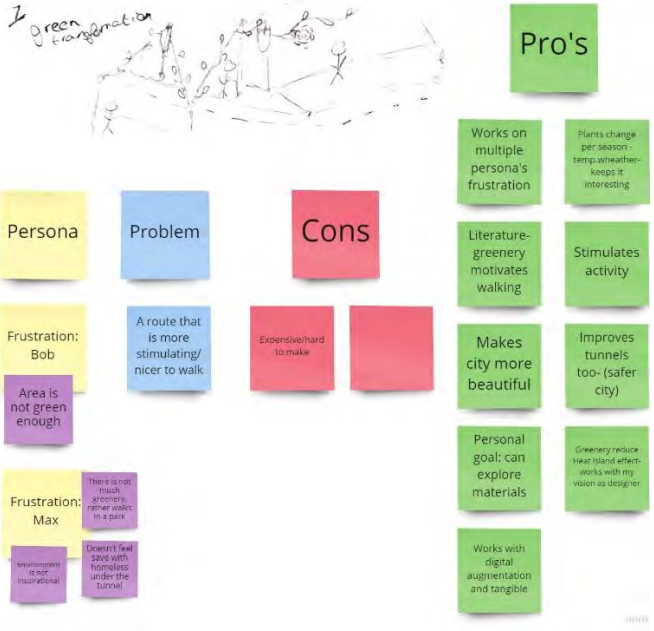
a. Sketch Challenge



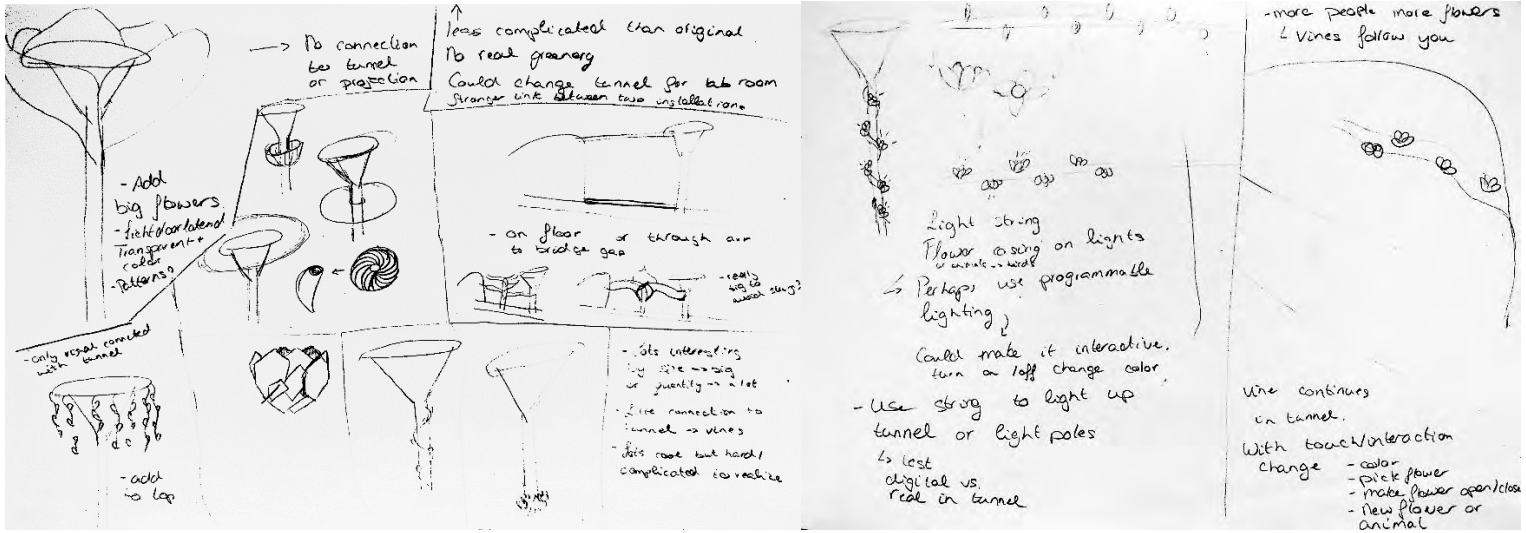
b. Decision process







c. Second Iteration sketches



V. Prototyping

a. First Iteration

b. Processing Code

The files have also been provided in the folder "\Finaldeliverable_D_S_Vermeer\DemoDay\Midterm\Prototype"

```
float x;
float y;

float easing = 0.05;
float offset = 0;

int num = 50;
float mx[] = new float[num];
float my[] = new float[num];



PImage mouseCursor;
PImage flower;
PImage wall;

ArrayList<PVector> clickedPos = new
ArrayList<PVector>();

void setup() {

 size(1600, 1200);

 noStroke();

 smooth();

 fill(255, 153);

  //Import images

 mouseCursor = loadImage("MouseCursor3.png");

 flower = loadImage("flower.png");

 wall = loadImage("wall.jpeg");

 background(wall);

}

void draw() {

 int which = (frameCount/3) % num;

 mx[which] = mouseX;

 my[which] = mouseY;

 for (int i = 0; i < num; i++) {

  // which+1 is the smallest (the oldest in the array)

   float targetX = mouseX;

   float dx = targetX - x;

   x += dx * easing;

   float targetY = mouseY;

   float dy = targetY - y;

   y += dy * easing;

  int index = (which+1 + i) % num;

  image(mouseCursor,mx[index], my[index], 115, 80);

 }

  for (int j = 0; j < clickedPos.size(); j++) {

  image(flower, clickedPos.get(j).x, clickedPos.get(j).y,
40, 40);

 }

}

void mouseClicked() {

 // Add a new position to the array

 // The positions will be used to draw the ellipses

 clickedPos.add(new PVector(mouseX, mouseY));

}
```

c. Arduino Code Wall Interaction

The files have also been provided in the folder "\Finaldeliverable_D_S_Vermeer\DemoDay\Midterm\Prototype"

```
const int TRIGX = 5;

const int ECHOX = 4;

const int TRIGY = 7;

const int ECHOY = 6;

// Define the number of samples to keep track of. The higher the number, the

// more the readings will be smoothed, but the slower the output will respond to

// the input. Using a constant rather than a normal variable lets us use this

// value to determine the size of the readings array.

const int numReadings = 10;

int readingsx[numReadings];      // the readings from the analog input of x axis

int readingsy[numReadings];      // the readings from the analog input of y axix

int readIndexx = 0;              // the index of the current reading

int totalx = 0;                  // the running total

int averagex = 0;                // the average

int readIndexy = 0;              // the index of the current reading

int totaly = 0;                  // the running total

int averagey = 0;

void setup (){

   // initialize serial communication with computer:

Serial.begin(9600);

pinMode(TRIGX, OUTPUT);

pinMode(ECHOX, INPUT);

pinMode(TRIGY, OUTPUT);

pinMode(ECHOY, INPUT);

  // initialize all the readings to 0:

  for (int thisReading = 0; thisReading < numReadings; thisReading++) {

    readingsx[thisReading] = 0;

  }

  // initialize all the readings to 0:

  for (int thisReading = 0; thisReading < numReadings; thisReading++) {

    readingsy[thisReading] = 0;

  }

}

void loop() {

int dataX = GetUltra(TRIGX,ECHOX);

int dataY = GetUltra(TRIGY,ECHOY);

Serial.flush();

  // subtract the last reading:

  totalx = totalx - readingsx[readIndexx];

  // read from the sensor:

readingsx[readIndexx] = dataX;

// add the reading to the total:

totalx = totalx + readingsx[readIndexx];

// advance to the next position in the array:

readIndexx = readIndexx + 1;


// if we're at the end of the array...

if (readIndexx >= numReadings) {

  // ...wrap around to the beginning:

  readIndexx = 0;

}

// calculate the average:

averagex = totalx / numReadings;

// send it to the computer as ASCII digits

Serial.print(averagex);

delay(1);        // delay in between reads for stability

  // subtract the last reading:

totaly = totaly - readingsy[readIndexy];

// read from the sensor:

readingsy[readIndexy] = dataY;

// add the reading to the total:

totaly = totaly + readingsy[readIndexy];

// advance to the next position in the array:
```

```
  readIndexy = readIndexy + 1;
  // if we're at the end of the array...
  if (readIndexy >= numReadings) {
    // ...wrap around to the beginning:
    readIndexy = 0;
  }
  // calculate the average:
  averagey = totaly / numReadings;
  // send it to the computer as ASCII digits
  Serial.print(',');Serial.println(averagey);
  delay(1);        // delay in between reads for stability


  delay(20);
}


double GetUltra ( int trig , int echo){
digitalWrite(trig , LOW);
delayMicroseconds(2);
digitalWrite(trig, HIGH);
delayMicroseconds(8);
digitalWrite(trig, LOW);
double distance = ( pulseIn(echo, HIGH) )* 343.2 / 2000;
return distance;


}
```

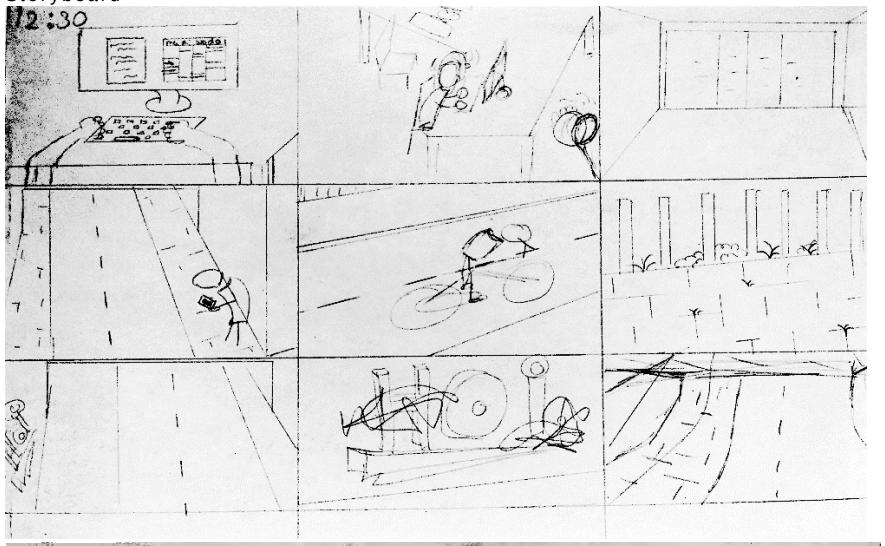
d. Arduino Code Final Prototype Light String

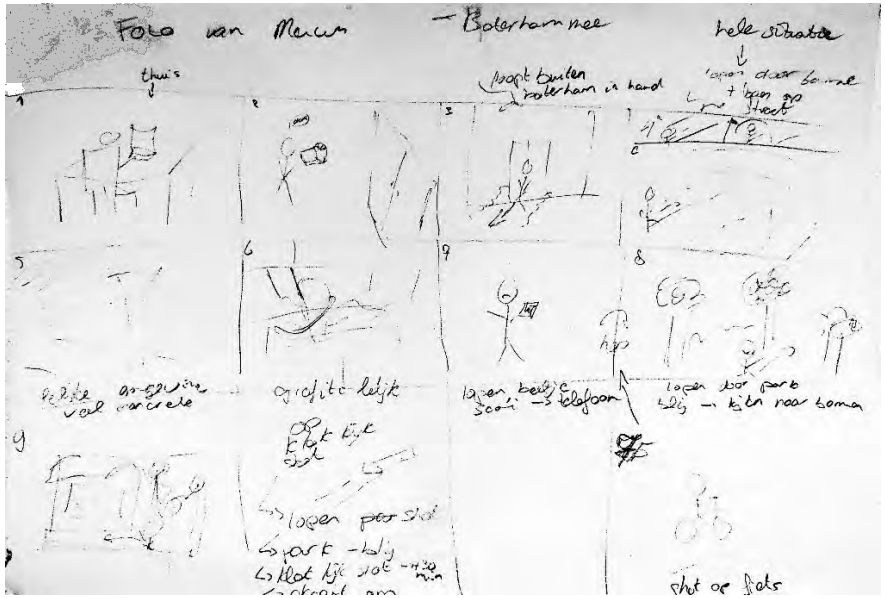
```
#include <FastLED.h>

FASTLED_USING_NAMESPACE
//Basis used of
// FastLED "100-lines-of-code" demo reel,
// -Mark Kriegsman, December 2014

#if defined(FASTLED_VERSION) &&
(FASTLED_VERSION < 3001000)
#warning "Requires FastLED 3.1 or later; check
github for latest code."
#endif

//define pin numbers
//proximity sensor
const int trigPin = 9;
const int echoPin = 10;
const int TRIGX = 5;
const int ECHOX = 4;


//rgb led
#define DATA_PIN    7
//#define CLK_PIN   4
#define LED_TYPE    WS2813
#define COLOR_ORDER RGB
#define NUM_LEDS    60
CRGB leds[NUM_LEDS];

#define BRIGHTNESS         100
#define FRAMES_PER_SECOND  120

// defines variables for proximity sensor
long duration;
int distance;
int safetyDistance;
const int numReadings = 5;      // Define the
number of samples to keep track of.
int readings[numReadings];      // the readings
from the analog input of x axis
int readIndexx = 0;             // the index of the
current reading
int total = 0;                  // the running total
int average = 0;                // the average
void setup() {
  delay(3000); // 3 second delay for recovery

  // tell FastLED about the LED strip
configuration
  FastLED.addLeds<LED_TYPE, DATA_PIN,
COLOR_ORDER>(leds,
NUM_LEDS).setCorrection(TypicalLEDStrip);

//FastLED.addLeds<LED_TYPE,DATA_PIN,CLK_P
IN,COLOR_ORDER>(leds,
NUM_LEDS).setCorrection(TypicalLEDStrip);

FastLED.setMaxPowerInVoltsAndMilliamps(5,500
);

  // set master brightness control
//Added to let brightness adapt to level of light
outdoor
  FastLED.setBrightness(BRIGHTNESS);

  //For the proximity sensor
  pinMode(trigPin, OUTPUT); // Sets the trigPin
as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin
as an Input

    // initialize all the readings to 0:
  for (int thisReading = 0; thisReading <
numReadings; thisReading++) {
    readings[thisReading] = 0;
  }

  //initialize the ldr sensor pin as an input- for
brightness.
  Serial.begin(9600); // Starts the serial
communication
}


// List of patterns to cycle through.  Each is
defined as a separate function below.
typedef void (*SimplePatternList[])();
SimplePatternList gPatterns = {rainbow, bpm,
rainbowWithGlitter, juggle, bpm, sinelon };
uint8_t gCurrentPatternNumber = 0; // Index
number of which pattern is current
uint8_t gHue = 0; // rotating "base color" used
by many of the patterns

void loop(){

  //For the proximity sensor
  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);

  // Sets the trigPin on HIGH state for 10 micro
seconds
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Reads the echoPin, returns the sound wave
travel time in microseconds
  duration = pulseIn(echoPin, HIGH);

  // Calculating the distance
  distance = duration * 0.034 / 2;
  // Prints the distance on the Serial Monitor
  Serial.print("Distance: ");
  Serial.println(distance);

  safetyDistance = distance;

  //When the average is below 20 for a more
measurements,this indicates that a person has
stopped to look.

    // subtract the last reading:
  total = total - readings[readIndexx];
  // read from the sensor:
  readings[readIndexx] = distance;
  // add the reading to the total:
  total = total + readings[readIndexx];
  // advance to the next position in the array:
  readIndexx = readIndexx + 1;

  // if we're at the end of the array...
  if (readIndexx >= numReadings) {
    // ...wrap around to the beginning:
    readIndexx = 0;
  }
```

```
  // calculate the average:
  average = total / numReadings;
  Serial.print("average: ");
  Serial.println(average);


 gPatterns[0]();

  if (average <= 20) {
     FastLED.setBrightness(100);

    // Call the current pattern function once,
updating the 'leds' array
    gPatterns[gCurrentPatternNumber]();

    // send the 'leds' array out to the actual LED
strip
    FastLED.show();
    // insert a delay to keep the framerate
modest
    FastLED.delay(1000 /
FRAMES_PER_SECOND);

    // do some periodic updates
    EVERY_N_MILLISECONDS( 10 ) {
      gHue++;  // slowly cycle the "base color"
through the rainbow
    }
    EVERY_N_SECONDS( 5 ) {
      nextPattern();  // change patterns
periodically
    }

  } else if (safetyDistance <= 50) {
     FastLED.setBrightness(100);
    for (int i=0; i<NUM_LEDS;i++){
      gPatterns[1];
      leds[i]=CRGB(255,0,0);
      FastLED.delay(1000 /
FRAMES_PER_SECOND);
      FastLED.show();
      }
    } if(safetyDistance > 50) {
      FastLED.setBrightness(0);
      FastLED.show();
     }

}

#define ARRAY_SIZE(A) (sizeof(A) /
sizeof((A)[0]))

void nextPattern()
{
  // add one to the current pattern number, and
wrap around at the end
  gCurrentPatternNumber =
(gCurrentPatternNumber + 1) % ARRAY_SIZE(
gPatterns);
}

void rainbow()
{
  // FastLED's built-in rainbow generator
  fill_rainbow( leds, NUM_LEDS, gHue, 7);
}

void rainbowWithGlitter()
{
  // built-in FastLED rainbow, plus some random
sparkly glitter
  rainbow();
  addGlitter(80);
}

void addGlitter( fract8 chanceOfGlitter)
{
  if ( random8() < chanceOfGlitter) {
    leds[ random16(NUM_LEDS) ] +=
CRGB::White;
  }
}

void confetti()
{
  // random colored speckles that blink in and
fade smoothly
  fadeToBlackBy( leds, NUM_LEDS, 10);
  int pos = random16(NUM_LEDS);
  leds[pos] += CHSV( gHue + random8(64),
200, 255);
}

void sinelon()
{
  // a colored dot sweeping back and forth, with
fading trails
  fadeToBlackBy( leds, NUM_LEDS, 20);
  int pos = beatsin16( 13, 0, NUM_LEDS - 1 );
  leds[pos] += CHSV( gHue, 255, 192);
}

void bpm()
{
  // colored stripes pulsing at a defined Beats-
Per-Minute (BPM)
  uint8_t BeatsPerMinute = 62;
  CRGBPalette16 palette = PartyColors_p;
  uint8_t beat = beatsin8( BeatsPerMinute, 64,
255);
  for ( int i = 0; i < NUM_LEDS; i++) { //9948
    leds[i] = ColorFromPalette(palette, gHue + (i
* 2), beat - gHue + (i * 10));
  }
}

void juggle() {
  // eight colored dots, weaving in and out of
sync with each other
  fadeToBlackBy( leds, NUM_LEDS, 20);
  byte dothue = 0;
  for ( int i = 0; i < 8; i++) {
    leds[beatsin16( i + 7, 0, NUM_LEDS - 1 )] |=
CHSV(dothue, 200, 255);
    dothue += 32;
  }
}
```

VI. Video Scenario

a. Storyboard





b. Script

= +1 needed = +2 needed = +3 needed

Film 1: Street Current.

Goal: Set base + mood
Problem definition of Office Workers

Area is not Green enough not safe → homeless
not stimulating to walk not inspirational
PM → add / find inspiration

Target = Office Workers POV → 1st Person

Flow:

1.3 lock screen, view of forest / park

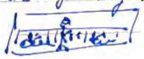
1. Working behind desk
1.2 clock after effects tells it's break
2. Waves coworker to come with
↳ Declines → nods no

3. Doors open → leaves building

4. overgang / Transfer
missing tunnel. 1st P looks at people on (a bench) on phone corner

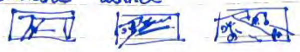
5. 1st person shifts view to left – to bike lane people cycling with head down

6. Cross street, shot with goal saying no green, beton, ugly
look at concrete
look at pathetic greenery? if it's there, up and down tree



→ mark point. 8th shot cross street see greenery there

Greenery
7. Walk towards tunnel 7.2 → look left graffiti
7.3 → look right people hurry
people on phone



8. In tunnel
See homeless? ↳ look at the wall end
filth look to right to the wall
see people walking by hurry / on phone

Film 2: Street + Tangible / Virtual

(16a → Tangible, 16b+ → Virtual)

Goal / mood: Connected with environment, relax, interesting, fun
Present in here + now
Restorativeness: Being away, fascination, compatibility + scope
↳ Ambiance
POV: 1st Person, regular visitors

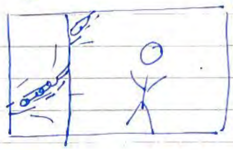
1. Working behind desk (same shot)
2. Wave coworker to come with
nods yes

3. leaves building (same shot)
walk + rightside corner, see coworker (chats)
4. look at people, looking at tunnel (2)

5. People walk towards tunnel (2)

6. People point(s), coworker enters view

walks shifts towards people / pole ← Pole Scenario
7. See people leaving → lights follow



P1 leaves
Just + near in start
P2 leaves

close to lights
8. semi-upwards, light = out
closer coworker standing still, is close now
coworker look at lights
light show ↳ starts waving / jumping

9. Close-up of lights + waving hand

10. look at tunnel walks further
11. Close up in sky

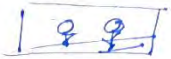
... leave light.
12. look at tunnel, walks
13. look back, light = out, See coworker?
14. Cross street (with coworker)
15. look at tunnel end, shift to right, look at
16a wall, people walking by towards pole painting

Virtual

16 b) look at wall tunnel

See 1 person outside tunnel passing by.
(after effects: vine grows with)

17) Person 1 is followed by another



(after effects: 2nd vine)

18) P.1 stops to look at wall, P.2 slows down (after effect: flower, vine)

19) P.1 & P.2 talk to eachother pointing/amused

20) P.2 walk a bit back, while P.1 moves closer / interacts → waves ↑

(after effects vine follows, flower changes color

21) P.2 stops, P.1 walks further

(flower grows A.E. vine follows)

21.a) P.3 enters left & office worker random / A.E. along vine = motivational quote)

21.b) P.3 stops to read, P.2 leaves to left, P.3 leaves to right

22) Coworker and you cross streets.
Coworker in front.

Shift

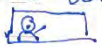
23) Coworker approaches and walks to left

(A.E. vine with 2 branches grows, text becomes visible.

24) You and coworker stop

25) Coworker interacts, jumps
(A.E. flower changes

26) Coworker turns around and points at vine wall text
→ starts talking.



27) Hand gestures indicate talk about topic.

28) You and coworker walk back while talking

29) → see edge of tunnel, lighting & vines
look to left

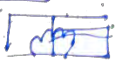
lights

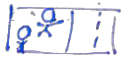
30

31) lights

32)

lighting guides
You steps closer, lighting shows and flower changes color
You look back to right people approaching and pointing





VII. Interview Questions

Demographic questions:

Name:

Age:

Work:

Location of office:

PRS Perceived restorative scale –

Answers with 7-item likert scale – ART: attention restoration theory

Factor: Being Away

1. I can imagine that being here is an escape experience. *

2. Spending time here would give me a break from my day-to-day routine. †

3. This seems like a place to get away from it all.

4. I could imagine being here helps me to relax my focus on getting things done.

5. Coming here could help me to get relief from unwanted demands on my attention.

Factor Fascination:

6. This place has fascinating qualities. *

7. My attention is drawn to many interesting things. *

8. I imagine, I want to get to know this place better. †

9. There is much to explore and discover here. *

10. If I was here, I would want to spend more time looking at the surroundings. †

11. This place is boring. (-)

12. The setting is fascinating.

13. There is nothing worth looking at here. (-)

Factor Coherence: extent – scope and connectedness

14. There is too much going on. (-) *

15. It seems to me that it would be a confusing place. (-) *

16. There is a great deal of distraction. (-) *

17. It feel like it is chaotic here. (-) *

Factor Compatibility: (23-26 = legibility ; refers to the possibilities one sees in an environment for staying oriented and making sense of the surroundings as one proceeds further)

18. Being here suits my personality. *

19. I feel like I can do things I like here. *

20. I would have a sense that I belong here. *

21. I think I could find ways to enjoy myself here. †

22. I have a sense of oneness with this setting. *

~~23. There are landmarks to help me get around. ‡~~

~~24. I could easily form a mental map of this place. ‡~~

~~25. It is easy to find my way around here. ‡~~

~~26. It is easy to see how things are organized.~~

ROS-6 items SRT and ART

Relaxation and calmness, attention restoration, clearing thoughts Subjective restoration

Answers with 7-item likert- scale

“I would feel calmer after being here,”

“I could imagine that My concentration and alertness clearly increase here,”

“I could get new enthusiasm and energy for my everyday routines from here,”

“I think that After visiting this place, I would always feel restored and relaxed,”

“I imagine that I can forget everyday worries here”

“I believe that Visiting here is a way of clearing and clarifying my thoughts”

Open interview:

Is there anything you would like to add or comment on following the questionnaire?

Goal: (extra info/thoughts of participant on questions and restorativeness of the concept. Check here and during interview if they understood the concept, if not explain.)

What do you think about the concept? *(general opinion)*

What kind of feelings/associations do you get/have from this concept? *(affect)*

Does this concept draw your attention? *(check design rational)*

Does this concept maintain your attention? *(check design rational)*

Does this concept give you the feeling of being more in nature? *(check design rational)*

Would you like to see this in the city, why? *(benefits, or cons)*

What did you find interesting? *(benefits, or cons)*

What could be improved? *(benefits, or cons)*

If you were to work in this area, what would this concept do for your motivation to walk during the lunch? *(check concept goal; motivation, triggered action)*

--Last question is only after the third video has been shown –

If you think back about the previous video (2) and the one you just saw (video 3). Which concept do you like better and why? *(direct comparison)*

In the last video (3) you just saw, there was a part inside the tunnel and there was the lightstring outside. How would you like it if that was just the piece in the tunnel? *(understand importance of combined/individual)*

Thank you for participating. Do you have any further questions or comments?

VIII. Quantitative Data Analysis

(For readability, Images of results are added as separate files in the folder "\Finaldeliverable_D_S_Vermeer\Final Research\Questionnaire Analysis")

a. Summarized per video

. sum if ihaveseen=="Video 1"

Variable	Obs	Mean	Std. Dev.	Min	Max
tijdstempel	0				
participant	6	3.5	1.870829	1	6
ihaveseen	0				
age	0				
whattypeof~o	0				
whereisyou~d	0				
doyouhavec~s	0				
doyouregul~c	0				
factorbein~y	0				
icanimagin~a	6	2.5	.83666	1	3
spendingti~a	6	3	1.264911	2	5
thisseemsl~m	6	2.5	1.378405	1	4
icouldimag~r	6	2.166667	.4082483	2	3
cominghere~f	6	3.666667	1.21106	2	5
factorfasc~n	0				
thisplaceh~s	6	1.833333	.7527727	1	3
myattentio~t	6	1.666667	.8164966	1	3
iimagineiw~c	6	1.5	.83666	1	3
thereismuc~h	6	1.5	.83666	1	3
ifiwashere~t	6	1.666667	.8164966	1	3
thisplacei~v	6	1.5	.83666	1	3
thesetting~g	6	3.333333	1.861899	2	7
thereareth~e	6	4	2	2	7
factorcohe~e	0				
thereistoo~n	6	2.833333	1.602082	1	5
itseemstom~i	6	2.5	1.048809	1	4
thereisagr~n	6	3	1.414214	1	5
itfeellike~e	6	3.166667	1.722401	1	5
factorcomp~y	0				
beingheres~y	6	1.5	.83666	1	3
ifeellikei~e	6	1.166667	.4082483	1	2
iwouldhave~e	6	1.333333	.5163978	1	2
ithinkicou~l	6	2.333333	1.505545	1	5
ihaveasens~t	6	2.5	1.870829	1	6
ros	0				
Iwouldfeel~e	6	2.333333	1.505545	1	4
Icouldimag~n	6	2.166667	1.169045	1	4
icouldgetn~f	6	2.166667	1.47196	1	5
Ithinkthat~e	6	1.833333	.7527727	1	3
Iimagineth~o	6	2.166667	.7527727	1	3
Ibelieveth~f	6	2.666667	1.21106	1	4

. sum if ihaveseen=="Video 2"

Variable	Obs	Mean	Std. Dev.	Min	Max
tijdstempel	0				
participant	6	3.5	1.870829	1	6
ihaveseen	0				
age	0				
whattypeof~o	0				
whereisyou~d	0				
doyouhavec~s	0				
doyouregul~c	0				
factorbein~y	0				
icanimagin~a	6	5.666667	1.032796	4	7
spendingti~a	6	5	.6324555	4	6
thisseemsl~m	6	4.5	.5477226	4	5
icouldimag~r	6	4.166667	1.602082	2	6
cominghere~f	6	4.833333	1.47196	3	7
factorfasc~n	0				
thisplaceh~s	6	4.666667	.5163978	4	5
myattentio~t	6	4.5	1.378405	2	6
iimagineiw~c	6	3.833333	1.169045	2	5
thereismuc~h	6	3.833333	.9831921	2	5
ifiwashere~t	6	4	1.264911	2	5
thisplacei~v	6	4.166667	1.32916	3	6
thesetting~g	6	4.666667	.5163978	4	5
thereareth~e	6	5.5	1.378405	3	7
factorcohe~e	0				
thereistoo~n	6	2.333333	1.032796	1	4
itseemstom~i	6	2.333333	1.032796	1	4
thereisagr~n	6	4	1.549193	2	5
itfeellike~e	6	2.166667	.9831921	1	4
factorcomp~y	0				
beingheres~y	6	3.666667	1.36626	1	5
ifeellikei~e	6	4.333333	1.36626	2	6
iwouldhave~e	6	3.333333	.8164966	2	4
ithinkicou~l	6	4.5	.83666	3	5
ihaveasens~t	6	3.5	.83666	2	4
ros	0				
Iwouldfeel~e	6	5.166667	.7527727	4	6
Icouldimag~n	6	4.5	1.378405	2	6
icouldgetn~f	6	4.333333	1.36626	2	6
Ithinkthat~e	6	4.166667	1.169045	2	5
Iimagineth~o	6	3.5	1.048809	2	5
Ibelieveth~f	6	4.333333	1.632993	1	5

. sum if ihaveseen=="Video 3"

Variable	Obs	Mean	Std. Dev.	Min	Max
tijdstempel	0				
participant	6	3.5	1.870829	1	6
ihaveseen	0				
age	6	30	12.86857	23	56
whattypeof~o	0				
whereisyou~d	0				
doyouhavec~s	0				
doyouregul~c	0				
factorbein~y	0				
icanimagin~a	6	5.833333	.7527727	5	7
spendingti~a	6	6	.8944272	5	7
thisseemsl~m	6	5.333333	1.36626	3	7
icouldimag~r	6	5.833333	.7527727	5	7
cominghere~f	6	6.333333	.5163978	6	7
factorfasc~n	0				
thisplaceh~s	6	6.333333	1.21106	4	7
myattentio~t	6	6.166667	.7527727	5	7
iimagineiw~c	6	5.833333	1.47196	3	7
thereismuc~h	6	6.166667	.7527727	5	7
ifiwashere~t	6	5.666667	1.36626	3	7
thisplacei~v	6	6.5	.5477226	6	7
thesetting~g	6	5.833333	.4082483	5	6
thereareth~e	6	6.333333	.5163978	6	7
factorcohe~e	0				
thereistoo~n	6	2.666667	1.75119	1	6
itseemstom~i	6	2.166667	.9831921	1	4
thereisagr~n	6	5.166667	1.602082	2	6
itfeellike~e	6	1.833333	.9831921	1	3
factorcomp~y	0				
beingheres~y	6	4.833333	1.47196	2	6
ifeellikei~e	6	5.333333	.5163978	5	6
iwouldhave~e	6	4.333333	1.032796	3	6
ithinkicou~l	6	5.5	.5477226	5	6
ihaveasens~t	6	5	.8944272	4	6
ros	0				
Iwouldfeel~e	6	6	.8944272	5	7
Icouldimag~n	6	6	.6324555	5	7
icouldgetn~f	6	6.333333	.5163978	6	7
Ithinkthat~e	6	5.333333	1.36626	3	7
Iimagineth~o	6	5	1.67332	3	7
Ibelieveth~f	6	5.166667	1.169045	3	6

b. Factor Analysis

Factor analysis/correlation — Number of obs = 18
Method: principal-component factors — Retained factors = 5
Rotation: (unrotated) — Number of params = 130

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	17.28675	14.69743	0.6174	0.6174
Factor2	2.58933	0.78403	0.0925	0.7099
Factor3	1.80530	0.51126	0.0645	0.7743
Factor4	1.29404	0.21175	0.0462	0.8206
Factor5	1.08229	0.28107	0.0387	0.8592
Factor6	0.80122	0.06300	0.0286	0.8878
Factor7	0.73821	0.10801	0.0264	0.9142
Factor8	0.63020	0.19595	0.0225	0.9367
Factor9	0.43425	0.09589	0.0155	0.9522
Factor10	0.33836	0.03382	0.0121	0.9643
Factor11	0.30454	0.08776	0.0109	0.9752
Factor12	0.21678	0.05788	0.0077	0.9829
Factor13	0.15890	0.02626	0.0057	0.9886
Factor14	0.13264	0.03545	0.0047	0.9933
Factor15	0.09719	0.02171	0.0035	0.9968
Factor16	0.07548	0.06097	0.0027	0.9995
Factor17	0.01452	0.01452	0.0005	1.0000
Factor18	0.00000	0.00000	0.0000	1.0000
Factor19	0.00000	0.00000	0.0000	1.0000
Factor20	0.00000	0.00000	0.0000	1.0000
Factor21	0.00000	0.00000	0.0000	1.0000
Factor22	0.00000	0.00000	0.0000	1.0000
Factor23	0.00000	0.00000	0.0000	1.0000
Factor24	-0.00000	0.00000	-0.0000	1.0000
Factor25	-0.00000	0.00000	-0.0000	1.0000
Factor26	-0.00000	0.00000	-0.0000	1.0000
Factor27	-0.00000	0.00000	-0.0000	1.0000
Factor28	-0.00000	.	-0.0000	1.0000

LR test: independent vs. saturated: chi2(378) = 3111.34 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Factor5	Uniqueness
icanimagin~a	0.8580	0.0905	0.0493	0.1954	-0.1866	0.1803
spendingti~a	0.8653	-0.0577	0.0605	-0.2289	-0.2194	0.1437
thisseemsl~m	0.8224	0.0714	0.0693	0.1667	-0.3884	0.1351
icouldimag~r	0.8914	-0.0564	-0.1433	0.1775	-0.0339	0.1490
cominghere~f	0.6806	-0.2236	0.1711	0.4331	-0.1936	0.2324
thisplaceh~s	0.9462	0.0491	0.1334	0.0546	-0.0352	0.0803
myattentio~t	0.9433	0.0539	-0.1845	-0.0259	0.1235	0.0573
iimagineiw~c	0.9135	0.0474	-0.0205	0.0977	0.1133	0.1405
thereismuc~h	0.9271	0.0864	-0.0399	0.1232	0.2381	0.0596
ifiwashere~t	0.9277	0.0668	-0.1630	0.0857	-0.0152	0.1009
thisplacei~v	0.8900	0.0527	0.2166	-0.0061	0.0655	0.1539
thesetting~g	0.6110	-0.4576	0.1038	-0.1305	0.4213	0.2121
thereareth~e	0.5334	-0.5360	0.4479	0.1904	0.3645	0.0585
thereistoo~n	-0.1563	0.6994	0.2183	0.0562	0.3118	0.3384
itseemstom~i	-0.2038	0.7323	-0.4156	-0.0333	0.1019	0.2380
thereisagr~n	0.4777	0.5146	0.4534	0.0091	0.1318	0.2840
itfeellike~e	-0.4830	0.6894	0.0405	0.4943	0.0709	0.0404
beingheres~y	0.8390	0.0983	0.1768	-0.1604	0.0114	0.2293
ifeellikei~e	0.8674	0.0911	0.2842	-0.1387	0.0419	0.1376
iwouldhave~e	0.8926	0.1679	0.1457	-0.2278	-0.0493	0.0995
ithinkicou~l	0.7935	0.1731	0.3450	0.1936	-0.0071	0.1839
ibaveasens~t	0.6571	0.3595	0.0574	-0.5927	-0.0202	0.0839
Iwouldfeel~e	0.8783	0.0732	-0.0254	-0.2407	-0.2646	0.0946
Icouldimag~n	0.8938	0.0511	-0.2808	-0.1217	0.0878	0.0972
icouldgetn~f	0.8866	0.0511	-0.3636	0.1258	0.0313	0.0624
Ithinkthat~e	0.8568	-0.0580	-0.3499	0.0658	0.1949	0.0978
Iimagineth~o	0.8256	-0.0089	-0.2032	0.1932	-0.2902	0.1555
Ibelieveth~f	0.6814	-0.1258	-0.5893	0.0542	0.2708	0.0962

Complete Questionnaire

Factor analysis/correlation — Number of obs = 18
Method: principal-component factors — Retained factors = 4
Rotation: (unrotated) — Number of params = 82

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	13.25505	10.69027	0.6025	0.6025
Factor2	2.56477	1.32602	0.1166	0.7191
Factor3	1.23876	0.14830	0.0563	0.7754
Factor4	1.09046	0.27720	0.0496	0.8250
Factor5	0.81326	0.10282	0.0370	0.8619
Factor6	0.71044	0.09622	0.0323	0.8942
Factor7	0.61423	0.09714	0.0279	0.9221
Factor8	0.51709	0.17271	0.0235	0.9456
Factor9	0.34438	0.07546	0.0157	0.9613
Factor10	0.26892	0.08394	0.0122	0.9735
Factor11	0.18498	0.04992	0.0084	0.9819
Factor12	0.13506	0.04441	0.0061	0.9881
Factor13	0.09064	0.01417	0.0041	0.9922
Factor14	0.07647	0.01057	0.0035	0.9957
Factor15	0.06591	0.04462	0.0030	0.9987
Factor16	0.02129	0.01301	0.0010	0.9996
Factor17	0.00828	0.00828	0.0004	1.0000
Factor18	0.00000	0.00000	0.0000	1.0000
Factor19	0.00000	0.00000	0.0000	1.0000
Factor20	0.00000	0.00000	0.0000	1.0000
Factor21	-0.00000	0.00000	-0.0000	1.0000
Factor22	-0.00000	.	-0.0000	1.0000

LR test: independent vs. saturated: chi2(231) = 1906.52 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
icanimagin~a	0.8570	0.0939	0.1426	-0.2219	0.1871
spendingti~a	0.8639	-0.0614	-0.2222	0.0133	0.2004
thisseemsl~m	0.8314	0.0693	0.0313	-0.3140	0.2044
icouldimag~r	0.8693	-0.0488	0.0335	-0.2835	0.1604
cominghere~f	0.6897	-0.2298	0.4056	-0.2726	0.2328
thisplaceh~s	0.9586	0.0484	0.0319	-0.0596	0.0743
myattentio~t	0.9142	0.0653	-0.1387	-0.1198	0.1264
iimagineiw~c	0.9100	0.0596	0.0109	-0.0818	0.1615
thereismuc~h	0.9198	0.1006	0.0498	-0.0545	0.1384
ifiwashere~t	0.9096	0.0798	-0.1029	-0.2494	0.0935
thisplacei~v	0.9124	0.0479	0.0620	0.0451	0.1593
thesetting~g	0.6283	-0.4476	-0.0676	0.2464	0.3397
thereareth~e	0.5840	-0.5350	0.4189	0.3139	0.0987
thereistoo~n	-0.1293	0.7062	0.1527	0.3574	0.3335
itseemstom~i	-0.2481	0.7405	-0.1889	-0.2711	0.2809
thereisagr~n	0.5140	0.5018	0.3025	0.3664	0.2582
itfeellike~e	-0.4724	0.6948	0.4540	-0.1679	0.0598
beingheres~y	0.8572	0.1023	-0.1349	0.1716	0.2071
ifeellikei~e	0.8896	0.0867	0.0115	0.2261	0.1498
iwouldhave~e	0.9091	0.1652	-0.1893	0.1151	0.0972
ithinkicou~l	0.8191	0.1726	0.3224	0.1297	0.1786
ibaveasens~t	0.6621	0.3463	-0.5200	0.2497	0.1089

PRS

Factor analysis/correlation — Number of obs = 18
Method: principal-component factors — Retained factors = 1
Rotation: (unrotated) — Number of params = 6

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.86209	4.31808	0.8103	0.8103
Factor2	0.54401	0.22380	0.0907	0.9010
Factor3	0.32021	0.20471	0.0534	0.9544
Factor4	0.11550	0.02846	0.0192	0.9736
Factor5	0.08703	0.01587	0.0145	0.9881
Factor6	0.07117	.	0.0119	1.0000

LR test: independent vs. saturated: chi2(15) = 112.37 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
Iwouldfeel~e	0.8355	0.3020
Icouldimag~n	0.9481	0.1012
icouldgetn~f	0.9630	0.0726
Ithinkthat~e	0.9467	0.1038
Iimagineth~o	0.8459	0.2845
Ibelieveth~f	0.8522	0.2738

ROS

i. Factor Analysis: Correlation Matrix

	icanim~a	spendi~a	thisse~m	icould~r	coming~f	thispl~s	myatte~t	iimagi~c	therei~h	ifiwas~t	thispl~v	theset~g	therea~e	ther~gon	itseem~i	ther~ion	itfeel~e	beingh~y
icanimagin~a	1.0000																	
spendingti~a	0.8189	1.0000																
thisseemsl~m	0.7978	0.7222	1.0000															
icouldimag~r	0.8175	0.7429	0.7225	1.0000														
cominghere~f	0.6097	0.5225	0.6724	0.7053	1.0000													
thisplaceh~s	0.8195	0.8033	0.8173	0.7989	0.7154	1.0000												
myattentio~t	0.7972	0.7815	0.6666	0.9149	0.5513	0.8781	1.0000											
iimagineiw~c	0.7929	0.7590	0.7307	0.8014	0.5450	0.9048	0.8824	1.0000										
thereismuc~h	0.7779	0.7233	0.7323	0.8358	0.5867	0.8906	0.8988	0.9496	1.0000									
ifiwashere~t	0.7639	0.7177	0.8257	0.8803	0.5974	0.8848	0.9199	0.8997	0.8848	1.0000								
thisplacei~v	0.6974	0.7090	0.7662	0.7439	0.6969	0.8987	0.7922	0.7616	0.8385	0.7936	1.0000							
thesetting~g	0.3666	0.4905	0.3291	0.5224	0.5206	0.5830	0.5641	0.5331	0.5883	0.6065	0.1000							
thereareth~e	0.4273	0.3951	0.3094	0.4940	0.5272	0.5171	0.4510	0.4999	0.5440	0.3855	0.5950	0.6780	1.0000					
thereistoo~n	-0.1007	-0.1933	-0.1318	-0.1496	-0.2506	-0.1006	-0.0818	-0.1153	-0.0228	-0.0936	-0.1197	-0.2132	-0.2984	1.0000				
itseemstom~i	-0.1701	-0.3086	-0.1724	-0.2098	-0.2995	-0.1943	-0.1039	-0.2081	-0.1143	-0.1103	-0.0884	-0.3502	-0.6401	0.3131	1.0000			
thereisagr~n	0.4928	0.4264	0.2934	0.3588	0.2916	0.4952	0.4196	0.5237	0.5093	0.3305	0.4842	0.0783	0.2428	0.3025	0.0596	1.0000		
itfeellike~e	-0.2638	-0.5795	-0.2895	-0.3947	-0.3014	-0.3801	-0.4282	-0.3312	-0.3082	-0.3595	-0.3544	-0.6250	-0.4726	0.5501	0.6209	0.1458	1.0000	
beingheres~y	0.6254	0.7091	0.7633	0.5858	0.3967	0.8162	0.7345	0.7850	0.7506	0.8266	0.7890	0.4952	0.4250	-0.0150	-0.1970	0.4067	-0.3898	1.0000
ifeellikei~e	0.7356	0.7594	0.7294	0.6157	0.5600	0.8314	0.7242	0.7151	0.7587	0.7052	0.8776	0.5923	0.5252	-0.0769	-0.1109	0.5603	-0.4020	0.8634
iwouldhave~e	0.7947	0.8260	0.7433	0.7524	0.4310	0.8319	0.8277	0.8102	0.7975	0.8196	0.7912	0.4982	0.3997	-0.0277	-0.1217	0.5333	-0.4127	0.8520
ithinkicou~l	0.7416	0.6399	0.7009	0.6305	0.6130	0.7663	0.6689	0.6660	0.7002	0.6864	0.7806	0.3456	0.5335	0.0686	-0.1688	0.5767	-0.1782	0.7852
ihaveasens~t	0.4308	0.6746	0.4828	0.5061	0.2042	0.6443	0.6610	0.5533	0.5860	0.5924	0.6607	0.3330	0.0583	0.1717	0.1131	0.5028	-0.3744	0.6334
Iwouldfeel~e	0.7746	0.8393	0.7478	0.7627	0.6029	0.8182	0.8175	0.6964	0.6869	0.7760	0.7980	0.4396	0.2841	-0.2485	-0.0632	0.4791	-0.5172	0.7142
Icouldimag~n	0.7423	0.7834	0.5871	0.8637	0.4765	0.7760	0.9500	0.8017	0.8443	0.8160	0.7311	0.4589	0.3811	-0.1816	-0.0420	0.4278	-0.4702	0.6391
icouldgetn~f	0.7085	0.6594	0.7312	0.8298	0.6244	0.7962	0.8781	0.8122	0.8773	0.8708	0.7504	0.4699	0.3144	-0.2002	0.0389	0.2953	-0.3589	0.6632
Ithinkthat~e	0.6963	0.6874	0.5954	0.7404	0.5124	0.7729	0.8769	0.8244	0.8523	0.8135	0.6766	0.5228	0.4049	-0.1934	-0.0882	0.2879	-0.4436	0.6660
Iimagineth~o	0.7455	0.7547	0.7783	0.8253	0.6548	0.7734	0.7968	0.7625	0.7158	0.8335	0.5981	0.3768	0.2386	-0.1281	-0.2323	0.2400	-0.3437	0.6679
Ibelieveth~f	0.5429	0.5255	0.4290	0.6759	0.3206	0.4886	0.7429	0.6342	0.6869	0.7062	0.4479	0.5046	0.2691	-0.2147	0.0243	0.0406	-0.4082	0.4919

Complete

	ifeell~e	iwould~e	ithink~l	ihavea~t	Iwould~e	Icould~n	icould~f	Ithink~e	Iimagi~o	Ibelie~f
ifeellikei~e	1.0000									
iwouldhave~e	0.8638	1.0000								
ithinkicou~l	0.8540	0.7745	1.0000							
ihaveasens~t	0.6325	0.7581	0.4289	1.0000						
Iwouldfeel~e	0.8190	0.8208	0.6588	0.7437	1.0000					
Icouldimag~n	0.6940	0.7760	0.6111	0.6705	0.8280	1.0000				
icouldgetn~f	0.6904	0.6996	0.6314	0.5213	0.7593	0.8933	1.0000			
Ithinkthat~e	0.6637	0.6225	0.6020	0.4522	0.7030	0.8809	0.9117	1.0000		
Iimagineth~o	0.5840	0.6903	0.6133	0.4277	0.7053	0.7347	0.8076	0.7227	1.0000	
Ibelieveth~f	0.4661	0.4972	0.3988	0.2714	0.5262	0.7675	0.8118	0.8734	0.6092	1.0000

(obs=18)

	icanim~a	spendi~a	thisse~m	icould~r	coming~f	thispl~s	myatte~t	iimagi~c	therei~h	ifiwas~t	thispl~v	theset~g	therea~e	ther~gon	itseem~i	ther~ion	itfeel~e	beingh~y
icanimagin~a	1.0000																	
spendingti~a	0.8189	1.0000																
thisseemsl~m	0.7978	0.7222	1.0000															
icouldimag~r	0.8175	0.7429	0.7225	1.0000														
cominghere~f	0.6097	0.5225	0.6724	0.7053	1.0000													
thisplaceh~s	0.8195	0.8033	0.8173	0.7989	0.7154	1.0000												
myattentio~t	0.7972	0.7815	0.6666	0.9149	0.5513	0.8781	1.0000											
iimagineiw~c	0.7929	0.7590	0.7307	0.8014	0.5450	0.9048	0.8824	1.0000										
thereismuc~h	0.7779	0.7233	0.7323	0.8358	0.5867	0.8906	0.8988	0.9496	1.0000									
ifiwashere~t	0.7639	0.7177	0.8257	0.8803	0.5974	0.8848	0.9199	0.8997	0.8848	1.0000								
thisplacei~v	0.6974	0.7090	0.7662	0.7439	0.6969	0.8987	0.7922	0.7616	0.8385	0.7936	1.0000							
thesetting~g	0.3666	0.4905	0.3291	0.5224	0.5206	0.5830	0.5641	0.5331	0.5883	0.5141	0.6065	1.0000						
thereareth~e	0.4273	0.3951	0.3094	0.4940	0.5272	0.5171	0.4510	0.4999	0.5440	0.3855	0.5950	0.6780	1.0000					
thereistoo~n	-0.1007	-0.1933	-0.1318	-0.1496	-0.2506	-0.1006	-0.0818	-0.1153	-0.0228	-0.0936	-0.1197	-0.2132	-0.2984	1.0000				
itseemstom~i	-0.1701	-0.3086	-0.1724	-0.2098	-0.2995	-0.1943	-0.1039	-0.2081	-0.1143	-0.1103	-0.0884	-0.3502	-0.6401	0.3131	1.0000			
thereisagr~n	0.4928	0.4264	0.2934	0.3588	0.2916	0.4952	0.4196	0.5237	0.5093	0.3305	0.4842	0.0783	0.2428	0.3025	0.0596	1.0000		
itfeellike~e	-0.2638	-0.5795	-0.2895	-0.3947	-0.3014	-0.3801	-0.4282	-0.3312	-0.3082	-0.3595	-0.3544	-0.6250	-0.4726	0.5501	0.6209	0.1458	1.0000	
beingheres~y	0.6254	0.7091	0.7633	0.5858	0.3967	0.8162	0.7345	0.7850	0.7506	0.8266	0.7890	0.4952	0.4250	-0.0150	-0.1970	0.4067	-0.3898	1.0000
ifeellikei~e	0.7356	0.7594	0.7294	0.6157	0.5600	0.8314	0.7242	0.7151	0.7587	0.7052	0.8776	0.5923	0.5252	-0.0769	-0.1109	0.5603	-0.4020	0.8634
iwouldhave~e	0.7947	0.8260	0.7433	0.7524	0.4310	0.8319	0.8277	0.8102	0.7975	0.8196	0.7912	0.4982	0.3997	-0.0277	-0.1217	0.5333	-0.4127	0.8520
ithinkicou~l	0.7416	0.6399	0.7009	0.6305	0.6130	0.7663	0.6689	0.6660	0.7002	0.6864	0.7806	0.3456	0.5335	0.0686	-0.1688	0.5767	-0.1782	0.7852
ihaveasens~t	0.4308	0.6746	0.4828	0.5061	0.2042	0.6443	0.6610	0.5533	0.5860	0.5924	0.6607	0.3330	0.0583	0.1717	0.1131	0.5028	-0.3744	0.6334

PRS

	ifeell~e	iwould~e	ithink~l	ihavea~t
ifeellikei~e	1.0000			
iwouldhave~e	0.8638	1.0000		
ithinkicou~l	0.8540	0.7745	1.0000	
ihaveasens~t	0.6325	0.7581	0.4289	1.0000

	Iwould~e	Icould~n	icould~f	Ithink~e	Iimagi~o	Ibelie~f
Iwouldfeel~e	1.0000					
Icouldimag~n	0.8280	1.0000				
icouldgetn~f	0.7593	0.8933	1.0000			
Ithinkthat~e	0.7030	0.8809	0.9117	1.0000		
Iimagineth~o	0.7053	0.7347	0.8076	0.7227	1.0000	
Ibelieveth~f	0.5262	0.7675	0.8118	0.8734	0.6092	1.0000

ROS

ii. Factor Analysis: Factortest

```
Determinant of the correlation matrix
Det                =     0.000


Bartlett test of sphericity

Chi-square         =          2791.497
Degrees of freedom =               378
p-value            =             0.000
H0: variables are not intercorrelated


Kaiser-Meyer-Olkin Measure of Sampling Adequacy
KMO                =         .
```

Complete

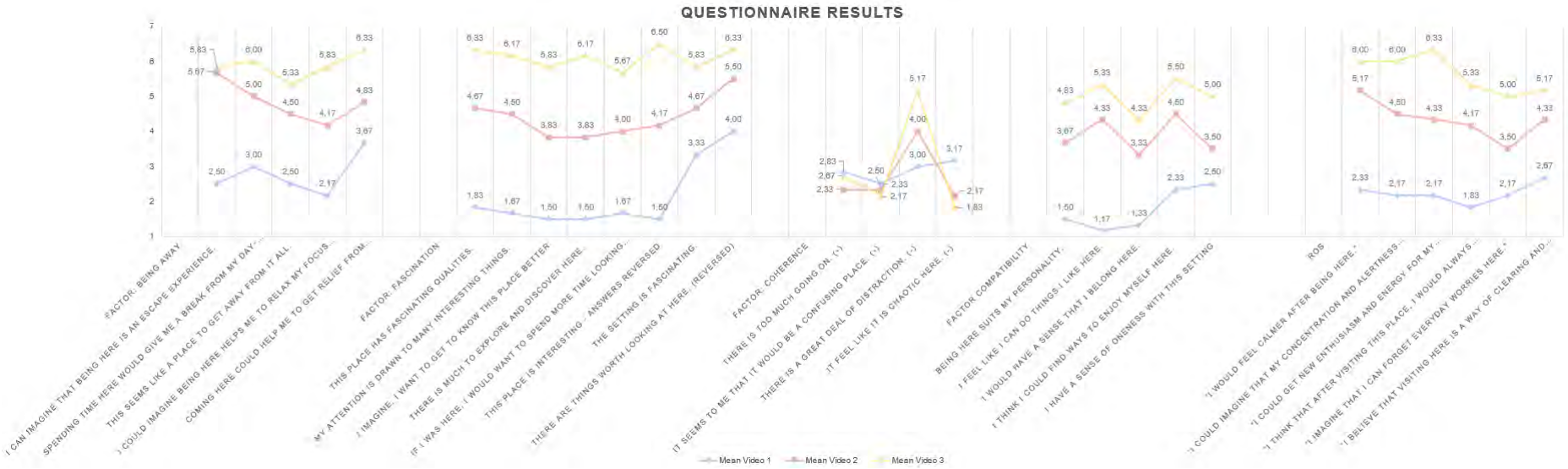
```
Determinant of the correlation matrix
Det                =     0.000


Bartlett test of sphericity

Chi-square         =          1774.196
Degrees of freedom =               231
p-value            =             0.000
H0: variables are not intercorrelated


Kaiser-Meyer-Olkin Measure of Sampling Adequacy
KMO                =         .
```

PRS

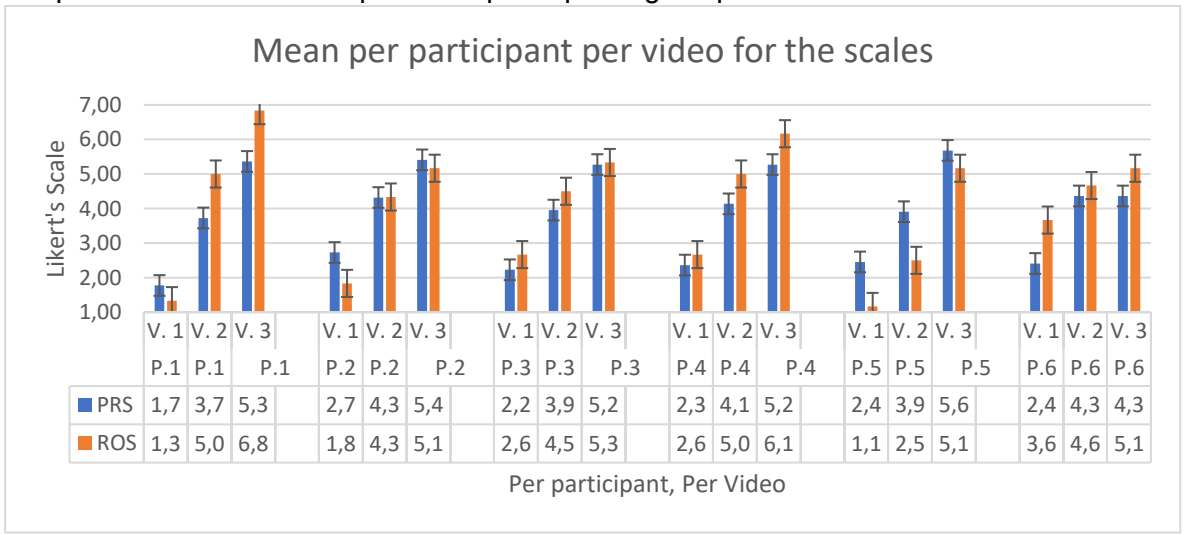
```
Determinant of the correlation matrix
Det                =     0.001


Bartlett test of sphericity

Chi-square         =           104.959
Degrees of freedom =                15
p-value            =             0.000
H0: variables are not intercorrelated


Kaiser-Meyer-Olkin Measure of Sampling Adequacy
KMO                =     0.879
```

ROS

c. Line graph mean per question of all participants per video.



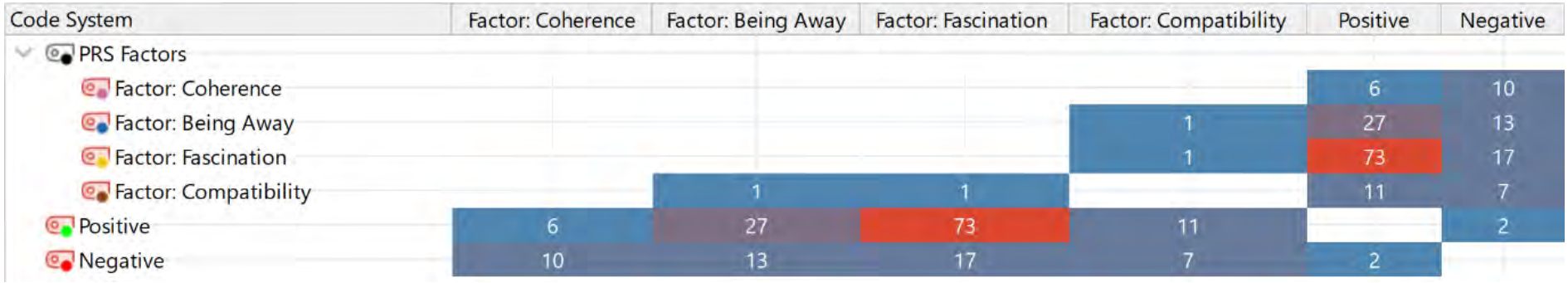
d. Boxplot the mean answers per scale participants gave per video



	V. 1 P.1	V. 2 P.1	V. 3 P.1	V. 1 P.2	V. 2 P.2	V. 3 P.2	V. 1 P.3	V. 2 P.3	V. 3 P.3	V. 1 P.4	V. 2 P.4	V. 3 P.4	V. 1 P.5	V. 2 P.5	V. 3 P.5	V. 1 P.6	V. 2 P.6	V. 3 P.6
PRS	1,7	3,7	5,3	2,7	4,3	5,4	2,2	3,9	5,2	2,3	4,1	5,2	2,4	3,9	5,6	2,4	4,3	4,3
ROS	1,3	5,0	6,8	1,8	4,3	5,1	2,6	4,5	5,3	2,6	5,0	6,1	1,1	2,5	5,1	3,6	4,6	5,1

IX. Qualititative Data Analysis

a. Code relations



Code System	Factor: Coherence	Factor: Being Away	Factor: Fascination	Factor: Compatibility	Positive	Negative
PRS Factors						
Factor: Coherence					6	10
Factor: Being Away				1	27	13
Factor: Fascination				1	73	17
Factor: Compatibility		1	1		11	7
Positive	6	27	73	11		2
Negative	10	13	17	7	2	