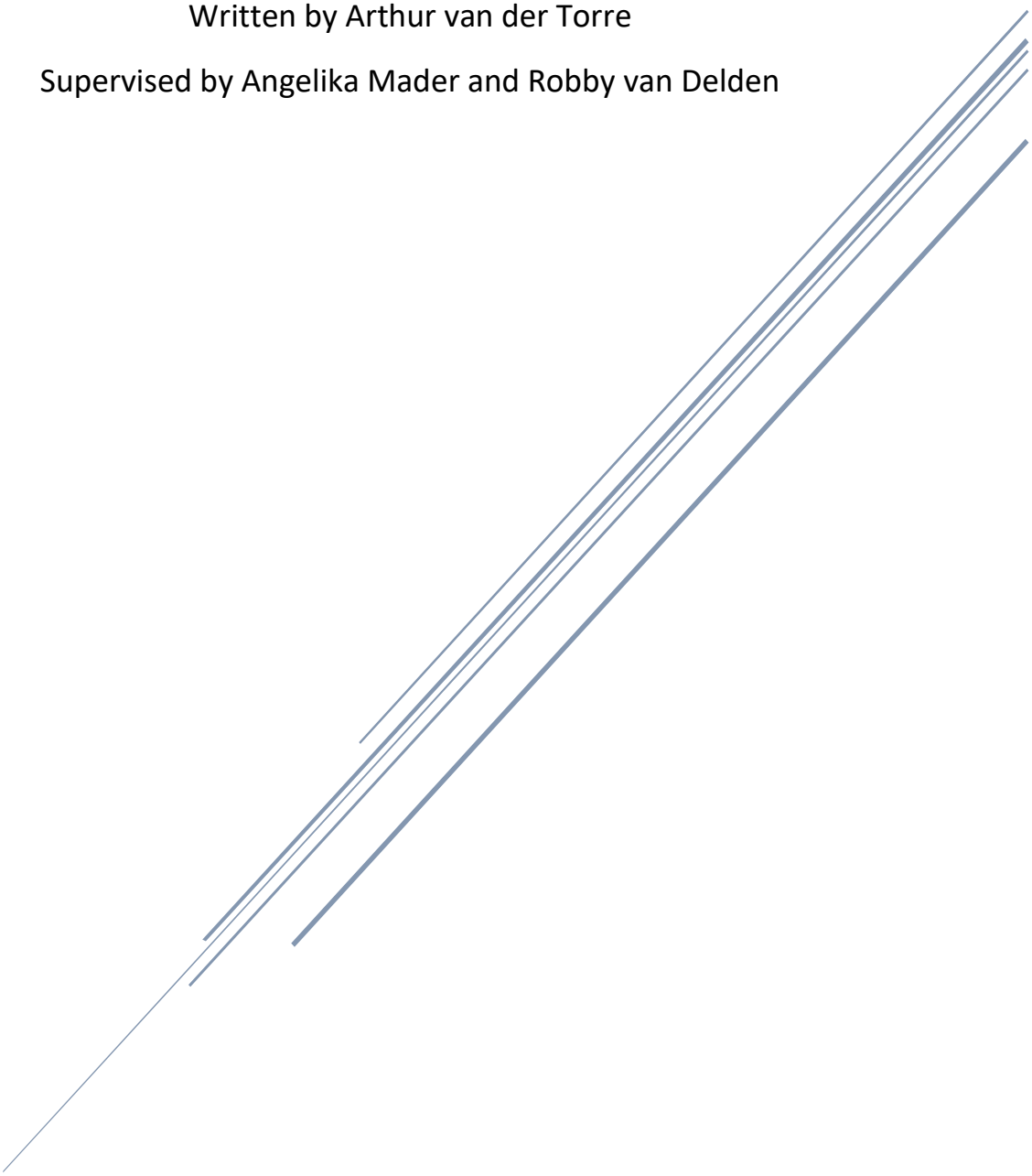
HERZ DER ZUKUNFT: CLIMATE ACTION BEHAVIOUR CHANGE THROUGH EDUCATIONAL ESCAPE ROOM PUZZLE

Written by Arthur van der Torre

Supervised by Angelika Mader and Robby van Delden



04/02/2024

University of Twente
Creative Technology (EEMCS)

Abstract

Climate change is arguably one of the most pressing issues humanity faces in the 21st century; To ensure a future for all, individual consumer behaviours must be reshaped towards the sustainable. Even so, this is already commonly known in our time, merely presenting this information to the public hence proves to be insufficient. By the opportunity provided by the client affiliated with the Escape climate crisis initiative, an attempt is therefore herewith documented to construct an educational escape room (EER) puzzle to alter the user's stance towards climate action and persuade them to more ecological behaviour through playful engagement with the thematic.

The solution devised is dubbed "Herz der Zukunft" (German for "Heart of the future"), consisting of a pin code puzzle where 3 passwords extracted from climate change posters are to be inserted, serving to build the theme of oil consumption, and a heart reanimation puzzle to physically emulate a rescue as to emotionally engage the user. This installation is situated in a 1940s family travel caravan model dubbed "Airstream" whence Herz der Zukunft has been inserted into the closet along with the shelf situated to the top right of said closet.

To evaluate this prototype, an user evaluation is performed to determine whether the designed user experience (UX) attains its purpose. 6 groups are observed as they complete a run-through of the installation, 12 persons complete a pre- and post-survey during this, posing questions regarding the UX as well as the user interpretation. The researcher is present during this activity, hidden behind curtains in the lavatory to record further notes of the user interaction and reactions.

Regrettably, the results of the pre- and post-survey suggest that Herz der Zukunft is not successful in persuading its users into more climate friendly behaviour, considering that no significant change in threat perception nor empowerment is detected. This may in part be due to the fact that users were not able to establish the relation between the interaction and personal climate action. While the experience thus was deemed emotionally triggering and the bulk of participants outed to have been struck by the visuals as well as the interaction, these emotions could not be related to climate action.

It is therefore not conclusive whether an EER piece may engender behaviour change, the author recommends interested persons to develop similar prototypes in such a manner that the personal significance is understood among users. The findings from this study suggest that appealing to the emotions is a salient aspect of persuasive design, the author hence recommends future related works to maintain the focus of the UX on emotional engagement through enjoyment and empowerment.

Acknowledgements

This project was by no means an individual initiative, I would herewith like to thank all those by whose deeds and words Herz der Zukunft was realised. Primarily, I wish to thank my supervisor Angelika Mader, critical supervisor Robby van Delden, client Stephan Heinrich and design supervisor Willy Dumaz for granting the opportunity to conduct this research, continued guidance throughout, material and financial assets and lending their hand when I required it.

I furthermore wish to thank Alfred de Vries, Edwin Dertien and Hilke van Born for granting their assistance with the realisation (and repair) of the final prototype, without which the quality of the final installation would have undeniably been reduced. Regarding said repair, I wish to express my appreciation to all those who encouraged me in a time when it seemed that the assembly would fail at a critical moment.

I would also like to thank Hilke van Born and Mark Ziegelhöfer for collaborating on the background research concerning interviews conducted and for having been pleasant companions throughout the progression of this project. In this regard, I wish to thank Ossi Sauer whose positive atmosphere contributed to the pleasant work environment in which Herz der Zukunft was devised.

Appreciation also goes out to all those who participated in the background research interviews conducted, as well as the user evaluation without which this study would not have been rendered possible.

Lastly, I wish to thank friends and family for their continued support and interest in the project, especially my mother Egberdien van der Pijl and grandmother Marijke van der Pijl who travelled across the country to Enschede to follow my progress, and my partner Matteo di Domenico for having been a pillar of support and encouragement.

List of Figures

Contents

1: Introduction

Recent studies demonstrate that the climate is in disarray; Temperatures worldwide have been deviating consistently, leading to increased geohazards for vulnerable communities through wildfires [1], heatwaves and floods [2], as well as a loss of quality in marine life through the acidification of various oceans [3]. One study extrapolated these modern findings into the future half of the 21st century, concluding that "Much of what climate model studies show, could happen to weather and climate extremes in a future climate…"[4], leading to a very possible future in which living conditions for humanity have taken a turn for the egregious.

Within the heat of these events, efforts may be undertaken to combat this multi-dimensional climate crisis. One aspect that may be ameliorated is modern consumer behaviour, for conscious and environmentally responsible consumerism is a salient factor in mending the earth. Consumers must then be guided to a point where food and material waste is reduced, as well as environmentally friendly transportation is chosen as to reduce carbon dioxide (CO2) emissions. [5] Although a median of 68% total population report to be aware of climate change and its gravity [7] , environmental behaviour has not been altered sufficiently, leading to the continuing need for activists to persuade the public into such.

Considerable attempts have been made to raise awareness on the topic of climate change, yet these possibilities have not yet been exhausted. For instance, one innovative form of how persons may be made attentive of these environmental causticities is through an escape room (ER). The teaching potential of ERs is increasingly considered among researchers and educators, as well as private agents, although the exploration of such possibilities remains at an incubational stage as of the time of writing [6]. Traditionally, the concept develops as such that a group feigns entrapment in a room where a certain set of puzzles must be solved communally before the time expires to grant a "win". Such a setup is hollow in thematic and puzzles may be designed to particularly teach about a specific subject, thus becoming an educational escape room (EER).

The project herewith documented presents the development of one puzzle within such an EER. The initiator of this project is Ansvar2030, a Germany-based enterprise, represented within this project by the client Stephan Heinrich, engaging themselves for the combatting of this climate crisis, by their moto "Climate neutral by 2030!". Hereby, an antique "Airstream" model caravan has been acquired by this agent [Figure 1] and at the time of writing is undergoing a transformation into a mobile EER meant to educate its visitors on more climate friendly behaviour and persuade them into acting so.

The airstream follows the theme of “Solarpunk”, an expression pertaining to a futuristic utopia in which nature and human civilisation harmoniously coalesce. Such a future is to be reflected within the installation, for it wishes to convey a hopeful attitude to its visitors concerning climate change, that it is not too late to become active.

Figure 1: The “Airstream”

The intent is for this automobile to tour German speaking countries as of July 2024 to invite as many end-users as it may. The project commenced in May 2023 and remains currently in a fluid state where concepts for puzzles within the automobile are as of the beginning of this bachelor thesis in the iteration phase. Mr. Heinrich granted the opportunity that the puzzles within his EER may partially be designed and crafted by the researcher of this thesis, hence providing the opportunity to further add to the body of knowledge on how an educational escape room may be conceptualised.

The client elucidated before the commencement of this thesis that the EER is succeeded by a workshop intended to reflect upon the experience and further collectively explore how the climate crisis may be tackled. This would be when the visitors are concretely informed on the current state of the climate and actions they may undertake, the pieces within the escape room serve hitherto as an introduction to the thematic which must spark curiosity on the thematic, motivate participants to actively engage with the material and, optimally, reconsider their everyday actions contributing to climate change.

Therefore, the question that the study herewith wishes to answer is:

How may a novel educational escape room piece be crafted which must touch upon the climate catastrophe in a manner that stimulates behaviour change towards climate action?

Further sub-questions that will be answered throughout this exploration are:

SQ 1: How may the climate crisis be addressed within the puzzle design?

To render the puzzle scientifically accurate, a portion of this initiative must be dedicated to understanding the climate crisis more precisely and in which sectors consumer behaviour must be amended as to convey the appropriate message to visitors.

SQ 1.1: What are the most salient changes in individual behaviour that must be encouraged to benefit the environment?

SQ 1.2: To what extent is the necessity of climate action recognised in the design of the escape room puzzle?

SQ 2: How may an effective educational escape room be installed?

Considering that EERs are a relatively novel form of fusing education and entertainment, time must be allocated to understanding this teaching method and how it may be designed to the most effective end.

SQ 2.1: How may a puzzle within an educational escape room be designed to engage and interest the user?

SQ 2.1.1: How do the design choices of an EER impact the user experience?

SQ 2.1.2 Which puzzle types are generally more engaging than others?

SQ 2.1.3 What specific aspects of a puzzle engage a user pleasantly and which ones are deemed frustrating?

SQ 2.2: Which attempts have already been made on constructing an EER?

SQ 2.2.1 What may be learned from these past attempts?

SQ 2.3: How may the Airstream's environment be cleverly exploited?

SQ 2.3.1: Which interesting artifacts remain within this caravan model?

SQ 2.3.2: Which lacks and limitations must be adhered to?

SQ 2.4: To what extent does the final prototype engage the user in a memorable manner?

SQ 3: Which requirements must the final product adhere to?

The puzzle to be manufactured will be required to conform to various requirements, such as the by the client predetermined context of the overall EER as well as user requirements to ensure a pleasant and safe experience.

SQ 3.1: What are the expectations and requirements of the client and his team regarding the final product?

SQ 3.2: Within which design choices previously made by the client and his team must the final product fit?

SQ 3.2.1 To what extent are these choices final?

SQ 3.3: What are the requirements of the end-users; escape room visitors?

SQ 3.4: To what extent does the final prototype adhere to said requirements?

SQ 4: How may the final prototype persuade players into climate action?

Behaviour change is a niche topic within psychology that must be understood along with the psychology of inaction if the final prototype is to effectively persuade users into adapting a new, perhaps individually undesirable behaviour.

SQ 4.1: What constraints the public from engaging in climate action despite the well-known gravity of the situation?

SQ 4.2: How may the design be rendered persuasive?

SQ 4.3: To what extent has the final product affected the user's perception of climate action?

This will be accomplished by first conducting contextual background research encompassing literature research, expert opinions and consolidating the state of the art, followed by an elucidation on the methods and techniques employed within this research, followed by a presentation of the ideation process, the precise final selected idea, it's development realisation, a formal evaluation of the prototype and concluded with a discussion and conclusion in light of the results.

Within escape rooms, there exists domain-specific terminology which this text will briefly elucidate before employing hereafter:

- Puzzle: A question, problem, or contrivance designed for testing ingenuity
- Clue: A piece of evidence that leads one towards the solution of a problem
- Hint: An indirect or generally human provided suggestion for how to solve a puzzle or how to proceed (e.g. gamemaster suggestion)
- Solarpunk: An expression pertaining to the harmonious coalescence between technical and natural within shared spaces
- Climate action: Individual action that makes a positive contribution to the climate crisis

2: Background research

In order to understand the context of EER design, as well as possibilities and preestablished EER norms, background research is herewith presented. The research questions 1.1, 2.1, 2.2 and 4.1 will herewith be answered.

Secondary research

From here, secondary research will be presented by the author. All sources employed have been found from scienceDirect as well as the association for computer machinery (ACM) digital library. They have been obtained from the keywords “Escape room”, “Educational escape room”, “Escape room design”, “How to create an educational escape room”, “emotional memory” and “Escape room state of the art”. Results were filtered based upon relevance to the project and significance of results, considering that there exist plethoric studies who do not present pre and post exams to indeed evaluate the effectiveness of their creations. In addition to this, the papers by Reuter [11], Van Lange [23], Ajzen [24], Fritsch [27] and Fotaris [6] were yielded from personal connections.

2.1 Literature research

2.1.1 Climate change causes

When reflecting upon which message visitors should take home, the first matter to direct one’s attention to is which aspects of climate change are catalysed by human intervention. Michael Pidwinry [8] asserts that climate change is rather the consequence of natural factors such as variations in the Earth’s orbital characteristics, volcanic eruptions and changes in ocean circulation. He furthermore names two catalysts of human origins: Urban heat islands as well as atmospheric greenhouse gases.

Urban dense structures, herewith referred to as urban heat islands, capture heat emitted from the sun greater than natural landscapes do, leading to an amplified heating effect on that specific terrain, though notably not on a global scale per se. Pidwinry elucidates that due to many global sensors being placed in such urban environments, “the portrayal of one degree temperature rise worldwide over the prior 140 years is a complete distortion and exaggeration of temperature rise”. According to Pidwinry [8], the climate crisis may be less gripping than popularly thought, and that the Earth may even be in a cooling state.

Regardless, one non-disputed observable human-centred intervention into the climate is through the emission of Greenhouse gases (CO2, CH4, N2O, HFC, PFC and SF6 [14]).] Such gases have, according to Pidwinry [8], been increasing due to “human activities
like deforestation, combustion of fossil fuels, [and] human population growth”. Even so, he elucidates that the highly non-linear increase [Figure 2] of Co2 since 1970 “indicate that the warming effect of atmospheric carbon dioxide may peak after addition of a further twenty percent rise in carbon dioxide”, meaning that perchance the quantity of atmospheric Co2 may not be the most troubling cause.

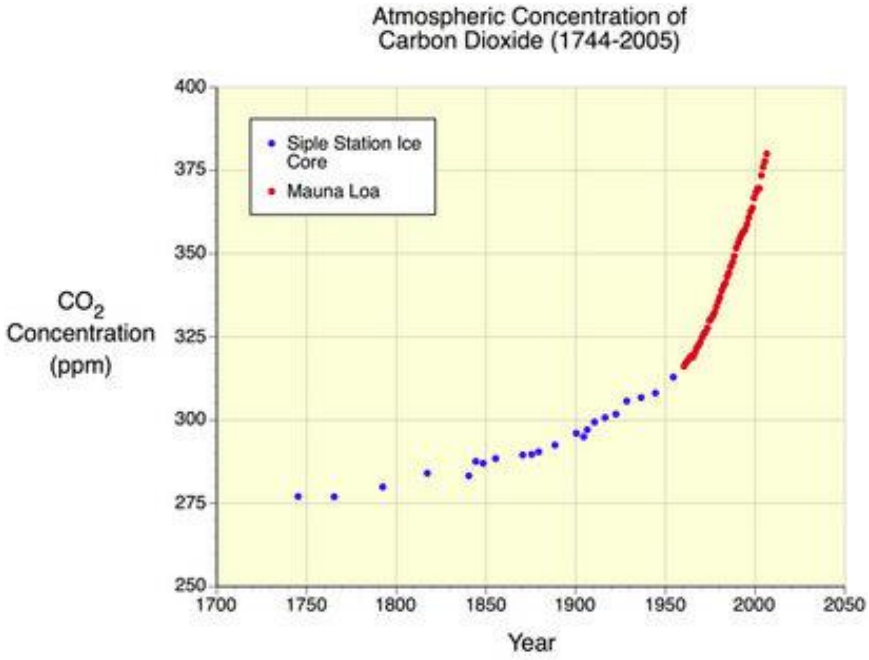


Figure 2: Trend of Co2 increase over the years [8]

This is an assertion which Muhammed Kabir [14] does not share, stating that there are reasons why atmospheric Co2 concentration should be worrisome. Greenhouse gases carry a part within the puncturing of a “hole” within the Ozone layer covering the Earth, meaning that the higher the emissions will become, the more facile sunrays may hit the Earth’s surface and amplify the heating effect. Muhammed claims that Co2 is the most perilous of the greenhouse gases, having further effects on agricultural quality, health of seas and direct health of organisms. In addition to this, certain countries may be more prone to risk than others, Pakistan for instance may only grow direly liveable should these changes come to manifest themselves, a situation numerous other countries share. [14] As such, Co2 emissions do play a significant role in the climate crisis and its exhaustion must be relented to mend the climate.

To add to this, Co2 emissions currently originate from a variety of human-induced sources. Muhammed presents a visual designed by Victor Kennel, depicting the percentage shares of Co2 release of each relevant human activity sector in 2010 [Figure 3]. Here, it is presented that the most polluting human activities are heat and electricity production, having multiple indirect correlations in certain sectors, automobile travel by petrol engine (referred to as “roads”) as well as industrial production, where agriculture [15], resource mining [16] and infrastructure construction [17] play notable roles. In light of this, if human behaviour is to be altered, the change must be targeted within one of these latter introduced catalysts to reduce emissions of greenhouse gases.

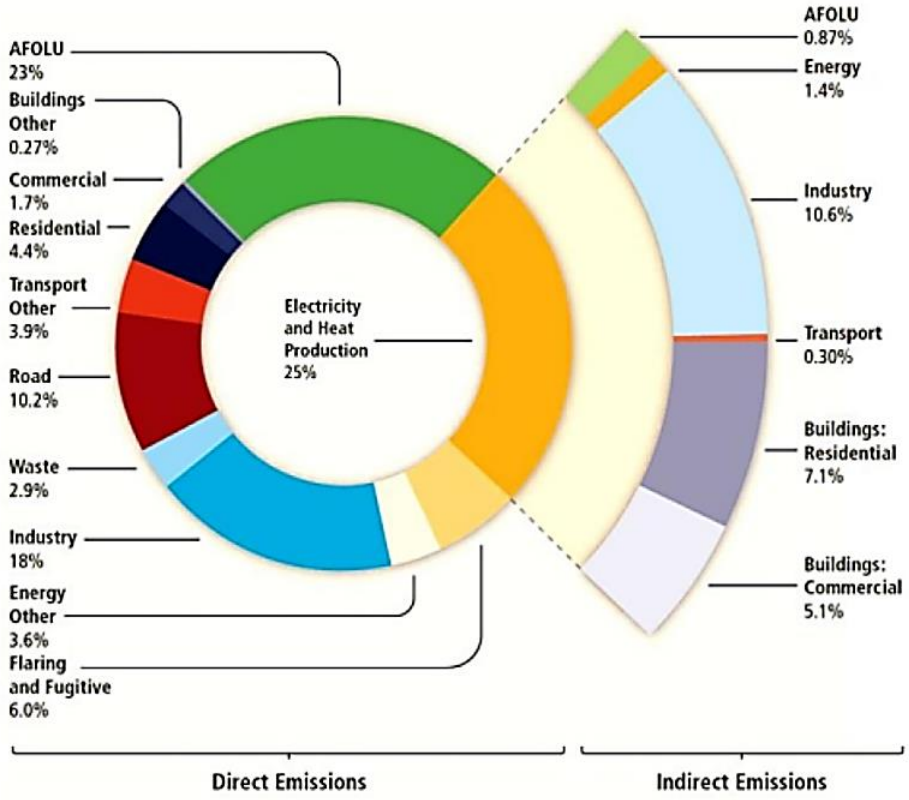


Figure 3: Percentages of co2 emission causes over global total in 2010 [14]

2.1.2 Psychology of climate-inaction

As touched upon, a global study found that a majority of persons report being aware of the climate crisis and the calamities which it entails [7], therewith raising the question what intrinsic factors cause these persons to be deterred from becoming climate-active, which would be in their own best interest. Herewith, RQ 4.1 and 4.2 will be addressed.

The construal level theory devised by Trope and Liebman [23] elucidates that the primary factors which withhold persons from coming to action are temporal discounting (“it’s still far away”),

spacial as well as social distance and perception of improbability of the event. As such, the non-immediate nature of the crisis leads to the repression of the issue at hand in spite of its direness.

The question herewith becomes how such individuals may be motivated to grow active in spite of their circumstantial reluctance. One framework presented by Azjen [24] elucidates this by presenting emotional states required to lead to the individual desirability of an action [Figure 4]. For one, it must be believed by the actor that the action undertaken will lead to a more desirable end result (Einstellung), the action must be witnessed normatively in the environment of the actor (Subjektive Norm) and the actor must perceive the action as feasible (Wahrgenommene Verhaltenskontroller). This may result in the intention of the actor to undergo the action, although it does not guarantee on itself that the action is indeed taken, for multiple factors may deter the individual from becoming active.

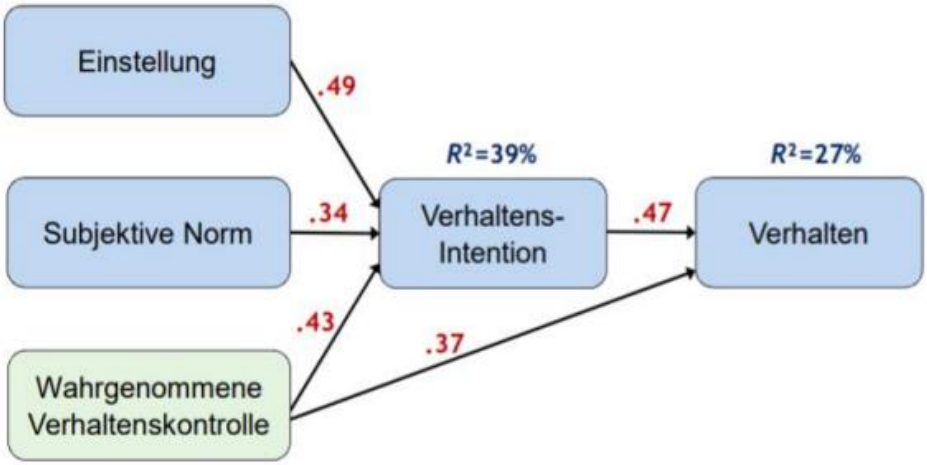


Figure 4: Theory of planned action [24]

Wittkower [25] states that there exist intrinsic factors, primarily the need for comfort and efficiency. that prevent an individual from surpassing the mere “intention” stage into “behaviour”. The cause behind why individuals refrain from behaving in a socially desirable manner is “a conflict between collective and individual concerns.” [25, page 6]. Wittkower furthermore elaborates that designers may create solutions to engender persons to behave more socially desirable through their product design. Such an intervention may be hidden or explicit, as well as persuasive or coercive, this design choice is dependent on the implementation context.

One framework presented by Michie [21] enumerates a vast array of techniques that may be employed within a product design to persuade users into adapting a certain behaviour, appropriately dubbed “behaviour change techniques (BCTs)”. These techniques may be employed to convince end-users to put their individual desires beside and behave more socially responsible.

Even so, Neuteleers [26] warns that one must be careful not to instil excessive social responsibility upon users, for they may be repulsed by the necessity ("you cannot demand such grave changes of me!"), while too little may have the opposite effect of rendering users apathetic ("my actions do not matter, why should I bother?"). Furthermore, Fritsch [27] suggests that "creating a stronger affective link between people and the environment can lead to changes in behaviour and habits". [27, page 7]. Indeed, to stimulate action, individuals must establish a healthy, yet serious relationship with the notion of behaving climate responsibly, meaning the perception of climate change is to be altered through product employment.

Moreover, Cadet [29] presents his findings illustrating that immersion within an experience and emotional response are positively correlated. With impactful scenery within the medium of VR, users were shown to increase their episodic memory and retain information better. Makowski [30] adds to this by elucidating how immersion, or presence, enhances episodic memory capacity even further by the hand of emotional engagement. As such, if certain information is to be remembered, it is most effective to design for emotional response. As such, a product that may stir its users to more ecological friendly behaviour must reshape the relationship between user and climate action by creating positive affinity, as well as personal relevance and information retention to the theme through pleasant emotional engagement.

2.1.3 EER design aspects

As to design a piece within an EER, it is salient to understand how an EER is devised from existing literature to understand within which context the work will take place. Broadly, a model devised by Fotaris serves to understand the overall design process of an EER [Figure 5]. Further EER theorisers have been considered, such as Reuter [11] or Clarke [22], the framework provided by Fotris is the most advanced and complete at the time of writing. The process illustrated therewithin consists of the following steps:

1. Defining the exact users of the EER, along with their background and needs
2. Deciding upon the goal of the EER
3. Set a theme and context in which the players will find themselves
4. Commence with designing puzzles
5. Conceive an introduction to the EER, often done through video
6. Prepare a denouement to the EER, may be video or a reflection session
7. Built the puzzles, subsequently as lo- and hi-fi prototypes
8. Document the most salient aspects of the functionality of the designed EER
9. Bring in participants to determine, to what extent the EER is received as desired

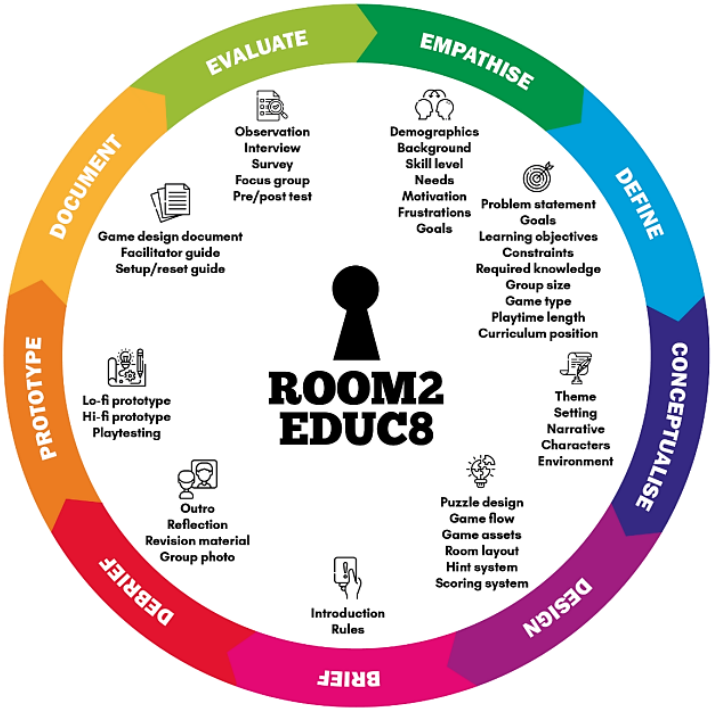


Figure 5: Room2educ8 framework [6]

Reuter [11] as well as Clarke [22] assert likewise that designing an EER is a step-wise process in which both emphasise upon the defining of a learning goal. Escape room design theorisers [6, 11, 13] as well as those who have built one themselves [9, 10, 12] all agree that EERs excel at developing soft skills such as communication, teamwork, time management and puzzle solving, and must primarily be designed to foster this. In addition to this, Reuter [11] and Veldkamp [13] both assert that there is room for further concrete knowledge goals which must be embedded into the puzzle design upon commencing by pertaining the tasks within the puzzles to them. Designers of EERs must therefore have a clear vision beforehand of what it is that they wish to teach their participants.

Once this has been established, the concrete design choices of the EER must be decided upon, such as the functionality of the puzzles and the user experience, Fotaris orders these within steps 2, 3 and 4. Veldkamp [13] elucidates the importance of immersion of the players within the theme of the EER, that puzzles must be adequately challenging as well as the need of evaluating one's own available resources. Immersion may be achieved by relaying the artifacts and decorations with the theme of the EER as well as creating a relatable persona [9]. To ensure enjoyable gameplay, puzzles should be manufactured that may be solved within a short amount of time as to prevent frustration. Furthermore, an assistant must be present either inside or outside the EER to mediate the players through hints to aid smooth progression [11]. To guarantee the realisation of the EER, one must watch one's own resources, for physical EER may quickly become expensive due to

material and space required as shown in the results of the experiment by Angela [10]. Alternatives for a tight budget may be digital EERs in the form of programs or VR games.

Finally, considering the numerous amounts of puzzles present in one EER, the designer must consider in which order they must be completed. Fotaris presents a model by Nicholson Scott [Figure 6] depicting the various branching possible in an EER, where “Meta-Puzzle” pertains to the final, most challenging puzzle to be solved by the visitor after which the game ends with a “win”. Puzzles are designed as a form of build-up to the finale, this may be done in sequence or more open, allowing users to forge their own path. Both come with positives and negatives, for instance, a more open path compared to a linear path prevents players from becoming stuck and losing the ability to advance, which would engender frustration in the experience, yet it simultaneously discourages collective learning, as groups may split, therewith rendering the learning experience an individual one, as is also concluded in Clauson’s results [10]. Considering teaching lies on the forefront of the EER, a tendency towards a linear path may be more advisable.

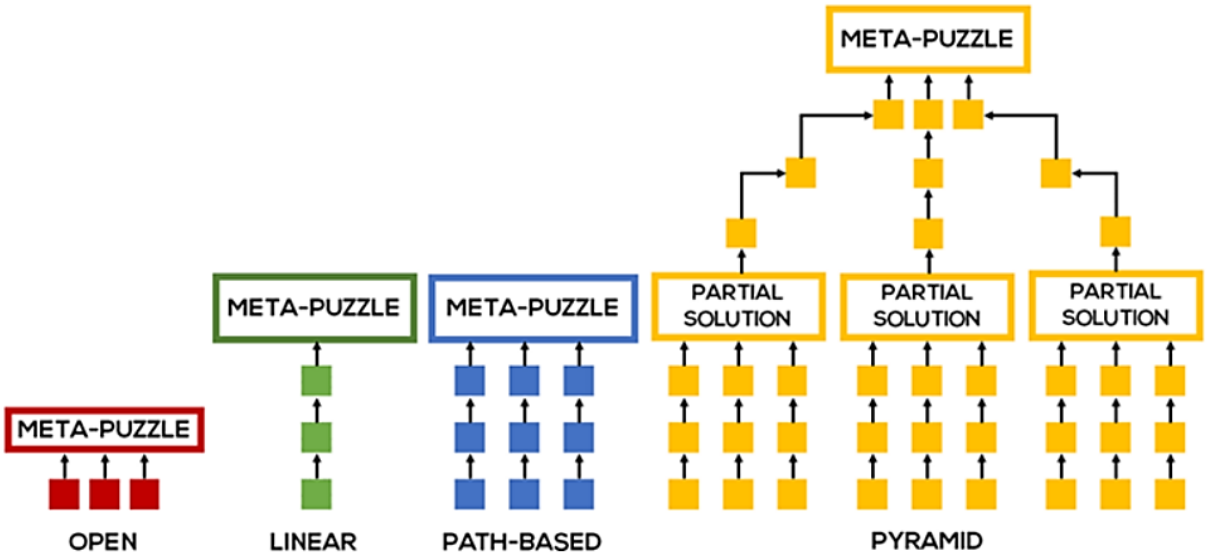


Figure 6: Possible branches of EER puzzle sequencing [6]

2.1.3 Positives and negatives of EER implementation

Having explored the design of EERs, it is worth considering where it’s strengths and weaknesses lie. There are two points that speak for and two against the utilisation of EER in education stated by the literature are herewith presented. One powerful advantage of the EER is its refreshing manner of teaching leading to a positive association with the taught curriculum. All

explored attempts at creating an EER within literature report that participants respond significantly positively to this form of teaching [9, 10, 12]. Veldkamp adds to this with the assertion that "In all studies, a vast majority of students enjoyed the activity and educators concluded that students were highly engaged and active…" [13, page 10], therewith affirming that escape rooms are a refreshing and stimulating new form of education well received among its participants, increasing motivation in the educational sector and engendering closer involvement with the taught material. When it comes to user reception of EERs, there appears to be no doubt that the activity will be positively received.

Furthermore, as aforementioned, escape rooms excel at teaching soft-skills parallel to the targeted academic material. Fotaris lists all the skills that may be acquired through engagement in EER [Figure 7], where the most notable are time management, problem-solving, communication, teamwork and delegation [6], all of which are salient skills to foster for professional careers and traditionally not as thoroughly taught in contemporary classrooms. Those who have installed an escape room themselves, such as for instance Clauson, furthermore affirm this sort of skill-development to be recorded among participants, although the emphasis lay with teamwork and critical thinking [10]. In none of the attempted EERs within the literature are all the soft-skills targeted, for they are simply to numerous. An EER may therefore be a sound choice to foster a modest selection of such skills

Skill type	Benefits
Intrapersonal	Perseverance (it's OK to fail) Time management Increased confidence in critical thinking and decision-making Problem-solving Attention to detail Cognitive flexibility Creativity and innovation Increased self-esteem Cultural understanding and appreciation Spatial reasoning
Interpersonal	Communication Teamwork and collaboration Improved ability to delegate tasks and work as a team Community building: learning about your own and other people's strengths Appreciate the diversity of thinking strategies encountered in any group of people
Academic	Reading comprehension Preview and review material Stronger emotional connection to curriculum material Higher rates of retention Competition can pique motivation Opportunity for feedback and practice Entrepreneurship: students could build a business around this

Figure 7 : Proposed skillset taught by EERs [6]

However, EERs are not always applicable due to their setup costs as well as their knowledge requirements. Reuter tells that one of the dominant reasons as to why EERs remain outside of teaching curriculums is due to the lack of game design knowledge within educators required to initiate such a lesson [11]. Veldkamp adds to this by elucidating that materials required may quickly reach a sum much larger than the average lesson, even when considering its reusability [13]. The literature agrees on the fact that, may EERs be as stimulating as they are, their implementation is challenging, time consuming and pricy. In spite of the fineries of EERs, their elaborate setup renders them only available to those who may surpass these hurdles.

Lastly, not all students respond equally well to EERs in forms of learning. For instance, in the attempt of Bezençon it was concluded that EER were more effective on pupils who already possessed knowledge on the material studied, and that less knowledgeable students tended to fall behind [9]. To add to this, it also reports that persons of higher cognitive capacities performed better at EER assignments than others, meaning that less cognitive students were to some degree left behind [9]. As of now, Benzençon is the only paper mentioning such a bias, which is likely the result of scarce post- and pre-examinations of student's retention of taught material within the current existing literature. The indeed peril of educational bias must be further explored, for implementing biased tools would be harmful to students.

2.2 State of the art

2.2.1 Exemplary attempts of academic EER

Since its recent acquisition of educational interest, EERs have been employed in a broad range of fields. Veldkamp conveys that "Escape rooms have been designed to foster domain specific skills and knowledge, such as nursing, medicine physiotherapy, chemistry, physics, computer science, mathematics, history, and English or to support the development of generic skills" [13], to which Panagiotis Fotaris adds: "EERs have been employed in Healthcare, STEM subjects, computer science, chemical engineering, pharmacie, physics, mathematics, chemistry, radiology, biology, sex education, teacher education, music, cultural mediation" [6]. Indeed, the EER proves to be a multidisciplinary, versatile teaching tool applicable to diverse contexts.

One interesting example of such an application is the "Escape addict" installation manufactured by Bezençon [9]. This EER served to render early high schoolers attentive of possible auto-destructive behaviours, such as excessive video game or nicotine consumption. Participants report to have found the experience enjoyable and assert to have learned from it. Even so, the pre and post-test comparison do not present significant changes beyond time spent on video games, which surprisingly increased. Bezençon herself concludes that merely a superficial layer of the

content was indeed retained by the participants despite their enthusiasm, which may be linked to the intrinsic entertainment focus of ERs which may outweigh the educational focus. If a message or information is to be retained, it must be carefully interwoven into the design.

Even so, the experiment also revealed a technique that may be employed to further immerse the players into the experience. Immersion plays a salient role in the enjoyment of the experience, which in turn stimulates active learning. Bezençon found that when participants could relate to the thematic or to a persona, their individual attention and retention rates increased, for instance, male participants felt more represented by a male avatar, and vice versa for females. When designing an EER puzzle, it must therefore not only be significant within the thematic, but may be rendered even more effective when visitors find personal significance in the piece.

A further example would be the EER designed by Soares [12] with the intent of teaching interdisciplinary medical staff how to collaborate. In the medical field, personnel of various educational backgrounds and differing expertise must learn to work within a team as to provide the highest quality care to the patient. Soares asserts that her attempt succeeded in teaching this, despite the fact that pre and post-exams here showed an average reduction in retention of taught material here as well. The strength of the exercise does not lie within prompting retention of concrete study material to staff, but indeed to strengthen professional working bonds through formally exploring team dynamics. The client indeed wishes to make use of the fostering of teamwork skills, for, as quoted from the client: “The climate crisis is inherently a communication crisis”. Applying an EER as a form of teaching collaboration is hence rather appropriate.

Another intriguing example would be the AR EER produced by Paraschivoiu to teach adolescents about fake news through an immersive storyline dubbed “Escape Fake” [20]. The story, told through a chatbot from the future, sets within a dystopian society in which fake news reigns supreme and truth may only be bought at high expenses. Paraschivoiu asserts that telling a story within an EER through a chatroom heightens the immersion that participants feel, a claim supported by the results of her conducted surveys where the median for “action awareness” (3,61 out of 5), defined as “involvement in the action” [20, page 5], is considerably high. She elucidates that “storytelling is of critical importance, as it provides engagement, clarifies the purpose and sets the stage for the experience.” [20, page 4]. As aforementioned, immersion induces active learning, therefore relaying the EER to a storyline may increase active learning and therewith the educational effect of an EER.

Although not involving an EER, the attempt of Galeote to teach about climate change through video games is also noteworthy [19]. Having built digital media both for a PC as well as a VR experience, he attempted to inform on climate change through visuals and interaction. Although the VR and PC game players did on average score better than the paper control group, this was not enough to be significant. Galeote explains that two causes of this are due to the similar text-based nature of the two games creating a plethoric overlap with the control group, as well as the fact that such games serve for cognitive engagement and conceptualisation, rather than preparing to answer text-based questions. He elucidates that it may have been more telling if beyond knowledge retention, the impact of the thematic on the player would have also been measured in a qualitative manner.

In his documented attempt, Galeote furthermore analyses which questions were answered with a higher success rate weighed against those who were not. Questions that pertained the user interaction directly to the material taught, such as turning off an AC to warn against the dangers of ACs on the climate, were answered significantly more correct than questions that strayed from connecting the message and the interaction. Galeote therewith commends designers to "create a memorable connection with learned concepts through actions and stimuli, in line with embodied and grounded cognition" [19, page 17]. As such, in order to design for information retention, the significance of this information must be somehow recognised in the user interaction.

All in all, the key points to be taken from state of the art EERs are:

- EERs do not serve to retain concrete information (Bezençon)
- Personal significance for participants heightens feelings of involvement (Benzençon)
- The forefront of EERs teaching is the harnessing of teamwork (Soares)
- Users must be stimulated in a memorable manner to retain information (Galeote)

2.2.2 Overview of relevant commercial ER

Primarily, escape rooms were invented as a means of commercial entertainment, some notable examples will herewith be presented. Firstly, the ER "Cybercity 2049"[1] situated in Barcelona was hailed as "the best escape room in the world" in 2021 due to its impressive decorations and storytelling. It revolves around a futuristic cyberpunk setting portraying a possible future in which we may find ourselves.

[1] Cybercity 2049: https://www.escapebarcelona.com/en/cybercity-2049.php

Before this, the holder of the title “best escape room in the world” was the ER “The dome”[2] situated in Bunschoten (Netherlands), also portraying a futuristic theme. The story of this ER is to survive in the aftermath of a dangerous criminal’s escape, which has led the so-called Dome to be reduced to a toxic state. Interestingly, the ER states that escaping from the room is merely an illusion, and that the players are in fact trapped in the Dome for eternity.

Figure 8: The dome inside view

More concerned with the thematic of climate change, a memorable example of a commercial EER would be the “Blue Mirror”[3] [Figure 9]. In this EER, the participants are tasked with reversing the effects of climate change while the effect are literally felt upon their feet as the water levels within the room rise, symbolically referencing the rise of sea levels due to the earths heating. It has been praised as a provocative and original concept by visitors.

[2] The Dome: https://escaperoom.nl/en/the-dome/
[3] Blue Mirror: https://bluemirrorexperience.nl/en/

Figure 9: Blue mirror promotional material

A further example of this would be "Adapt or BTrapped"[4] initiative undergone by Dutch university students. Within this EER, the player must symbolically adapt their habits within a short time span of 20 minutes so that they may complete the game. The message which this EER conveys is also that of a future in which the Earth is no longer habitable, unless the people alter their habits in the present.

Generally speaking, it would seem that for an ER to become nominable, a large sum would need to be invested into decorations and creating an immersive experience. It appears that futurism is a popular theme among successful ER. Lastly, an EER pertaining to climate change is no longer a novel concept, it may be that the public has already grown accustomed to receiving the warning of climate change in this manner. The novelty of this project partly comes from the attractive airstream artefact in which the EER is placed, but must come from the puzzles themselves as well, otherwise the interest of visitors will fade once they engage in the game, for it will resemble something the public has already witnessed and will not be sufficiently impressive.

Primary research

From here, primary research conducted by the author in collaboration with Hilke van den Born and Mark Ziegelhöfer, to whom was also assigned the task of installing a puzzle in Escape climate crisis. Both persons have granted their permission for their findings to be included in this study. The ethical committee of the university of Twente's EEMCS department has furthermore granted their approval for this research.

[4] Adapt or BTrapped: https://038games.nl/?page_id=991

2.2.3 Auto-ethnographic visit

To further strengthen the understanding of ERs, the author, Hilke van den Born and Mark Ziegelhöfer visited the ER “Enschede Airport”, of the “Escape Enschede” chain[5]. This research, along with This visit serves to on one hand enhance our understanding of how participants experience an ER, on the other hand to further discover new concepts and ideas, where the latter is rendered more effective through the real-life observation since matters that may not be conveyed descriptively through literature may be understood through the interaction with the puzzle.

Before the game commenced, there was a 15-minute briefing time where the story was laid before us by the gamemaster as well as instructions on how to solve puzzles, what might be constituted as codes and that we would receive a walkie-talkie with which we could remain in contact. He furthermore elucidated that we might fall under a category of 3 players: “Escape room nerds”, who play multiple rooms per week and break out of any room within 30 minutes, “casual players”, who attempt one every now and then and probably succeed, and lastly “basket cases” who would never escape no matter how much time you would give them. To ensure that all 3 categories of players would enjoy the entire 60 minutes of the experience, the game was designed with the goal to solve as many puzzles as one’s ability allows within the time limit. In addition to this, one competes against another team over most solved puzzles. Regrettably, to protect the integrity of the puzzles and the experience, it was not permitted to document the ER through pictures or note taking.

The story portrayed was such that we as a group were meant to figuratively fly to various countries and hence collect boarding passes within the ER, almost all puzzles were hence related to the theme of air travel or airports in some manner. There were, for instance, decorative suitcases with locks and wallpaper resembling a waiting room at an airport. Within the main room, a touchscreen was hung on a wall where found codes were meant to be inserted. Once a correct code was found and typed out, a QR code was promptly printed, meant to be scanned at the main board located opposite of the room, which would then result in a boarding pass being stamped. The interaction was meant to resemble the check-in process of an airport, although it could have been ameliorated with QR codes that resembled an actual boarding pass even closer. Even so, such a typing system is a wise design choice, for it immediately communicates to the player what form of clues they are searching for.

Memorable puzzles were:

[5] Enschede Airport: https://enschede.letsescape.nl/rooms/enschede-airport/

- Teamwork puzzle directing a plane: On a 2D map, three persons had to work together to move a plane across a map by pulling levers adjusting the speed and direction of the plane. The two persons near the levers could not see the screen, a third person had to convey whether the plane was moving in the right direction, as well as what pulling the lever did exactly. Although very challenging, the interaction was very engaging and pleasant to coordinate.
- Door opening puzzle: A second room with a connecting door was visible through glass panes upon entering the room. Halfway through the game, the gamemaster reached a further artifact with which the door could be opened through a scanning puzzle. Once certain areas were scanned in correct sequence, the door unlocked and the second room could be entered. It is worth mentioning, however, that certain design aspects were not intuitive e.g. the button had to be held for a longer time, and even when the door could be opened, it remained jammed for a moment, giving the impression that it was still locked.

Less endorseable puzzles were:

- Connect music to years: One puzzle consisted of connecting a mixtape of 10 songs to years, for instance “Barcelona” by Freddy Mercury would have to be connected to the year 1988, it’s release date. Unfortunately, this form of puzzle relies heavily upon previous knowledge on elderly music within the contester, which in the case of our group did not exist. The result of this was that the puzzle could not be solved, for making online searches was also not permitted, rendering the experience rather frustrating.
- Scanning the suitcase: For this puzzle, a suitcase had to be inserted into a scanner, which was meant to show its contents from which a code was to be derived of the bottles included. Even so, the device worked rigidly and we as players had to be instructed on pushing it even further multiple times until the puzzle operated as intended. Ensuring intuitiveness as well as functionality within systems proves to be of high importance from this experience.

This visit therefore revealed that teamwork and exploring further spaces render an ER more memorable, while system failures as well as cultural and linguistic barriers to a puzzle render the experience frustrating and should therefore be avoided.

Figure 10:: Picture taken at the end to commemorate the experience

2.3 Workshop designing EER

During the background research phase, the possibility was granted to attend the workshop "How to design an educational escape room" hosted by Panagiotis Fotaris serving to cover RQs 2.1 and 2.2. Over the course of this workshop, certain previously acquired knowledge was repeated, while there being certain information relayed through personal communication that is relevant to reiterate:

- An expert at the workshop spoke of the importance of durability and solidity in EER puzzles, for they allegedly break caustically quick. She also recommended to design the puzzles with the moderate expectation that they will break, so to prepare a replacement or facile repairing options.
- All puzzles within an escape room should share a red-thread among their design in how they may be solved, otherwise players may find it excessively challenging to understand the design of the puzzles and hence strive away from the "outlier" puzzle(s).
- A more linear approach is indeed more recommendable for an EER, not only to prevent groups from spreading out and avoiding certain learning experiences, but also because the EER will be progressed through at a high pace by the visitors. Even so, completely linear structures may engender for one person to dominate the puzzles and also foul the experience. A balance in between open and path-based is optimal.

Most importantly, however, Panagiotis presented valuable insights into how a puzzle may be designed, henceforth answering RQ 2.1.2. The primary design choice he forefronts, is whether the player may be able to affirm themselves that the puzzle is solved (e.g. a lock or a jigsaw puzzle) or whether the host must confirm this. Once this is established, puzzles are ordered into types:

- Cognitive puzzles (Employ players' thinking skills and logic)
- Encrypted and Password puzzles
- Physical puzzles (Require manipulation of artifacts)
- Puzzles of multiple bodies (May be the most memorable)
- Sensory puzzles (May also impress more)
- Technology puzzles (QR codes, VR, E-mail etc)
- Punishments (Traps leading to a reduction in time)
- Meta Puzzle (Unites several puzzles that lead into it)

In addition to this, puzzles that rely heavily on language, culture, and luck are to be avoided due to accessibility issues, such as was for instance the case with the visited ER. Non-singular solutions as well as ambiguities are also not advisable for they tend to confuse players and muddy their progression unnecessarily. So-called "Red herrings", meaning artifacts that do not pertain to any puzzle are also to be avoided, since players will attempt to make connections to puzzles when there are none.

Lastly, the workshop was structured around active learning; After having covered a new topic, attendees were tasked to put this knowledge into practice by designing a fictious EER meant to inform employees on cyber security. For this purpose, a "postcard escape room" was undergone, personas were constructed, learning goals developed and a story written to which the EER would pertain. Regretfully, there was no time remaining to cover the crafting of a puzzle, which would have been most insightful, regardless, the workshop was inexpendably valuable, for the experience led to a stronger intuition of the researcher regarding EERs.

2.4 Expert opinions

During the research phase, one expert within the field of ER design was so kind to grant their insights into their work and shared advice on how the project may be approached. This person was interviewed by Hilke van den Born, who shared the results with the author. Much of the recorded served to further affirm the claims made by Fotaris [6] in his framework, as well as points of advice to heed during the design phases.

Certain points were mentioned in this interview, however, that eluded Fotaris' framework explanation. For instance, while Fotaris does mention the importance of considering one's available space, he does not speak of which aspects would need to be considered precisely. One expert elucidated how the most salient aspects are the number of electrical sockets available, possibility of physically bringing it into the space, for instance through the door, and whether there are pyro-hazardous places in the room. In the case of this project, the space may not be visited physically at all times, receiving measurements from the client is therefore important. These are the hard constraints by which the designer operates, if they are not respected from the beginning, it may lead to the abrupt abortion of an idea halfway.

Furthermore, one expert emphasized the importance of reflecting periodically upon one's design choices within the story, asking "Does it make sense that the players have to do this at this point in the game?" Fotaris does not specifically assert that the logical sequencing and understandability of the design choices within the storyline must be reflected upon during the design process, this is left to the evaluation whence this is evaluated. It is worthwhile, however, to reflect occasionally upon these aspects prior to the evaluation, as the coherency of the story leads to the emersion, which, as aforementioned, is crucial in an EER.

A noteworthy point was additionally brought forward concerning the evaluation. Fotaris presents various methods on how an EER may be evaluated, but does not touch upon when this should be in the design period. An interviewed expert asserted that this must be well in advance of the deadline, approximately 3-4 weeks as to ensure that time remains for uncovered flaws within the design or bugs within the program and resolve them. Considering the final product is meant to be of use by the client, this process is of utmost importance.

Points of advice taken from the experts are:

1. Considering that the Airstream will be mobilising, the puzzles designed within must be sturdy enough to withstand this, for instance through steep turns and speed bumps, or designed as such that it can be detached and stored safely.
2. Protection against a myriad of weather conditions must be considered. As the EER will be in operation the entirety of the year, its circuitry must not fail in warm summers as in cold winters. Moreover, rainy days will make the interior more humid, it must be ensured that the final prototype is resistant against this. Placing puzzles on the outside is therefore not advisable.

3. Since the owned space consists of one room in a caravan, there is no possibility of placing the circuitry of each puzzle outside the wall, as is generally done with escape rooms. In addition to the location of the puzzle itself, it must hence also be reflected upon where it's circuitry may be placed so that the player does not accidentally disable it.

2.5 ER players insight

To answer RQ 3.3, persons falling under the target demographic, meaning a random pool aged above 16, were interviewed and observed with the intent of understanding the group behaviour within an EER and the needs of EER engagers considering design aspects.

2.5.1 Past visitor insight

To unveil the aspects of an ER that are most memorable to visitors, a selection of 7 interviewees were questioned on which moments they have retained since their last ER participation. The assumption here is such that if a participant remembers a design choice, then this must have left an impression on the player to have lasted so durably. The selection criteria for the interview is to have played an ER at least once six months past the soonest. Participants were recruited from social circle and on university campus, the interviews were conducted by Hilke van den Born.

What many reported was endorsement for decoration that had been installed impressively and uniquely. One respondent could recall quite clearly how an "Alice in Wonderland" ER had been designed, indicating that outstanding décor leaves a lasting impression. This may also be accomplished if the player is taken by surprise, for example how one interviewee recalled having to suddenly crawl through a washing machine to another room. This may be further enhanced by employing light effects, meaning highlighting certain areas, or rendering the entire room dark at start, the playing with light is a further aspect that is well retained. An impressive design should therefore be produced for the final prototype.

Puzzles themselves may furthermore also contain design aspects that are memorable to players. Multiple respondents indicated that puzzles where collaboration was required with another group member to be especially fun and exciting. In addition to this are the meta-puzzles well remembered when designed to be imposing. For instance, one interviewee explained how opening the final chest in an ER was the most exciting aspect of that visit for them. When players perceive a puzzle as more exciting, it is more likely to be remembered. With this reasoning, unengaging puzzles will not be prone to recollection, unengaging design must henceforth be avoided.

On the other hand, negative feelings also engender an ER to be remembered, albeit in a negative light. Frustration induced through confusion surrounding the understanding of the storyline, accessibility issues due to language barriers or when the manner of solving a puzzle is not intuitive was retained by the interviewees long after the ER had concluded. A certain amount of frustration is unavoidable when appealing to the general public, but when reflecting upon these experiences, the incorporation of the points for avoiding player frustration relayed by Fotaris [6] discussed prior in chapter 2.3 carries increasing weight.

2.5.2 Observation

In addition to past visitors, it is worth exploring how immediate visitors to an ER navigate the experience, meaning how an ER functions behind the curtains. Mark Ziegelhöfer henceforth visited the ER "Team escape Münster"[6] where two groups of 5 and 11 persons were observed succeeding the completion of the games "Temple escape" and "Room blood diamonds" and shared the results with the author. Within the "Temple escape" game, the group was split into two and played to outcompete each other, meaning to complete the room the swiftest. Furthermore, the gamemaster allowed for a glance behind the scenes [Figure 11], where the players could be observed as they progressed through the game. There were three screens present. The structure of the puzzles in both games was entirely linear [Figure 6].

As the game commenced, the groups generally spread out, tackling as many puzzles as their group size allowed and collecting clues. Due to the linear structure, all found themselves on a dead-end, leading to the converging of the team and sharing their findings. From this, teams understood where which found piece of information was meant to be applied and puzzles were beginning to be solved. Occasionally, the gamemaster would influence the game by activating a certain mechanism, such as opening a door, so that it would appear to open automatically. The groups expressed surprise from this. In the end, all teams completed their respective escapes within the time limit of 60 minutes.

[6] Team escape Münster: https://teamescape.com/muenster/escape-rooms/

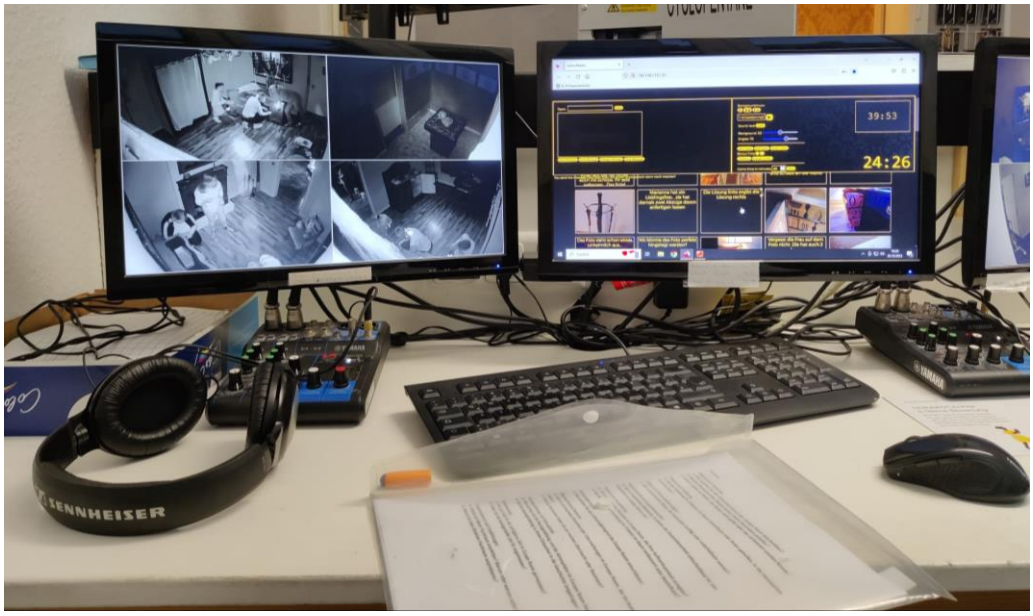


Figure 11: Overview of the gamemaster

In this session, 3 games occurred at once, rendering it challenging for the gamemaster to observe all teams simultaneously. In a questioning afterwards one team expressed that they did not believe the gamemaster responded quickly enough, that it would have been preferable to have one observer per group in order to proceed faster. The role of the gamemaster is indeed quite salient to mediate the frustration of progression that players may feel as they grow stuck, for too much frustration results in capitulation, while too little frustration results in disinterest in the game. Employing a capable gamemaster who is able to oversee the activity in the (E)ER is therefore most advisable.

2.6 Reflection on background research

Overall, the topics explored within the background research may be divided into three aspects: Global warming thematic research, contextual EER analysis and design aspects of EER puzzles. As to comprehend the context in which the designed final prototype, alias the puzzle, would find itself, it is salient to understand EERs functionality, as well as employability and design aspects. Even so, the information gathered on ERs does overshoot the limits of what is employed within the Escape Climate Crisis EER, meaning that not all the information gathered in this paper is directly applicable to the project at hand. For instance, the overwhelming majority of analysed ERs were static models, it would have been more effective to specifically target mobile ERs, but due to the scarcity of literature and experts available on this specific niche, an overarching contextual analysis was performed instead. This remains worthwhile, as the bulk of learnt information on EER design from both state of the art as well as physical visits is also applicable to within this project's context,

while the remainder may be presented to interested persons as inspiration for future considerations.

Designing a singular puzzle within an EER is regrettably too niche of a subject for it to be covered in depth in most existing literature by experts, the most valuable insight was gained from addressing design aspects in expert and visitor interviews directly, as well as the workshop hosted by Fotaris. While the interviews particularly discussed which frustrations and implementation perils must be avoided in the design process, the workshop illuminated how a puzzle may be designed effectively by presenting classic ER puzzle forms along with explanations on how to manufactured them. The workshop furthermore elucidated which forms of puzzles are generally well received and which not, granting new inspirations for the final product. Unfortunately, not enough time remained for a puzzle design activity in the workshop. In spite of this, enough activities were undergone to strengthen the author's intuition towards EER puzzle design and carry this with him into the ideation phase.

The pre posed RQs 1.1 and 2.2 have herewith been answered, 2.1 has partly been answered, but still requires further development at point 2.1.3 through exploring these design aspects oneself in later chapters. 3.3, as well as 4.1 and 4.2 have been covered to sufficient extent that the results may be employed in the ideation phase.

3: Methods and techniques

3.1 Methods from literature

Three methods derived from literature will be referred to in this design process, one to understand the process of developing an EER, one how a technical artifact may be crafted and one how the visitor may be persuaded to alter their behaviour. The aforementioned model proposed by Fotaris will be employed to lay out the EER design process [Figure 6]. The freedom of development within this project lies within the categories “Design”, “Prototype”, “Document” and “Evaluate”, since the users, problem statement and theme in the steps “Empathise”, “Define”, and “Conceptualise” have priorly been defined by the client. Regardless, a puzzle will be heavily influenced by these design choices previously made, these will hence also be denoted. “Brief” as well as “Debrief” is considered beyond the productional scope of this project, for it will not be altered by the researcher and has reduced effect on the prototype, will however be elucidated to a necessary extent in context of the storyline and user experience. Employing this framework will serve to answer RQ 3.2.

The development process of the prototype will be mediated by the design process proposed by Angelika Mader and Wouter Eggink specifically tailored to the creative technology bachelor [Figure 12], simply dubbed “A design process for Creative Technology”. This process divides the manufacturing of a “product prototype”, or final prototype, in three phases; The ideation phase, the specification phase and the realisation phase. In all of these phases, ideas are first diverged, meaning that the creative space is broadened, followed by a conversion of ideas, meaning that the space is narrowed until one or a set of feasible ideas remains. The generation of ideas in done in a circular procedure, where design aspects are revisited and revised as deemed necessary.

This design process is applicable to this project, as this paper entails the development of a singular technical product which will be subject to multiple iterations and prototyping strategies until it adheres to certain client wishes as well as until it induces a certain user experience among the end-users, in this case being the introduction of the climate crisis in a pedagogical manner. The room for creative idea generation within the Creative Technology design process through diverging upon ideas is salient, as the nature of the Airstream EER is creative and hence requires out-of-the-box thinking by the designer to produce a satisfying product. Considering the aforementioned, the Creative Technology design process will be employed to further develop RQ 2.

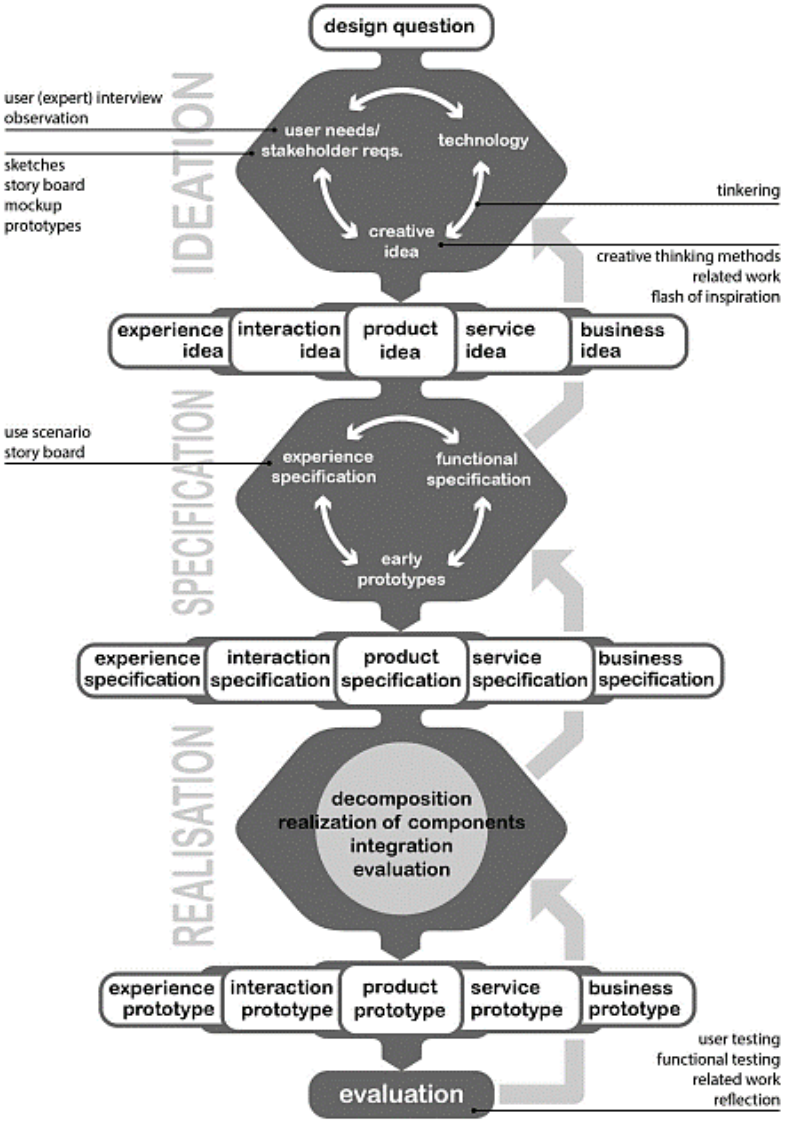


Figure 12:: Design process for creative technology [18]

To elucidate each phase, in the ideation phase, a broad range of possibilities are considered by the designer through brainstorming methods and related work. Ideas may in this phase be worked out slightly further in the form of simple prototypes or mock-ups, such as paper prototypes also endorsed by Fotaris [6], sketches and storyboards to elucidate their destined purpose. The user needs and client requirements may guide the idea generation, depending on the brainstorm method employed, but must at the latest be integrated into the selection procedure of final ideas. Simultaneously, the technology employed should also be superficially defined as to elaborate upon it later on.

In the specification phase, the selected idea, or small selection of ideas if applicable, is developed further to now include the precise experience and functional specifications by the designer. The designer then defines the experiences by picturing the interaction through possible

use scenarios or storyboards, leading to a clear presentation of how the final product is intended to be employed. The functional specifications elucidate what the final product must comply with performance-wise, as well as further elaboration upon the technology and enumeration of list of materials accompanied with the stepwise assembly.

In the realisation phase, the attempt of the development of the final prototype is documented by the designer, along with notable complications that may have arisen throughout the process of which was not thought beforehand. Once complete, the designer evaluates the prototype through a presentation to end-users as well as systematic functional testing for bugs and system failures. Here, the artifact is placed to the test of whether it incorporates the functional specifications defined in the specification phase beforehand. The design process is then concluded with a reflection upon the results by the designer, touching upon how the system may be designed more effectively in the future.

Lastly, behaviour change technique (BCT) taxonomy proposed by Susan Michie [21] will be incorporated into the design during the specification phase as to persuade towards a specific behaviour change, in this case being an alteration to more environmentally friendly behaviour among players. The client expressed that this does not carry significant weight and will therefore be implemented modestly. A list of possibilities to select from is depicted in Appendix D obtained from the UT “Persuasive health design” course. This framework will be coupled with the results to RQ 1.1.

3.2 Techniques employed

The formal techniques employed within the design process will herewith be elucidated. For one, as to include the clients wishes into the design in the form of system requirements, as well as contextualising the project by the hand of the room2educ8 framework, the client and his design group will be interviewed. These interviews, as well as those conducted with ER players and experts will be condensed into representative personas for the client and user, this will grant the design process an overview of the client requirements and user needs. This data will further also be employed to specify the experience and the functional requirements later on, answering RQ 3.1.

A visit to the airstream automobile will reveal the possibilities of puzzle installations and address RQ 2.3. The airstream will not be available to be measured at all times, since it is situated in Germany, while the project takes place in the Netherlands. Following the advice of the expert, a formal evaluation of the workspace will therefore be undergone, where potential puzzle locations will be recorded, measurements taken and as well as a general impression of the airstream will be

obtained, including strong and weak points. This collected data will be considered in the ideation phase and play a salient role in the selection of the final concept.

The author will generate ideas for this project through the formal brainstorming methods “Mind mapping” and “Lotus blossom”. Mind mapping is defined as branching smaller topics and spontaneous ideas out from a central topic. Ideas may grow interconnected and may be developed as much or as little as the designer wishes. The Lotus blossom method is conducted by selecting a central theme around which 9 connecting elements are ideated. These are then separated, becoming central themes themselves and the process is repeated once more. Compared to each other, the Lotus blossom method is more structured than mind mapping, they will therefore be employed to first ideate on possible core themes surrounding climate change and then develop a selection of concrete ideas further respectively.

4: Ideation

Within the creative technology ideation phase, the user and client requirements, applicable forms of technology (as well as forms of interactions) and possible gross concepts are explored. For this specific project, it is also salient to explore the progress that has been made on the EER thus far, since the context is already defined to a certain extent.

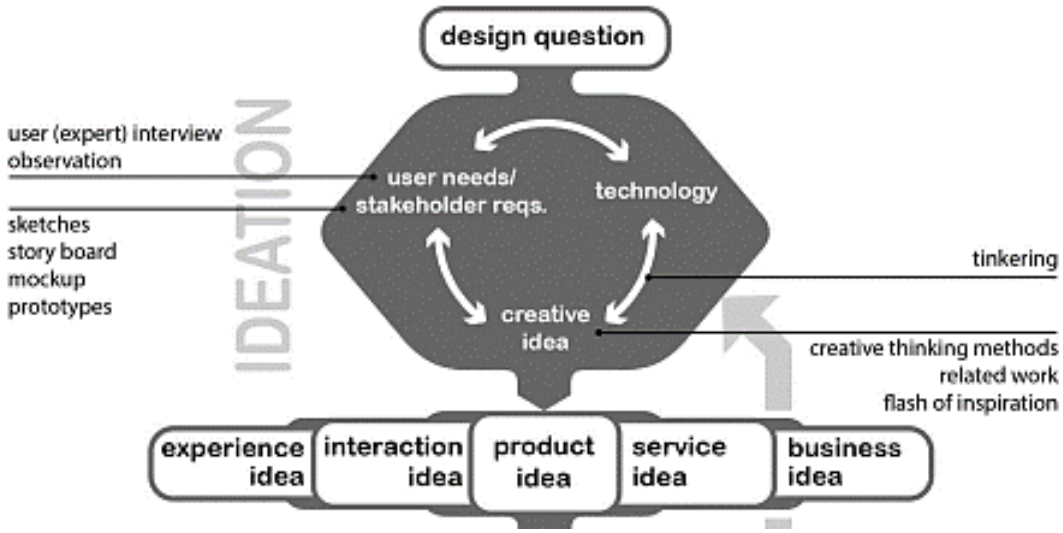


Figure 13: Ideation in creative technology

As Escape climate crisis progresses in parallel to the development of the documented final prototype, It is worth noting that collaborating with an outside agent, the client, had an effect on the ideation, since concepts were required early on. Therewith, brainstorming is undergone to produce 3 early most preferred concepts, validating these not only from a set of requirements, but also from contextual applicability, meaning whether the idea may feasibly be installed in the airstream. Furthermore, client as well as user feedback played a role in the ideation, as the final product is to be employed by the client and therefore must consider their wishes. As such, the ideation was undergone as depicted in figure 14, where multiple aspects defined the final idea.

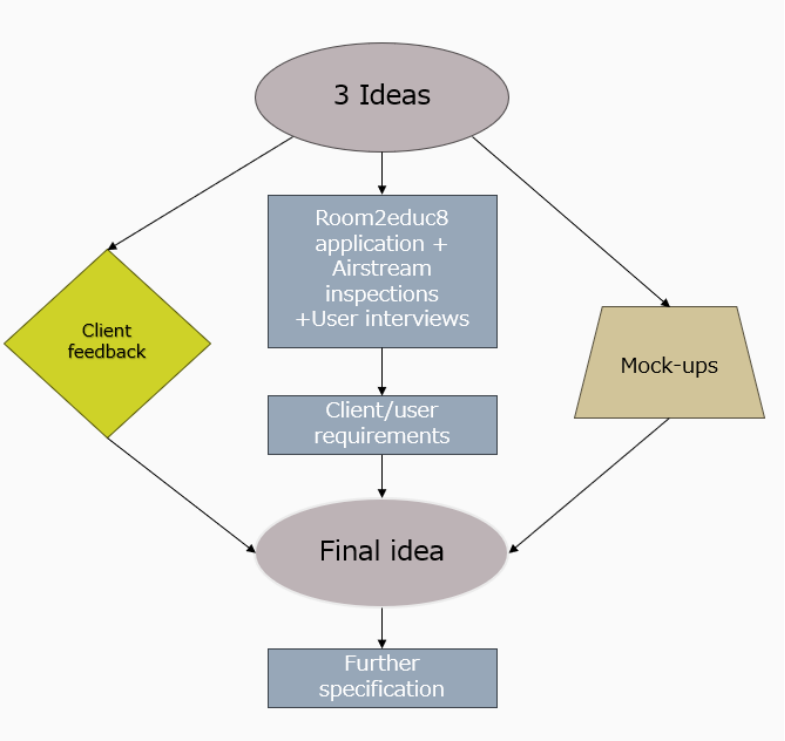


Figure 14: Ideation process of final idea

4.1 Three selected ideas from brainstorming

Brainstorming was performed prior to any consideration of client requirements or for user needs as to diverge the ideas as far as they may. Initially, 20 ideas were ideated from these sessions of varying depth of development, where inspiration was drawn from the state of the art and ER theory uncovered in the performed background research, aiding to shape the ideation. The ideation results of the undergone brainstorming sessions may be found in Appendix E. From the information gathered during the research phase as well as client feedback, 3 proposals were deemed to be of potential.

4.1.1 Herz der Zukunft

Herz der Zukunft (Heart of the Future) is situated in an enclosed area of the Airstream. Visually, it consists of a large hybrid cyborg plant. Screens are hung on the walls surrounding this plant, inactive at the beginning, but will be set alight by the player as the puzzle progresses. The environment is further decorated with screens, posters and post-its to describe the artifact. The intent of the décor is to create a shocking or surprising effect to the player once they take notice of the puzzle, sparking immediate interest into the puzzle. This puzzle would consist of combining two elements, a keyword and a description or such, by connecting two physical points in some fashion.

As such, the player may be made to reflect upon the presented theme and discuss it among the team to communally attain the solution.

This concept is partly derived from Soares [12] attempt at initialising an EER, as the group will be greatly prompted to collaborate to medically rescue this plant (or alternative artifact) by engaging in a similar form of teamwork which the medical staff of Soares was prompted to. In this case, however, the thematic is more abstract than the one treated in Soares' EER, as the users are not meant to be physically taught a certain medical procedure, but rather the emotions of heroism and responsibility of a medical procedure are applied to the interaction of Herz der Zukunft by emulating a revival of a living being.

AI generated collage depicting idea

4.1.2 Stimme der Jahreszeiten

Stimme der Jahreszeiten (Voice of the seasons) is a circular puzzle in the shape of a phenological calendar, on which it is based. Within this circle, certain cavities near the months on the calendar allow 10 types of 12 pieces of seasonal puzzle pieces to be placed into 12 months, along with a screen on which the current health of biospheres is represented by either a thriving or withering natural landscape. The closer the placed season pieces represents the natural order of the phenological calendar, meaning the optimal state in which that month should be, the healthier the natural landscape becomes, indicating progression to players. The design of the puzzle pieces will pertain to nature and the season they represent in some manner. Due to the contraptionless design of the puzzle, it may be versatilely placed onto a flat surface or designed to be hung on a wall.

This interaction is based on the findings of Galeote [19], as the puzzle attempts to create a memorable interaction by spurring the users to reflect upon what the optimal scenario may be and physically inserting it into a calendar artifact, thus rendering it more memorable. Furthermore, the confrontation with the current pattern of seasonal change engendered by climate change should

induce a certain discomfort among users, engendering them to reflect upon how they contribute to this shift.

AI generated collage depicting idea

4.1.3 Unsere kleine Welt

Unsere kleine Welt (Our little world) is game played within an enclosed space while receiving instructions from a second player right outside, hence rendering it a 1-1 teamwork puzzle. This video game is a 2D pixel art game in which the planet earth is depicted, along with the ozone layer requiring mending. As a small hand icon, the player glides across the ozone layer represented as a white shell around the globe and explores “puncturing zones” where the damaging chemicals must be deconstructed, for instance CO2 into C4 and O3 (Ozone). The game will be hung on a door or wall, it should be secluded from other players, ensuring that the one playing the game is truly doing this with only one other person present. The puzzle disguised as a game therefore explores the idea of how punctures within the ozone layer could be mended, with regards to which chemicals are harming it in the present time.

Taking inspiration from the “Cyberpunk 2049” ER, this concept would primarily be concerned with creating impressive decorations and memorable visuals above anything, as the research presented by Veldkamp [13] asserts that immersivity is a key factor in establishing memorability and personal engagement. The inside of the closet would therefore be designed to present a considerable futuristic and environmentally involved thematic as to create affinity to the thematic for the player and therewith persuade behaviour change.

AI generated collage depicting idea

All ideas described hitherto are rough concepts serving as starting points for concrete idea forming, none of the details elucidated priorly are therefore to be considered as final. As to make a fitting choice among the candidates, the remaining RQ 3.2, 2.1, 2.3 and 2.4 must be answered, the coming chapters will treat this.

4.2 Room2educ8 application

The exact situation in which the final prototype, meaning the puzzle, would be required to fit is herewith analysed as to answer RQ 3.2. Fotaris [6] elaborates upon the necessity of unison within an EER, thus, in table 1 below, his framework [Figure 5] is filled in with the responses of the client's design group concerning the context of the project as to determine which concept may be most suitable in the overall EER. The precise responses may be found in Appendix A.

It is worth noting that the EER is not to be strictly applied in educational settings and that the approach taken by the team is in certain regards less formal than academic standards, there are therefore instances where Fotaris' framework is not fully applicable. Furthermore, the information denoted does not reflect the final stage of the project, but the situation in which the project exists at the time of the ideation phase when the selection among the 3 suggestions was made. In this everchanging project, the information presented may be subject to later change.

Step within room2educ8	Escape climate crisis
1. Emphasise	The target group for the installation are young adults above 16 years old among the German speaking public. Specifically those are targeted who have already been confronted with the thematic of climate change, but who were not swayed

	by a pedagogical approach and may be convinced through a more playful manner of teaching by the EER. Children are not included due to legal complications.
2. Define	The purpose of the EER is to render more young persons climate aware through confrontation with negativities and causes of climate change through play while evoking hopeful emotions, with the highest ambition being to inspire its visitors into climate action. By the end, the visitor should be more informed on and motivated to tackle climate change. Beyond vague retention of past mentions concerning climate change, the visitor is not expected to know much on the thematic. A group may at most consist of 3-4 persons and will be given 60 minutes to complete the challenge. The EER is modelled after an “Open the box” concept, where the box is a final message that is decoded by the players. There is no relation to any curriculum.
3. Conceptualise	The context of the EER is engulfed into a storyline. Dr. Dorothy Hardman has sent the Airstream (meaning the ER) back in time from the year 2050 to warn the public that her world has become unliveable due to climate change. A message has been planted by her to be found by the visitors where she elucidates this need for action. She is a scientist with a love for merging the organic with the mechanic, which is why plants slither all across the caravan. Many of the puzzles are artefacts left behind by her for the visitor to find, and therefore pertain to technopolis as well as the natural. Within the story, the visitor witnesses the airstream appear out of thin air and then steps inside to explore, the story is therefore applicable on various locations since the environment outside Airstream is not considered. The inside should preserve the theme of travel through its caravan-style interior, while also giving a futuristic solarpunk feeling. The entire flow of the game should furthermore pass through the stages of “Understand/Sense”, “Courage/Acting” as well as “Sensing/Love/Empathy” [Figure 15].
4. Design	The players will enter the EER and will then move around freely. The structure of the puzzles will tend to be more linear [Figure 15], catalysing that puzzles must be designed to be approachable by many at once as to not seclude less dominant players. They may step outside the room if they wish as well as open all cupboards, the only location where they may not come is the electrical cabinet due to safety hazards.

Each puzzle is meant to pertain to climate change in some form, as to teach on a specific aspect of the climate crisis. The atmosphere must be mysterious, cool and futuristic while setting an engaging and fun tone for the participants. Furthermore, it must cleverly add to the furnishments inside the caravan by respecting the travel feeling induced by the caravan's setup. Visually, the puzzles must pertain to solarpunk, meaning embody elements of the natural and mechanical. There will be certain larger puzzles to which the player will progress by solving smaller predecessors, ensuring constant engagement throughout the experience, as may be seen in the figure below. In Appendix F, visuals depicting the Airstream may be found to further elucidate the space in question.

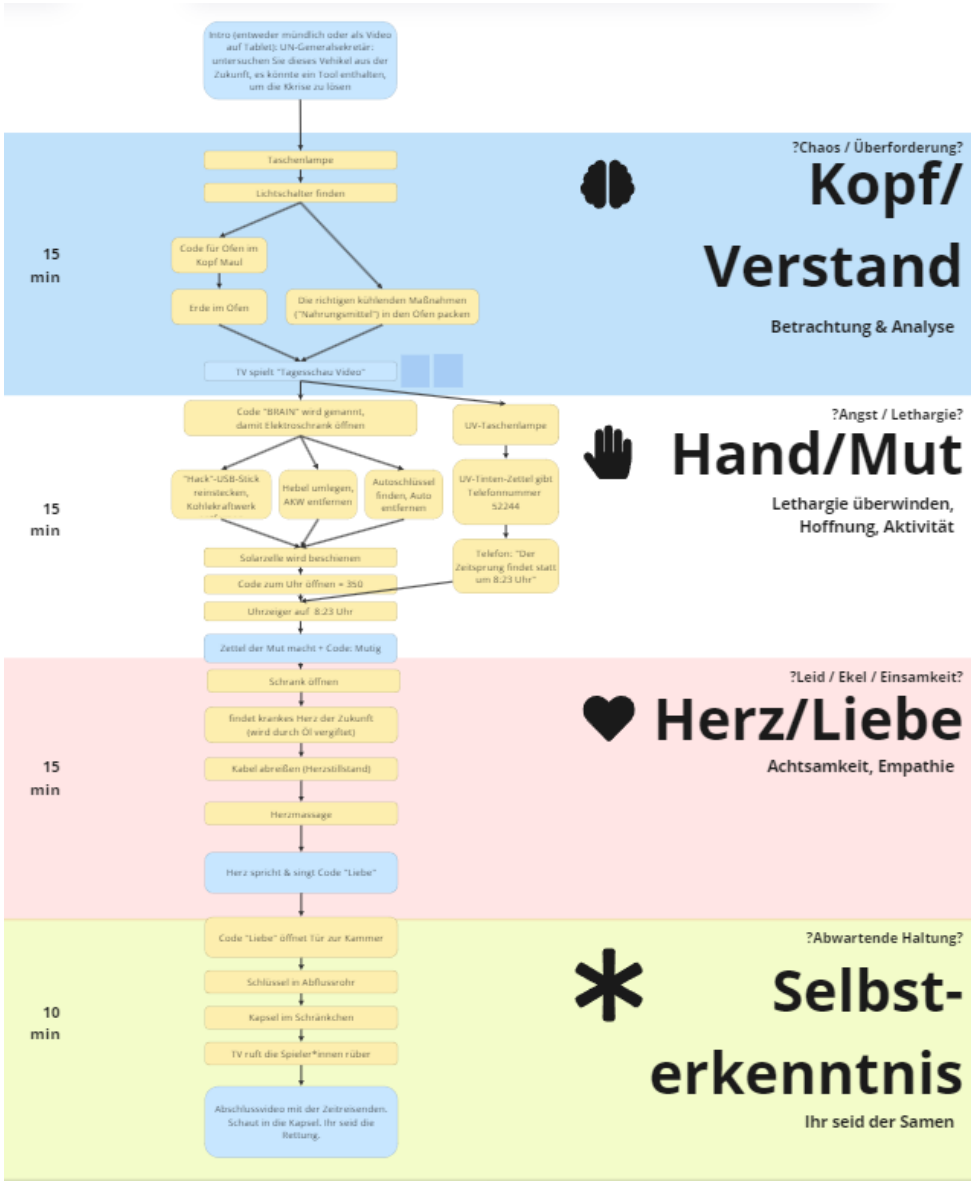


Figure 15: Puzzle structure (Time of writing)

5. Brief	Briefing has not been defined concretely as of the beginning of the ideation phase, but will serve to inform visitors how an ER is played, the limits of allowed action, the storyline and how to request aid if a puzzle is deemed too challenging. It is being considered to perform this in the form of an introductory video.
6. Debrief	The final puzzle will convey a message to the players once solved. Dr. Dorothy will elucidate the purpose behind the installation, that it embodies a warning from the future to engage in climate action now to preserve the future. After this, players will be asked to join a workshop in which the specifics on what form of action is required as well as details on current climate change are elucidated by the Escape climate crisis team. The player may choose to not engage with this part, or to attend it separate from the EER. It furthermore grants them the opportunity to discuss all they experience during playtime and reflect upon the message. After this, they will be given a souvenir to recall the experience once they have left in the form of a “Climate action” card, on which a positive environmental impact scenario is depicted that may be performed in the lives of the players.
7. Prototyping	So far, paper prototypes have already been crafted by the design team to emulate what certain puzzles would represent in the final EER as to explore the possibilities of puzzles that may be appropriate and what simply does not fit. So far, this has not reached a conclusive stage yet, further prototyping will be undergone by the Escape Climate crisis team parallel to the project described in this paper. Furthermore, the artifact has been presented to the public, friends and family to receive feedback on the airstream’s first impression and possibly recruit further volunteers.
8. Document	Documentation has not been formally touched upon as of the beginning of the ideation phase.
9. Evaluate	Evaluation has not been formally considered as of the beginning of the ideation phase.

Table 1: Room2educ8 applied to Escape climate crisis

4.3 Consideration of spaces

As elucidated from the expert interview conducted, the physical room in which the puzzle will be installed must be transparent to the designer, no aspect may remain doubtful. During a visit by the EER design team from Germany, the space of the Airstream is physically explored and notable locations for a puzzle recorded, as well as possible pitfalls. A visual depiction of possible locations of the puzzle may be derived from Figure 16, more elaborate depictions may be found in Appendix F The analysation of these spaces serves to answer RQ 2.3, meaning how the area of the EER may be cleverly exploited, as well as further gain insight into which of the 3 concepts may be most employable.

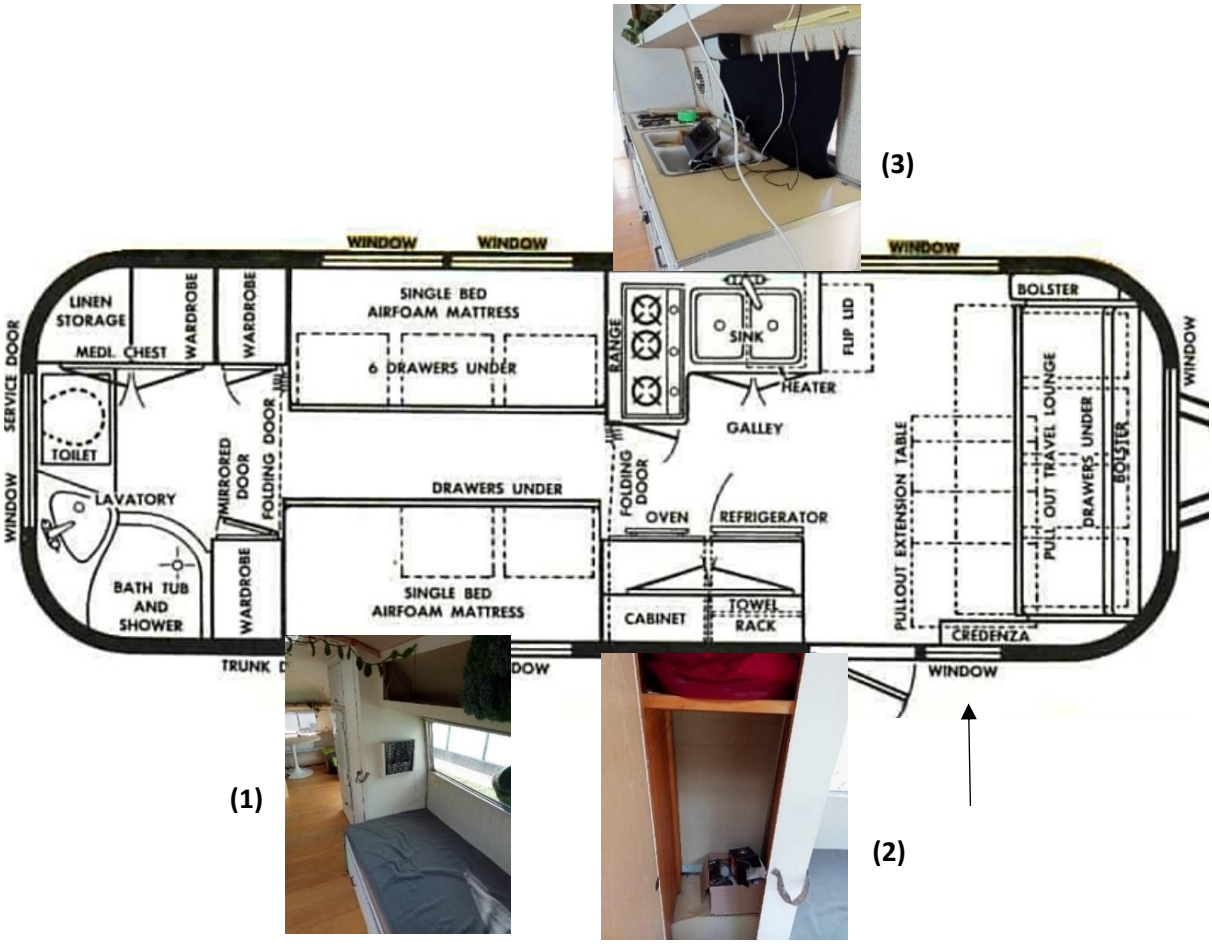


Figure 16: Considered spaces depicted on Airstream blueprint

One interesting location to include a puzzle would be on the foam beds (1) , since the space would be large enough for a group of 4 to be seated simultaneously and discuss a puzzle collaboratively. The surrounding walls could be employed to hang an artifact, or the overhead cupboards, although persons would need to stand for this then. It would also be possible to drill

walls and connect consecutive spaces, such as the bathroom or the closet with the bedding area. Furthermore, this area favourably contains a local power socket.

Another area to consider would be the closet (2). Here, a larger puzzle could be installed and covered until a later stage in the game by locking this door through a prior puzzle, creating high tensions as well as a “wow!” effect when the door is finally opened. Even so, the area is limited, not many may gather around it at once, unless the area were expanded to the bedding area or other cupboards. Moreover, there is not much room to hide the circuitry of the puzzle, it may be prone to sabotage from the player unless clearly instructed that they are not to handle the electronics. Regrettably, the space is not large enough for a person to stand in (unless it were a very tiny person). There is also no local power supply, an extension cord would be required.

Lastly, a noteworthy space is on the kitchen counter (3). This counter is equipped with and old gas stove, sink with tab, a gas lamp, cupboard and multiple drawers, all intriguing artifacts to employ within a puzzle. Furthermore, the space would be large enough to allow 4 players to work on one puzzle at once, although the hallway would be untraversable then. Furthermore, there is a power socket close enough that a puzzle may be supplied with electricity facilely. The weak points of this spot are that the space is not very large if one does not wish to make use of all facilities, meaning merely the stove, the sink or the counter. In addition to this, while a puzzle is being performed here, the closet and fridge are essentially unreachable.

Further salient points to bear in mind during production are:

1. The power sockets are all American and require adapters to be used.
2. The floor is not perfectly hygienic, players should not be asked to sit or lie on it to resolve a puzzle.
3. When all openings to the outside are closed, the inside is satisfactorily soundproof. Not sufficiently to confidently employ microphones in all environments, but employing audio is possible.

4.4 Paper prototyping

Paper prototypes of “Herz der Zukunft” as well as “Stimme der Jahreszeiten” are crafted and are depicted in Figures below. These were informally presented to 6 persons consisting of persons within the author’s social circle, as well as local interested persons on campus to attempt and solve the puzzles and state their opinions. No data was recorded nor was an ethics request made. This was undergone to further answer RQ 2.1.1.1 and begin with an insight into RQ 2.4, meaning how potential final prototypes are perceived upon first glance, whether there are conceptual flaws that might disqualify them and which interactions may be appropriate for the final concept.

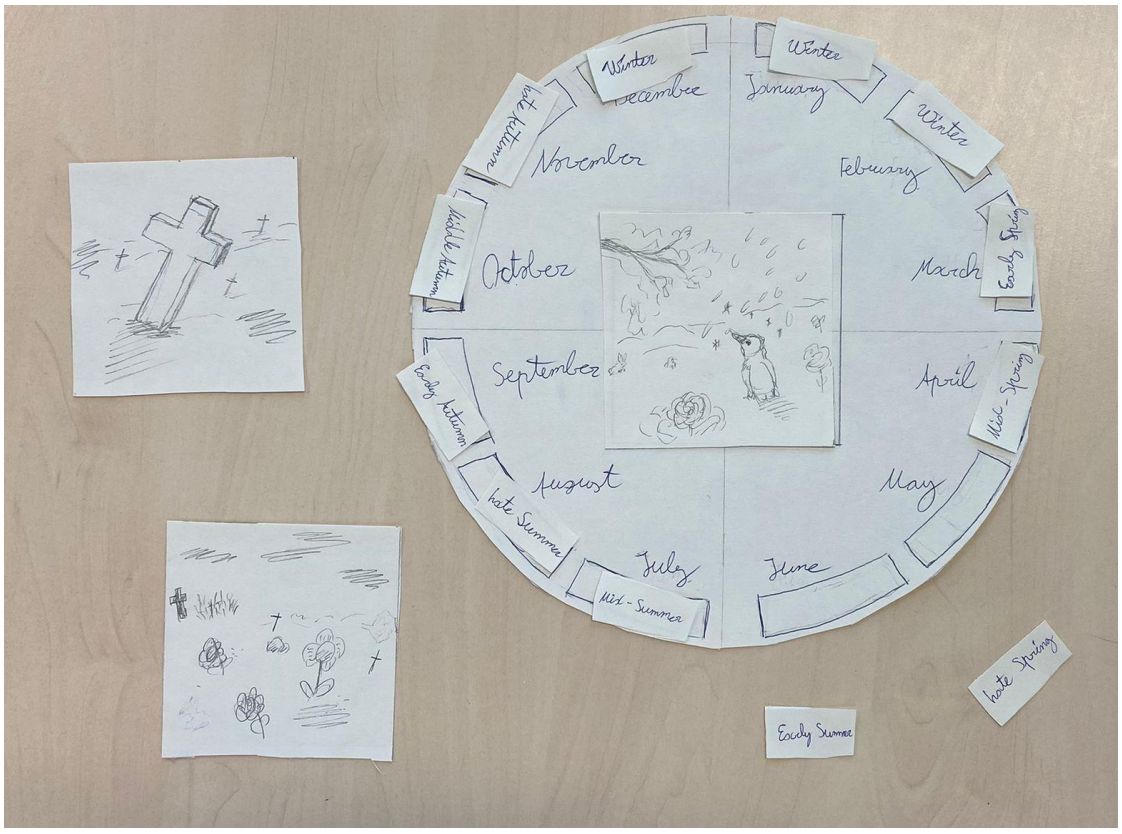


Figure 17: “Stimme der Jahreszeiten” paper prototype

Within Stimme der Jahreszeiten, the concept of the phenological calendar was presented to participants along with 12 seasonal pieces representing the 10 seasons. If they were placed correctly, that is according to when the calendar states they should occur, the middle visual would be swapped from a graveyard to a natural hub. Participants were not briefed beforehand.

The puzzle was on average solved within a few minutes, much shorter than anticipated, meaning that there were clearly no issues of intuitiveness within the design. As shown in Figure 15, the time reserved for the authors puzzle within the overall EER is 15 minutes, this along with the fact

that most responders stated the puzzle was “too easy” suggests that the design may be rendered more challenging in the final prototype, for instance by rendering it less clear what season each piece represents immediately. Even without understanding what the phenological calendar is, players intuitively made the connection to the 4 seasons and promptly filled up all the spaces. No mistakes were made by none of the players. If this puzzle is to be produced, it must indeed be designed in a more challenging manner than this prototype.

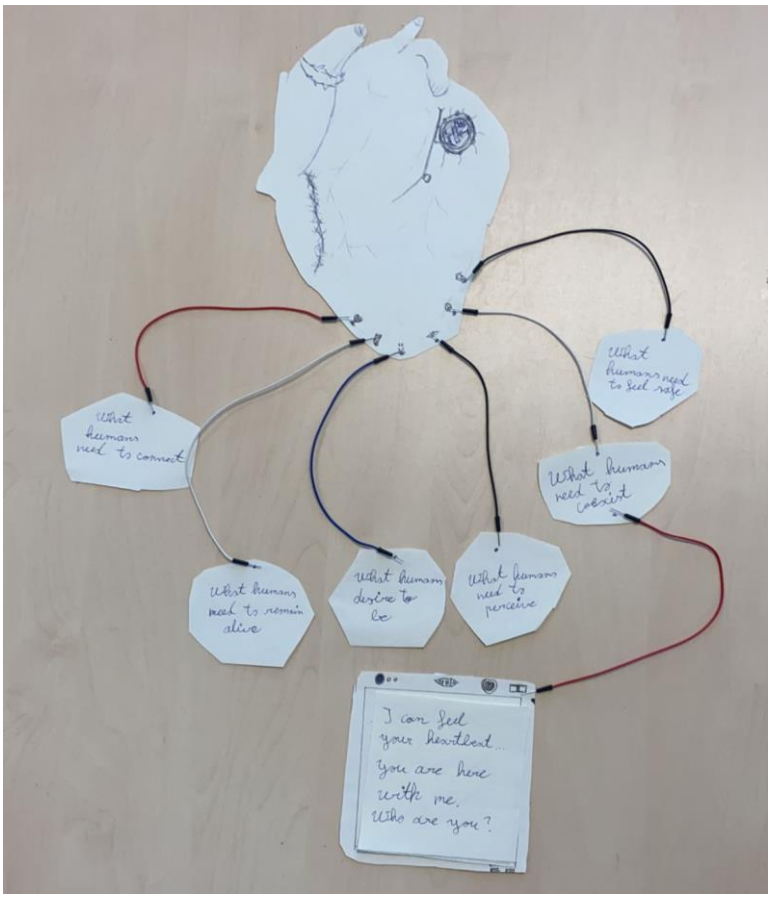


Figure 18: “Herz der Zukunft” paper prototype

In Herz der Zukunft, the phrases are to be connected to their respective symbol, for instance “What humans desire to be” would be the smiley (happiness). Additionally, paper screen is connected to a phrase, representing the phenomenon of a screen illuminating as the puzzle progresses and the heart speaking to the person. A heart was chosen as representative visual after feedback received from the client initiated that a mechanical heart may also be a viable artifact. The specific artifact will be ideated further.

This puzzle was also resolved very swiftly by participants, the average time of completion being approximately 6 minutes, also presenting no issues on the intuitiveness. Similarly, this puzzle

was also dubbed “pretty easy”, although some expressed that they did find it a tad more challenging than the previous one, and visually more interesting. Indeed, it seemed to cost participants slightly more time to decipher a meaning to a symbol than it did a season to month, likely due to the latter one being common knowledge among all. Experimentation may be further conducted on which symbols would be connected to which end terminals, and how this may be rendered more challenging, although it may be advisable to alter the interaction to a more challenging one altogether. Furthermore, the activation of the screen gains attention for a moment, but players did not heed it much mind. This may also be the case for the final artifact, in which case succinct messages should be considered.

4.5 Client and user requirements

To appropriate the product for the client as well as the end-user, respective requirements are listed drawn from interviews, as well as literature research enumerating the results of all the pre-evaluation research questions (all except RQ 1.3, 2.4 and 4.3). To condense this further, personas have been crafted that may be found in Appendix G to represent client and user. These requirements are the guiding principles for the 3 concepts, the most conforming one is deemed suitable for production.

For the end-users, the final prototype should:

1. Consist of an intuitive interaction, which may not be confusing or misleading
2. Not frighten or place excessive stress on the player
3. Employ the surroundings in an unexpected manner, generating a surprise effect
4. Create a feeling of personal relevance to the player
5. Not attempt to convey concrete information to the player
6. Not employ excessive language or cultural knowledge without which the puzzle becomes inoperable
7. Employ impressive decorations and designs that bewilder the visitor
8. Induce teamwork in some form within the puzzle design
9. Contain a single, non-ambiguous solution which the players are searching for
10. Present a certain challenge to the player to avoid being deemed boring
11. Allow for immersion within the theme of the EER (through story, interaction, décor etc)
12. Stimulate a memorable interaction
13. Contain a clear stylistic relation to other puzzles in the vicinity, the puzzle should not be an abnormal outlier
14. Not contain elements that do not pertain directly to the solution

For the client, the final prototype should:

15. Pertain to the theme of solarpunk, as well as climate change and travel
16. Contain the moral or message or the puzzle must pertain to love, consideration and empathy
17. Must not engender fire hazards, or equivalent
18. Be solvable in at most 15 minutes
19. Not compromise the enjoyment of the experience for educational aspects, while maintaining a friendly, non-judgemental tone
20. Align with the story of the time traveling Dr. Dorothy Hartmann and her warning to the past
21. Be utilisable by the staff, who has little experience with technology (simple technical design)
22. Be durable enough to last 3-5 years without serious breakdown
23. Consist of parts that are facilely replaceable should they commence malfunctioning
24. Be sturdy enough to continue functioning after repeated usage, through transportation and if “someone accidentally drops it or steps on it”
25. Be located somewhere where the cables may be hidden
26. Operate without significant system errors
27. Present correct information
28. Maintain expenses within a 200 euro budget
29. Consist of recycled and non-polluting material
30. Play a melody upon completion that relays to the succeeding puzzle

4.6: Selection of idea

In table 2, all the requirements were considered and to what extent each potential concept complies to it. A + is given for positive, 0 for neutral and – for negative conformity to a specific requirement. Finally, all positives will be summed, where the negatives will subtract from the final weighing, a neutral has no effect. Please note that not all requirements listed priorly are denoted in this table, as certain requirements are heavily dependent on the manner in which the final prototype is built rather than pertaining to the idea itself, such requirements are relevant to be tried for the specification and evaluation phase.

Requirement (chapter 4.5)	Herz der Zukunft	Stimme der Jahreszeiten	Unsere kleine Welt
1. Intuitively	+	+	0
3. Surprise	+	-	+
5. No specifics	+	-	-
6. Inclusivity	0	+	-
7. Impressive	+	-	-
8. Teamwork	0	+	-
9. Non-ambiguity	+	+	0
11. Immersion	+	-	+
12. Memorability	+	-	0
13. Fitting	-	+	-
15. Solarpunk	+	+	+
16. Thematic	+	-	0
19. Light-hearted	+	0	+
25. Location	+	+	-
27. Factual correctness	0	+	-
Final:	10	3	-5

Table 2: Weighing of ideas

4.7 Final idea

Considering all the aforementioned, “Herz der Zukunft” was selected as final concept to be developed further. Users as well as the client found this proposition to be more intriguing, as well as meaningful and understandable. Furthermore, it contains significant potential to take the player by surprise, since the artifact may be designed to be abnormal and irregular. The puzzle interaction furthermore requires teamwork in the form of discussion among team members to find the solution,

rendering the piece even more memorable. Lastly, this proposition conformed the most to the set requirements by users as well as client.

"Stimme der Jahreszeiten" was deemed not interesting enough to be memorable by the client, as well as not granting interesting opportunities to blend into the furnishment of the physical space in a meaningful manner. Because of the urgency of seasonal balance, its pedagogical worth is considerable, yet in spite of this, end-users dominantly preferred Herz der Zukunft. "Unsere kleine Welt" regrettably did not conform to sufficient client requirements established throughout the ideation phase, such as the linear puzzle structure or "love" theme. In addition to this, the supervisors asserted that it would be plethorically challenging to ensure the information conveyed would be correct, hence leading to the rejection of the idea.

4.7.1 Possible alternate forms

Certain aspects of Herz der Zukunft are fixed as fundamental, such as that it will pertain to a central artifact, initially but not finally deemed to be a cyborg plant, as well as that this artifact will speak to the players in some manner, whether it be through screens and text or alternate forms. Furthermore, it has been decided that the puzzle will be situated in the closet, as to generate this lasting shock or surprise effect. Regardless, a handful of aspects remain open to revisitation to adhere to the requirements as well as RQs even more closely, such as which artifact will become centralised, what the lasting message should be, with which materials the puzzle should be produced and what the themes are which the player interconnects. Table 3 presents all these considerations from which a final choice will be made to carry into the specification phase. This possibility must be within adequate balance of all the unveiled information encompassing RQ1, RQ2 and RQ3.

Possibility	Main artifact	UX impact	Materials employed
1.	A puppet entrapping a vengeful spirit from the future who died due to a cause of climate change, blaming the player for their actions that led to the demise of the world.	Witnessing the tale of a perished soul should stir an emotional experience among users, engendering empathy and shame, as well as dread concerning such a death possibly occurring to them.	Worn-off doll, USB cables or other types to pass through this doll and suspend it from the top platform. A motor will be placed inside should the doll move throughout the interaction.

2.	The mechanised heart of Dorothy Hartmann entangled into the Airstream, speaking words of the future to players through the screens surrounding it.	A heart should create a relation between the problematic and humanity, indicating that this is a human issue. Furthermore, an organ may take the player by surprise upon first witnessing.	Plastic anatomical model heart if life size is desired (larger is very expensive), or produce oneself through sculpting or such. Recycled mechanical parts should be integrated into this artifact.
3.	The “Urpflanze” transformed into partly mechanic to serve as a new form of sustainable and environmentally friendly fuel to power the Airstream.	The user will feel hopeful after being presented with a fictional salvation to oil consumption and empowered that they have brought it to realisation.	Plastic or, depending on possibility of care, real plant fused with cables and mechanical parts to be obtained from recycling centre. Also a pot of sorts in which this plant will stand.
4.	A large computer processes datasets of all of Dr. Hartmann’s research on future calamities such as natural disasters, worsening general health and wars.	Being presented with the realities of current climate change and possible future climate catastrophes should stir discomfort within the player and create an empowered association of combatting these events.	A raspberry pi would be required to represent information on a large, old computer screen. Other artifacts may render the computer more believable, such as a mouse and keyboard, though may be challenging to acquire recycled.

Table 3: Possible variants of Herz der Zukunft

4.7.2 Possible interactions

For all the presented possibilities, the interaction must also be further considered since it is the most salient aspect of the product. With certainty, the final interaction is to pertain closely to the results obtained from RQ 2.1, 2.3 and 3.1. Herewith, 3 considerations are presented:

Connecting with cables:

The player obtains a male-to-male cable and connects a certain keyword to the description that fits it by creating a link between two female plugs. If the final answer is erroneous, the screens relay this to the player.

Positives:

- The interaction has been experimented with in the paper prototype and was deemed the most intuitive and meaningful by participants.
- The setup may be build cheaply and facilely, rendering it an effective option for the design group as the setup may be repaired swiftly and parts are not costly to replace.
- Despite the simplicity, it is not likely that the system will fail during the interaction of the players since the employed material is not fragile, though it may wear off over longer periods of time.
- Since players will be connecting physical points, they must communicate effectively as to not entangle each other, engendering teamwork.

Negatives:

- Each connection point must be physically connected to its neighbour, meaning that they may not be too far apart. Creating a puzzle large enough to fit all therewith becomes challenging.
- As it stand now, this form of interaction may be too facile for the player and not adequately challenging.

Inserting keypad code:

A singular code or multiple are entered into a keypad obtained from nearby the central artifact. If the answer is correct, the screens illuminate green, if not they illuminate red.

Positives:

- Keypads are widely recognised from everyday life, it may therefore be well assumed that their employment is intuitive.
- Here as well, a keypad is not costly and setup not excessively challenging.
- The keypad may be placed further from the central artifact, allowing players to spread across a larger space.
- Depending on the type of password, inserting it may be rendered more challenging or facile as needed.

Negatives:

- Due to the many cables required in the circuitry of the keypad, it may be that the game decouples easily.
- A keypad is operated by a single person, this interaction itself does not stimulate teamwork.

Pressing a button:

The screens present the current keyword and the players seek out the button accompanying the correct description to press it. If the correct answer is given, the next keyword is shown, if an erroneous one is pressed, the entire group is punished with a 30 seconds delay.

Positives:

- This setup enforces close communication between group members, for mistakes affect everyone, meaning that uncertain individual attempts are discouraged.
- Communication points again do not require to be near each other, rendering the game scalable to encompass 4 members.

Negatives:

- The circuitry may be less operable for the design team to repair should it fail, since buttons may have a tendency to behave irregularly and must be soldered to the cables.
- This is the most fragile setup of the considered options, if players feel inclined to yank and pull on the button or the cables nearby, the connections

- Buttons are not costly to acquire and may therefore be replaced without many complications.
- Although this interaction has not been tested among end-users, it is not much more complex than previous interactions and may be deemed sufficiently intuitive.

could come lose and the puzzle rendered out of commission.

Both the “pressing button” and “connecting with cable” interaction have numerous strong points, rendering them both viable. In this context, it is of great saliency that all group members may participate simultaneously, as well as incorporate teamwork to the maximum into the design, two points at which the button triumphs over the cables. Should the button be chosen, however, solutions to the repairability as well as the fragility of the system must be devised to ensure that the system may uphold functionality for the required timespan of 3-5 years.

4.7.3 Further possible material

Finally, the material employed must be considered to conform to the clients wishes. The first hurdle detected after browsing materials was considering the screens: Screens are either minuscule and limited, or large and expensive. To scale the puzzle, there must be multiple points of information access, which would mean multiple screens, henceforth growing susceptible to cracking after repeated usage by the player (may be (accidentally) kicked, dropped etc) as well as likely use up much of the budget, as finding second hand models, which is preferred by the client, would be challenging. An alternative to this would be to employ audio instead, as speakers may be hidden outside the players reach, the cost is significantly less and the experience is not compromised by much. To ensure followability of the questions posed and to present the punishment time to players, a small Arduino LCD screen may be employed to summarise the content of the question as a further followability aid rather than as main conveyer.

In addition to audio, light effects may be employed to further enhance the atmosphere. This may be through LED strips or such. Due to the large space, individual LEDs are not advisable. These light effects may also be within the central artifact itself by rendering it transparent with mediums such as silicone or glass. Even so, the question of sustainability comes into question here, it may be preferable to employ natural materials, such as real plants or biodegradable materials and traject light onto it, although the effect may be less memorable.

With a complex sound/visual system, it is near certain that a Raspberry Pi microcontroller will be employed. Further simpler microcontrollers such as Arduino Nano may be employed to perform simpler tasks akin to dimming or brightening lights, detecting button touch etcetera as slaves. Should the puzzle fail, a backup to be handled manually by the game master may be installed through an ESP32, so that through Bluetooth the final melody may be played regardless of the puzzle's collapse. Furthermore, both ESP32s and Raspberry Pis operate at 3.3V, if they must intercommunicate by wire, it would be wiser to set up a system with ESPs rather than Arduinos, which operate at 5V output, to circumvent volt-splitter circuits, which may overcomplicate the product for the client.

5: Specification

In the creative technology specification phase, the possibilities diverged from the ideation phase are progressively converged until a concrete, final idea is formed. Throughout this phase, prototypes are swiftly build to confirm certain assumptions of usability. From the considerations presented in the ideation phase, the final selections are herewith elucidated for Herz der Zukunft.

Figure 19: Specification in creative technology

5.1 Aim of prototype

As discussed priorly, the main research question envelops **"How may a novel educational escape room piece be crafted which must touch upon the climate catastrophe in a manner that stimulates behaviour change towards climate action?"**. Differently phrased, the users of the puzzle must be impacted as such that they are persuaded into more ecological everyday behaviour by stimulating the intent towards climate action, and as such possibly engendering climate action as seen in the theory of action [Figure 4].

The results of RQ 1.1 yielded the understanding that the most polluting sector currently is oil consumption through heating, transportation etcetera. Hence, the final product must present this finding in some way by presenting oil consumption as humanity's antagonist. Moreover, from the results of RQ 4.1, it became clear that the attitude towards climate action plays a significant role in an individual's willingness to engage in climate action. The final product must therefore lay emphasis on the user experience and tune it so that users feel personal relevance to the thematic and establish a positive relationship with climate action through emotional engagement.

As such, the specific goal of the puzzle becomes for players to be introduced to the causticities of oil consumption in a friendly and playful manner as to reshape their perception of the climate crisis through positive emotional association and remembrance. This approach may stimulate behaviour change as it employs BCT 13.2, “reframing”, considering how it reframes the climate crisis as fun and empowering rather than serious and dreadful.

5.2 Description of final product

To facilitate the elucidation of the final installation, a 3D model has been produced in blender demonstrating the vision for the product depicted in figure 20. The puzzle occupies the closet space, as well as the shelf situated to the right. Herz der Zukunft must on one hand stimulate pleasant emotions from the user, on the other hand also establish a clear context such that these emotions may be related to the thematic of oil consumption. The overall interaction is therefore divided in two sections: A pin code puzzle presenting the thematic to the users and a heart reanimation puzzle to emotionally engage the players.

Figure 20: Blender model of Herz der Zukunft

5.2.1 Inside closet

From all the options, the heart artifact was decided upon due to its close affinity with humankind and the possible grotesque first impression it could make. The heart will be suspended from the top of the closet through various cables and placed such that it may easily be grabbed by a player opening the door. Furthermore, because a small confined space grants the opportunity to exhibit extraordinary light effects, it was decided by the author to render the heart transparent and place lights inside of it by producing it out of silicone (or equivalent). These lights are red and pulsate in a manner to emulate the heartbeat of the heart, presenting it as “alive”, thus heightening impressionability and emotional relation of the user.

It was regrettably not deemed possible to include large screens as a mean of communication between the heart and the players, the installation therefore makes use of audio to stimulate the experience, such as factory noises, nature chirps and a voice emblematic of the heart. The main circuitry, as well as loudspeakers, would be hidden in the compartment behind what is represented in figure 20 as “Caution! Oil Spil!”.

Furthermore, to pertain to the solarpunk theme and strengthen the relation to the environment and the natural, a small garden is installed directly below the heart. These plants should be ones considered traditionally beautiful, such as for instance flowers, to create a divide between the “ugly” oil plant and the “pretty” nature. Depending on the design team’s willingness and possibility to maintain this garden, it may also be exchanged for a plastic variant, although this may send conflicting messages to the users regarding sustainability.

5.2.2 Pin code puzzle

To create a more complex puzzle that may challenge the users adequately, the author decided upon a pin code puzzle in which a password must be inserted, connecting wires or pushing buttons was deemed too facile for a puzzle meant to last 15 minutes. This type of interaction does limit the input other team members may give, the keypad is therefore be placed at a distance from the closet so that more persons may stand before the puzzle. Near the keypad is an LCD screen to give the users visual feedback on their input.

Posters attached to the inside of the closet door is from whence the solution must be extracted. Thematically, they pertain to the damage of oil extraction in some manner, for instance by portraying statistic on sectors in which humans accelerate global worming through fossil fuel combustion or caricatures addressing the climate situation in a humorous manner. Small post-it notes would be attached next to these posters to indicate what exactly must be searched for. It is

with the extraction of the code that the team is pressed to collaborate amongst themselves. From Fotaris' [6] emphasis on prompting teamwork within EERs, the design of the puzzle was tuned to include room for team collaboration.

The keypad is a symbolic representation of oil factories, pumping oil into the heart of the future through a connecting tube, next to the keypad must be some form of small model factory representative of real oil refineries built by spare electronic parts in a similar fashion to Stanza's "Nemesis machine"[7] as to employ recycled parts rather than new ones as the client requests. To represent a flow into the heart, a LED strip is employed with oily decoration encompassing it. Lastly, to ensure the users grasp the relation between this artifact and oil production, warning signs are glued onto the furniture, not necessarily as large as depicted in figure 20.

5.3 System operation

To grant an insight into what an intended full cycle usage of the system resembles, the desired use scenario is herewith elucidated.

5.3.1 Description of three states

From a systematic view, there are 3 states through which the system cycles as presented in figure 21. In the initial state, the system emits factory audio along with distressingly rapid heartbeats. The oil flow representation is active and the heart blinks in a rapid tempo to visualise pain and discomfort. The heart does not respond to being massaged, the system, however, plays a sound effect to indicate that it is too early to engage with it.

[7] Stanza's nemesis machine: https://www.stanza.co.uk/Nemesis_deus/index.html

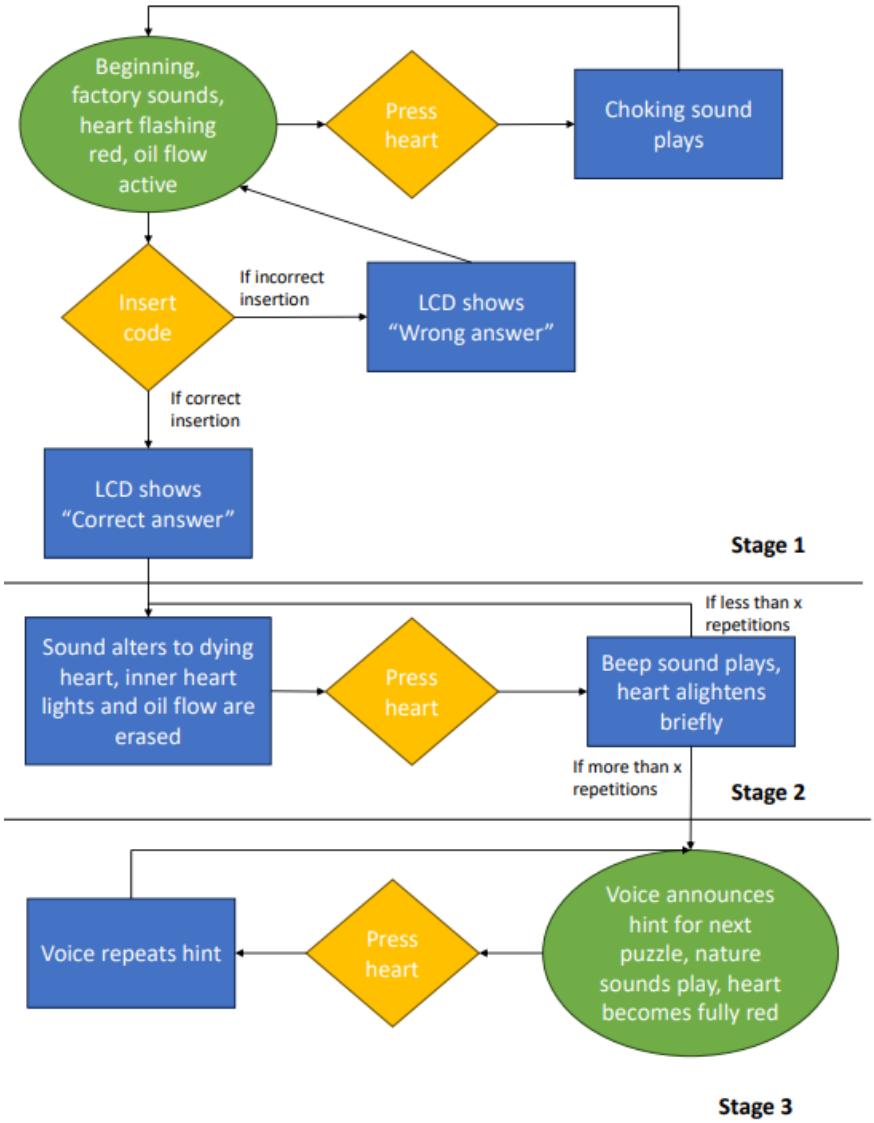


Figure 21: System flowchart

The first desired input from the user is into the keypad. When a key is pressed, the input is represented on the small LCD screen situated directly beside the keypad to create visual feedback on the user's interaction. Furthermore, the keypad allows for the option to clear the input as well as verify it. In the latter scenario, if the input is not equal to the password, the LCD conveys this. If it is equal, the LCD also demonstrates this.

By entering the correct password, the second stage is entered in which the LED strip slowly dims out, the heart's colour fades out and cardiac arrest sound effects are played through the speaker to indicate that the heart is decaying. From this point onwards, the keypad grows unresponsive and the LCD indicates that the focus is to be shifted towards the heart. This second

stage was added as to emotionally engage the players more, as merely solving a keypad puzzle was deemed emotionally underwhelming by outside advisors.

The players are hence meant to reanimate the heart manually by applying compressions to the artifact. Each time a compression is detected, the light inside the heart will illuminate proportionally to the pressure applied and a beep sound effect will be played as to indicate to the player that the compression is detected. After a certain amount of compressions, the heart is "saved" and the second stage terminates.

The final stage may be seen as a resting stage, as little further input is taken. The sound system produces one final message to the player announcing that they solved the puzzle and must advance to the proceeding puzzle, then merely nature sounds and a healthy heartbeat are audible. The keypad remains unresponsive and the heart visually no longer responds to compressions. The solution melody briefly plays at the beginning of the resting stage and repeats itself if a compression is detected, this is preferable to allowing it to loop in the background, possibly irritating the players after a certain time.

5.3.2 Precise functionality of the heart

Due to the more complex construction of the heart, it is worth elaborating further upon its functionality. Considering that the interaction revolving around the heart consists of squeezing it, the heart itself requires for its microcontroller to be placed on the outside, out of reach of the player, connected by cables. All that remains on the inside is a LED strip to illuminate the heart in red, as well as a barometer to measure the pressure. To maintain a steady pressure, the heart is built to fully isolate the gas inside, meaning that no air seeps out over multiple uses.

This signifies that the heart may be in two conditions: When pressed, the barometer detects a higher pressure than initialised and when released, the barometer detects a depression in pressure. One compression is considered passing from the first stage into the second. The heart is designed to be a little larger than a real heart as to fit comfortably in a dual-handed grip. Figure 22 presents visually how this would be performed.

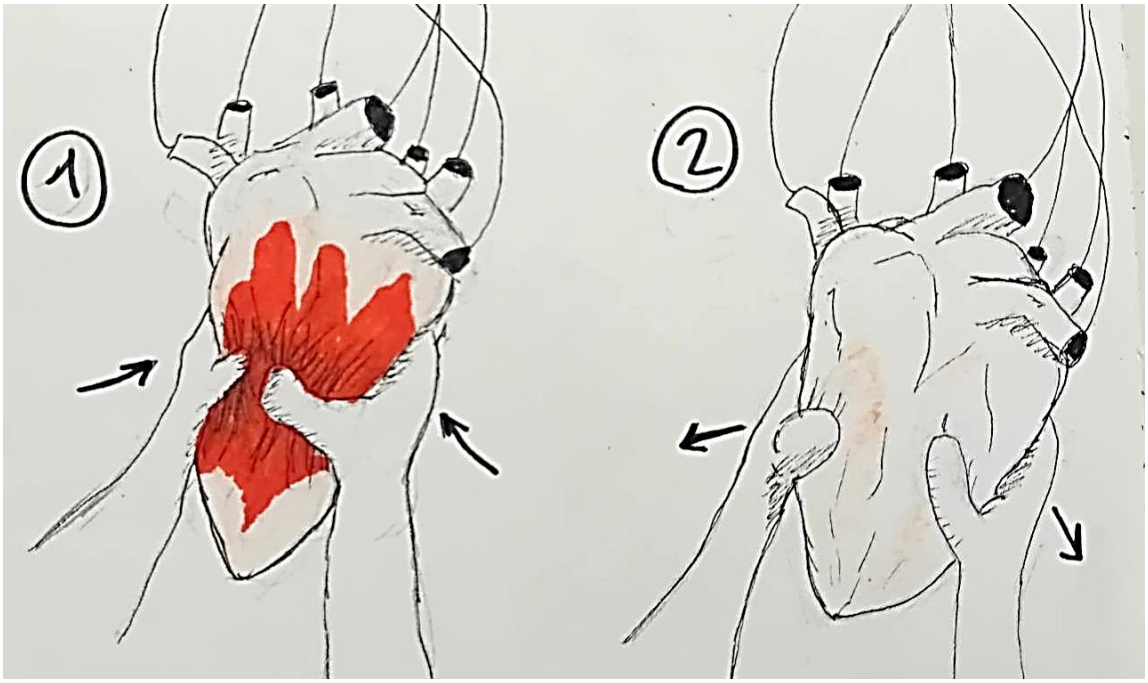


Figure 22: One compression upon the heart

5.4 User experience

Along with the prior elucidation of the system functionality, the desired user experience is herewith presented. From the results of Fritsch [27], Cadet [29] and Makowski [30], the primary aim of the installation is to emotionally engage the players to create affinity to the underlying themes of oil consumption and induce personal relevance to the notion of climate action. The players take on the role of saviours, which is accompanied by emotions of responsibility and empowerment, which are designed to be carried with them beyond the EER as well. In addition to this, the experience should be a pleasant one, as to employ the BCT “reframing” and create a positive interpretation of climate action within the user.

Negative emotions such as nervousness and confusion are standardly included due to the challenging nature of EERs, these may serve to enhance the feelings of empowerment once the puzzle has been solved, thus negative emotions are transformed into equally strong positive one. This does however insinuate that users must be able to complete the puzzle in its entirety, as otherwise, these negative emotions will linger due to the abrupt termination and hence create a negative association with climate action instead. As such, employing an EER for the purpose of persuasion may be considered a wager of some sorts.

In figure 23, a visual representation of this experience may be found in the form of a storyboard. The persona, Thomas Gibsnich from Appendix G will be employed for the sake of illustration. Each step performed by the user is enumerated below this figure and elucidates how the user is meant to respond to it.

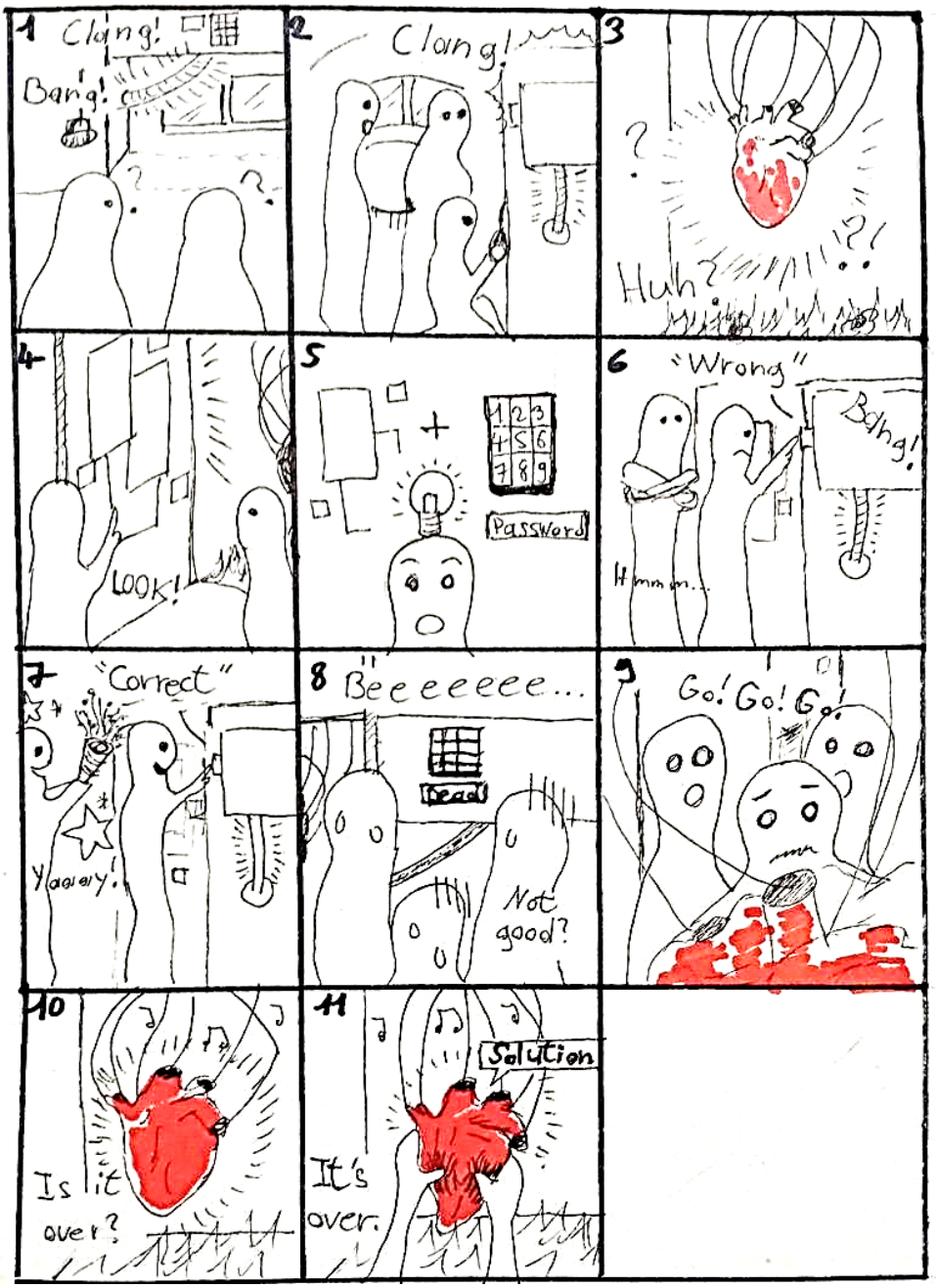


Figure 23: Storyboard of interaction

1. The experience of Thomas and his friends concerning Herz der Zukunft commences far before they succeed in opening the closet. The oil flow from outside into the closet and the factory sounds heard from outside the door stirs curiosity in Thomas' group and they begin to wonder what is inside the closet as they navigate the previous puzzles.
2. As they unveil the password to unlock the closet door, further suspense is built as they twist the dials of the lock, now being so close to finding out what those sounds are.
3. The lock is detached and the door turns outwards. Thomas and his friends are taken by surprise: There is a heart beating inside the closet! Of all things, this was certainly not expected.
4. One of Thomas' friends is the first to notice three posters attached to the closet door. The group directs their attention towards them. From the post-it memos, it becomes clear that some sort of code is to be extracted from them.
5. In that moment, Thomas remembers the keypad they found on the shelf prior and makes the connection between this and the poster puzzle. The group communicates what they believe the solution to be inserted could be.
6. Thomas' friend makes a suggestion, the screen next to the keypad turns red and reads "Wrong". That was not it… The group is beginning to grow confused, not entirely certain if they may find what the device expects of them.
7. Then, a new possibility flashes into Thomas' mind. He inserts a different code, the screen alights green, it was correct! He rejoices with his friends for a moment.
8. Suddenly, the sounds alter; a nasty gurgling along with medical flatline is heard. The screen imposes: "Reanimate the heart!" The group is taken aback by this, was this not right? How much time until the heart perishes?
9. Thomas dashes to the closet and begins compressing the heart, it flashes red as he pushes, then blank again as he releases. Thomas repeats this for a while, the group begins to grow nervous, unsure whether they are performing it correctly and are about to run out of time.
10. At once, the heart shines bright red and the gurgling stops, pleasant nature sounds are emitted and a voice thanks the player for having saved the heart. Thomas' group slowly realises that they have succeeded and fall into relief. Even so, the escape is not over yet, they begin pondering how to employ the hint they received for the next puzzle.
11. One of Thomas' friends presses the heart once more, but now only the solution is repeated. It is clear that the puzzle here has concluded.

5.5 Early prototype

To evaluate this concept, an early prototype consisting of a simple pin code puzzle and a plastic bottle as heart (Figure 24) is informally presented to a 5 persons in the authors social circle as well as physical environment. Further footage of this prototype may be found in Appendix H if desired. No ethical permission is requested as no data is recorded during these presentations beyond informal observations. Persons were not briefed beforehand on what they were meant to do, merely that they are solving a puzzle and that they would be informed when this puzzle had been solved.

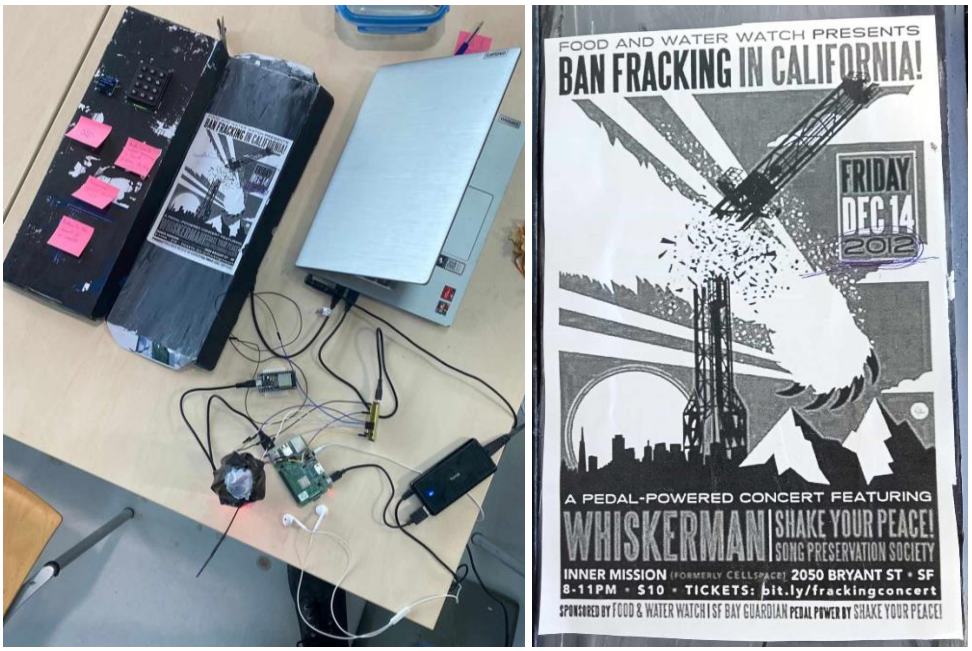


Figure 24: Early Herz der Zukunft

As may be seen in figure 24, the participant is first meant to obtain the year “2012” from a poster on the carton box, representing the closet door on which the poster will hang, to emulate stage 1. After this has been performed, the heart bottle will enter stage 2, from whence the participant is meant to squeeze the bottle to reanimate the heart. There is no sound in this prototype, stage 3 is therefore not present.

It appears that overall, such an interaction is quite intuitive, nearly all participants were able to operate the keypad and insert the code, though there were complaints that encircling the number in question is too easy of a puzzle. One participant, however, was very hesitant to engage the keypad due to the rigidity setup, the final setup must ensure that the user feels safe to engage with it. Moreover, there were complaints that the author’s handwriting in the post-it notes was illegible, efforts must be dedicated towards ensuring readability in the final version.

In addition to this, all participants were unable to intuitively interact with the bottle unless prompted to do so. This hints that a reanimation is not naturally engaged in within the sequence of the puzzle and must be prompted technically in some manner, such as for instance written hints in the LCD screen or direct audio cues. It also became clear during testing that the sensitive electronic parts will be required to remain in a safe encasing where, regardless of how much force a user applies, they remain untouched, as otherwise, cables will undoubtedly disconnect after a handful of uses.

5.6 Product specification

Herewith are the specifics for product assembly are presented.

5.6.1 Specific parts required

In table 4, a list of required components is presented by name, amount required and along with their intended usage. No specific details will be given since whomever would like to reconstruct the device may select their own brands, given that the functionality is identical to the presented. An example of possible applied parts will be provided in chapter 6. For all electronics that require it, it is assumed that they are supplied with power. Cables may be soldered or employed as jumper cables, the author relays this choice to the individual.

Component name	Amount	Usage
Keypad	1	Insert the password.
LCD screen	1	Give visual feedback to user on current insertion.
LED strip	1m-1.5m	Represent oil flow visually. Each individual pixel must be addressable.
Spare electronic parts	Uncertain	Parts required to fabricate the model factory. Maybe be anything from rusty gears to fried microcontrollers.
Paper printed oil warnings	1-3 pieces	Decorative oil warnings create the relation between the electronics and an oil refinery.
Posters	Uncertain	To solve the pin code puzzle. Amount and design may be altered as preferred.
Post it notes	Uncertain	Accompany the posters to give additional clues and hints.
Miniature-garden	1	Decorative item strengthening the solarpunk theme. Placed directly below the heart of the future. May be altered as desired.

Formable silicone	0.4L-0.6L	Create outer shell of heart.
Inner shell (e.g. plastic bottle)	1	Shell in which the barometer and LED strip are placed. Must be compressible.
Barometer	1	Measure inner heart pressure.
LED strip	~0.1m	Produce pulsating light effects inside heart.
Decorative electronics	Uncertain	Additional decorations around the heart to grant the “solarpunk” feel.
Raspberry PI (model 1 and onwards)	1	Sound system. This is accompanied by all the requirements of a raspberry pi, such as micro SD card etc.
ESP32	2	One to control the pin code puzzle and one to control the heart. Equivalent microcontroller must output 3.3V.
Arduino nano	1	One additional microcontroller to control the LED strip oil flow. Does not necessarily need to be a nano.
Loud speaker	1	For emitting the sound. Must have an aux connection accompanied with it.
Cable	Uncertain	Constructing the circuitry.

Table 4: Preliminary material list

ESP32 microcontrollers were chosen to maintain the possibility of implementing a Bluetooth exit route should this prove to be necessary. The Arduino nano is inserted due to the fact that an LCD screen occupies much computing power from a microcontroller, which may lead to lagging within the flow of the LEDs. To overcome this, a further microcontroller must be employed, this particular one may be replaced by another kind if desired.

It may be that during production, one finds that additional decoration or technical functionalities may be fitting at either the heart or the keypad, the system currently designed allows for further additions since there remain available pins on both ESP32s. This list of components is therefore not to be interpreted as a definitive and restricting list, but rather as a presentation of what is considered the minimum requirements for a complete system capable of all priorly elucidated.

5.6.2 Overall schematic

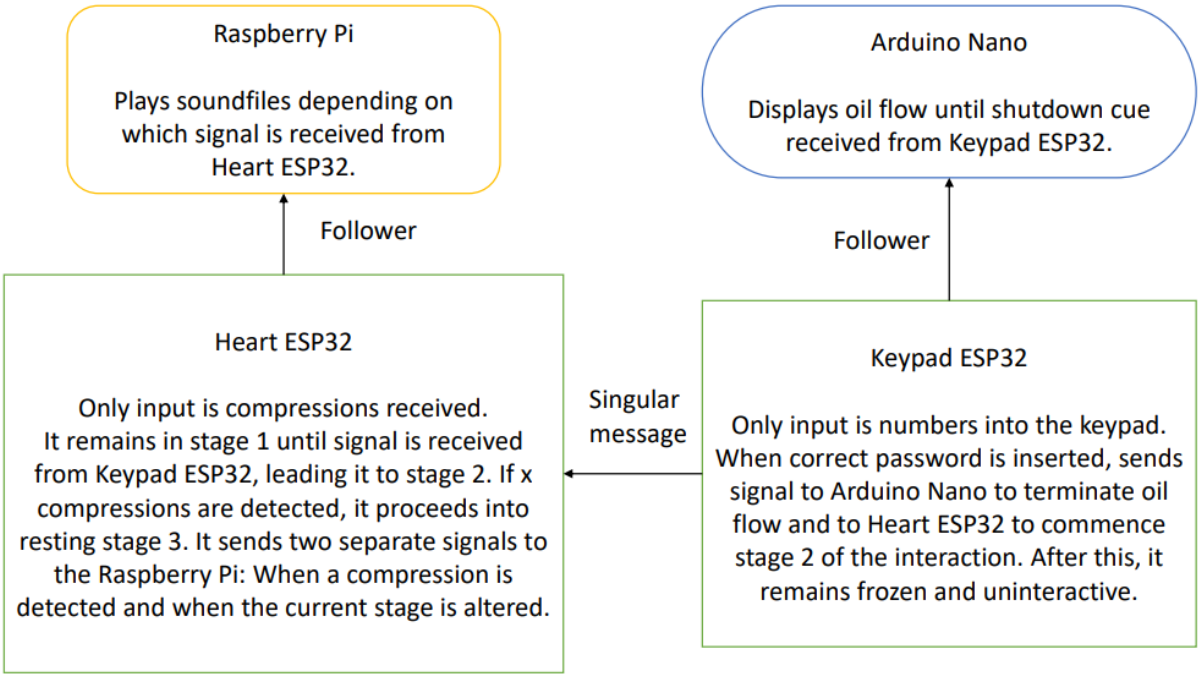


Figure 25: System overview

Within the devised system, there exist 4 major agents: Keypad ESP32, Heart ESP32, Raspberry Pi and Arduino Nano, as depicted in figure 25. Here, the Raspberry Pi is a slave to the Heart ESP32, and the Arduino Nano is a slave to the Keypad ESP32. They Keypad ESP32 sends a singular message to the Heart ESP32, it may therefore be considered its master to some extent, yet retains very little control over the Heart ESP32.

The Keypad ESP32 reads inserted pin codes until the correct one is unveiled, it then emits a shutdown signal to the Arduino nano and signals the heart to proceed to the next stage. As seen in figure 21, the keypad henceforth becomes unresponsive, it therefore only serves to receive a correct pin code and progress the system to the second stage. If additional functionalities are to be added to the Keypad ESP32, it must be so that they merely require the shutdown signal to react.

The Heart ESP32 remains in stage 1 and is unresponsive (beyond playing a gurgling sound) until it receives this signal. From there on it autonomously remains in stage 2 until sufficient compressions are detected and proceeds into stage 3. As such, the 3 stages only exist in the Heart ESP32 (and therewith also the Raspberry Pi), the Keypad ESP32 is merely in an on/off stage.

The raspberry pie constantly awaits signals from the Heart ESP32 conveying whether a change in state has taken place or whether a compression has been detected, hence it expects 2 differing signals. Depending on the state, it will emit different audio to the command of the Heart ESP32. Due to the computational delay in the Heart ESP32 due to combined pressure measuring and LED strip powering and the fast response rate required to play more elaborate audio files, it was deemed preferable by the author to separate the device emitting sound and the one controlling heart.

5.7 System requirements

Having developed the final concept as such, chapter 4.5 is revisited once more to establish functional as well as non-functional requirements that the system must adhere to, based upon the previously gathered user and client requirements. It is worth noting that the product is developed for all persons above the age of 16, so-considered adults, precautions for the inclusion of younger demographics are therefore not required. Not all requirements from said chapter are of relevance for the system requirements, however, the ones that are, are denoted as follows.

Functional requirements:

- Repeatability: The system must be resettable within 5 minutes without great complications.
  - ➔ Client requirement 21
- Durability: The system should prevail for an approximate timespan of 3-5 years without requiring major maintenance.
  - ➔ Client requirement 22
- Firmness: The system must be robust enough to withstand multiple uses in one day.
  - ➔ Client requirement 24
- Continuity: The system must not fail once during the interaction, abruptly halting the experience. It must continuously function as priorly described.
  - ➔ Client requirement 26
- Safety: The system must not present one safety hazard to its users as well as the environment in the form of possible electro shocks, pollution, punctures or pyro hazards.
  - ➔ Client requirement 17
- Simplicity: The system should be built in a facile enough fashion that also persons of little technical knowledge may operate and maintain it.
  - ➔ Client requirement 21

Non-functional requirements:

- Intuitiveness: The system should be intuitively employable by users without requiring plethoric outside guidance.
  - ➔ User requirement 1
- Welcome: The system must feel welcoming and pleasant to the user, no significant and lasting stress should be placed upon them.
  - ➔ User requirement 2
- Inclusivity: The system should be employable by non-German speakers to the minimal extent that the puzzle may be completed.
  - ➔ User requirement 4 and 6
- Impressionability: The system must impress the users by evoking a powerful emotional reaction through the interaction with the puzzle.
  - ➔ User requirement 4, 7 and 12
- Impact: The system must alter the user's perception of the climate crisis towards the more positive.
  - ➔ Main research question
- Time: The system should be solvable within the given 15 minute time limit.
  - ➔ Client requirement 18
- Collaboration: They system should steer users to communicate with and aid one another in order to obtain the solution.
  - ➔ User requirement 8 and 12

6: Realisation

Within the creative technology design process, the final phase of development is dubbed the realisation, fundamentally describing an attempt of product assembly. The first assembly of Herz der Zukunft is herewith documented. A fritzing diagram of the entire circuitry has been devised of which sectional relevant snippets will be employed, it may be found in its entirety in appendix I.

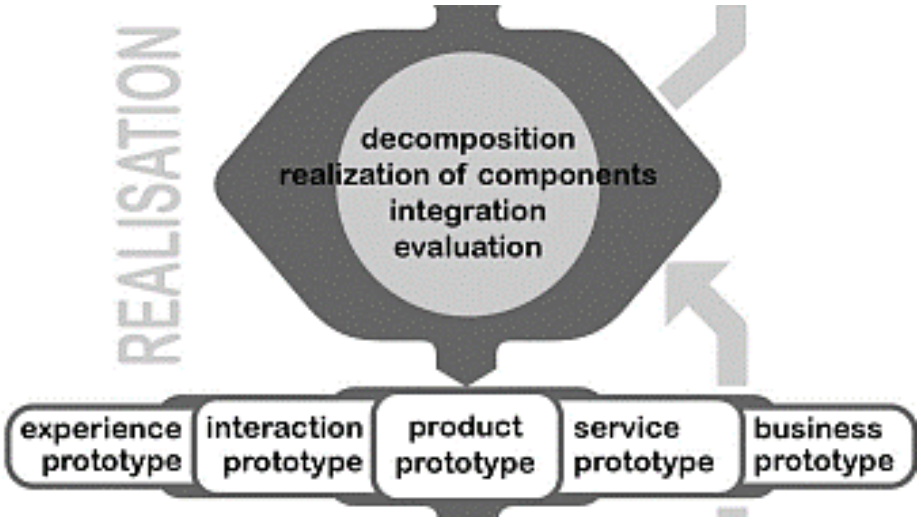


Figure 26: Realisation within creative technology

6.1 Tools employed

The employed microcontrollers were programmed with the Arduino IDE version 2.2.1 with the installation of the Adafruit_MPL3115A2, Fast_LED, Wire, U8G2, Arduino and Keypad library where the Adafruit_MPL3115A2 library serves to operate the barometer, Fast_LED the LED strip, Wire and Arduino the LCD screen, U8G2 the oled screen and Keypad the keypad. The programs are uploaded to the microcontrollers with a simple Lenovo laptop. In addition to this, the communications among microcontrollers all occur through wire connections.

The Raspberry Pi 3 model comes from a unaffiliated previous owner who is no longer aware what had been done with the devise precisely, it is therefore not entirely clear how the computer has been initialised or handled prior to this project. It is worth noting that not all pins on the device are functional anymore and that libraries, along with further unknown system alterations, have been installed onto the device. In spite of this, the device is functional and employable for this project. It is programmed entirely in python with the IDLE IDE in python version 3.12.3 with the employment of the GPIO, os and pygame libraries. To program the computer, a mouse, keyboard and screen with

HDMI connection are required that may support the 5.1 V output of the Pi. Audio files employed by these programs were obtained from freesound.org and edited with audacity by Willy Dumaz.

Moreover, the Heart ESP32 circuitry has been soldered solid due to its precarious nature, a soldering station with regular soldering tin has therefore been employed. Cables are connected on a PCB board to ensure stable connections. The majority of this soldering took place at the University of Twente's Design Lab institution. From hence, spare parts for the factory décor assembly were obtained as well.

All the files (Arduino, python, word and mp3) employed for this project may be found on the github repository vanar095/Herz-der-Zukunft-files.

6.2 Implementation

The assembly of Herz der Zukunft began on the 11th of December 2023 and continued onwards until the 10th of January 2024 with the winter-break in between from the 25th of December until the 8th of January. On the 8th of January, the installation of Herz der Zukunft had begun with the arrival of the Airstream situated at the "O&O Plein" of university campus. It was anticipated that the 8th and the 9th may be employed to install the puzzle into the closet, as well as prepare decorations, and the remainder of the time would be dedicated to evaluating the prototype. The Airstream was scheduled to leave on the 13th of January, hence granting the author short of a week to install the puzzle as well as user-test it in the appropriate environment.

Regrettably, system failure was experienced on the 8th of January, leading to an immediate alteration of the schedule. Seeing how the grounds were not interconnected among the microcontrollers, Heart ESP32 had been compromised and no longer received nor sent signals properly. The issue was tended to and resolved on the 10th when the microcontroller was replaced and this vital ground-ground connection established. Even so, this delay engendered that décor was not developed to the extent as desired and that less participants were recruited to evaluate the system. The author therefore strongly encourages for a Ground-Ground connection to be ensured during the assembly of Herz der Zukunft.

Regardless, Herz der Zukunft was successfully installed as depicted in figure 27. Due to circumstances, certain deviations were made from the visions denoted within the specification, these deviations along with their reasons will be elaborated upon henceforth.

Figure 27: Herz der Zukunft installed

6.3 Keypad section

In this section, the realisation of the pin code puzzle will be elucidated.

6.3.1 Pin code, screen and oil flow

A 3 by 4 membrane keypad was obtained from tiny-electronics to serve as input mechanism. This specific model requires for cables to be soldered into the copper openings beneath the number squares, as shown in figure 28a. Furthermore, the circuitry inside the aforementioned keypad model is not ideal in the sense that the columns and rows are not sequential, the matrix initialisation within the Arduino program has therefore been adapted to synchronise with the circuitry of figure 28b. Should an ideal keypad be employed, this is to be altered.

Functionally, a keypad operates as many minor, individual buttons that are aligned in matrix columns and rows. The purpose of this matrix setup is such to reduce the amount of pins required from the microcontroller. A high signal is sent from pins 2, 7, 6 and 4 and received by pins 3, 1 and 5 when a certain key is pressed precisely as would be the case with a typical button. As such, when a key is pressed, the program detects from whence to where the signal is lead and as such deduces the pressed key. E.g. if button 5 is pressed, the microcontroller detects a closed circuit from pin 7 to pin 1 and yields “5” as output.

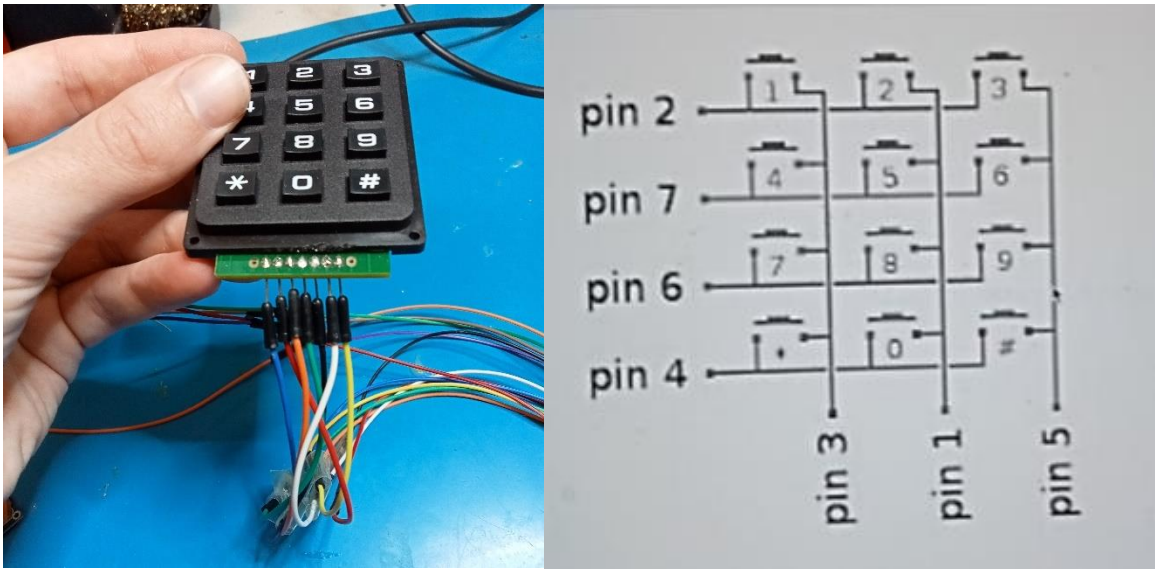


Figure 28: Soldered keypad (a) and internal circuitry schematic (b)

To grant the user visual feedback on their input, a 1602 LCD screen was acquired from Waveshare. This particular model allows beyond presenting simple text also for the background colour to be altered, it has therefore been programmed to flash into red when an erroneous password is inserted and to lime-green when a correct one is produced as may be seen in figure 29. With this, even if "Eingabe: Falsch" (German -> Insertion: False) is not understood by a non-German speaker, the colours may convey that the attempt was faulty, as well as add a more dramatic effect to the entire experience. This particular model requires more complex programming than standard LCD models, the Arduino program employed for this project is therefore heavily reliant upon the demo program provided by Waveshare[8].

Figure 29: 1602 LCD screen RGB background

[8] LCD demo code website: https://www.waveshare.com/wiki/LCD1602_RGB_Module#Demo

Moreover, due to the previously mentioned system failure, no time remained to properly decorate the LED strip so that it may resemble an oil pipe, it was installed raw as presented in figure 30 along with certain warning signs to create a relation between the strip and oil production. The flow leads from inside the shelf to the miniature-garden inside the closet, as players may otherwise attempt to eject the LED strip from the heart to solve the puzzle, which would have no functional effect. To individually address each pixel in the LED strip, a ws2812b model is employed. Due to the short distance to the miniature-garden, no additional powering is required.

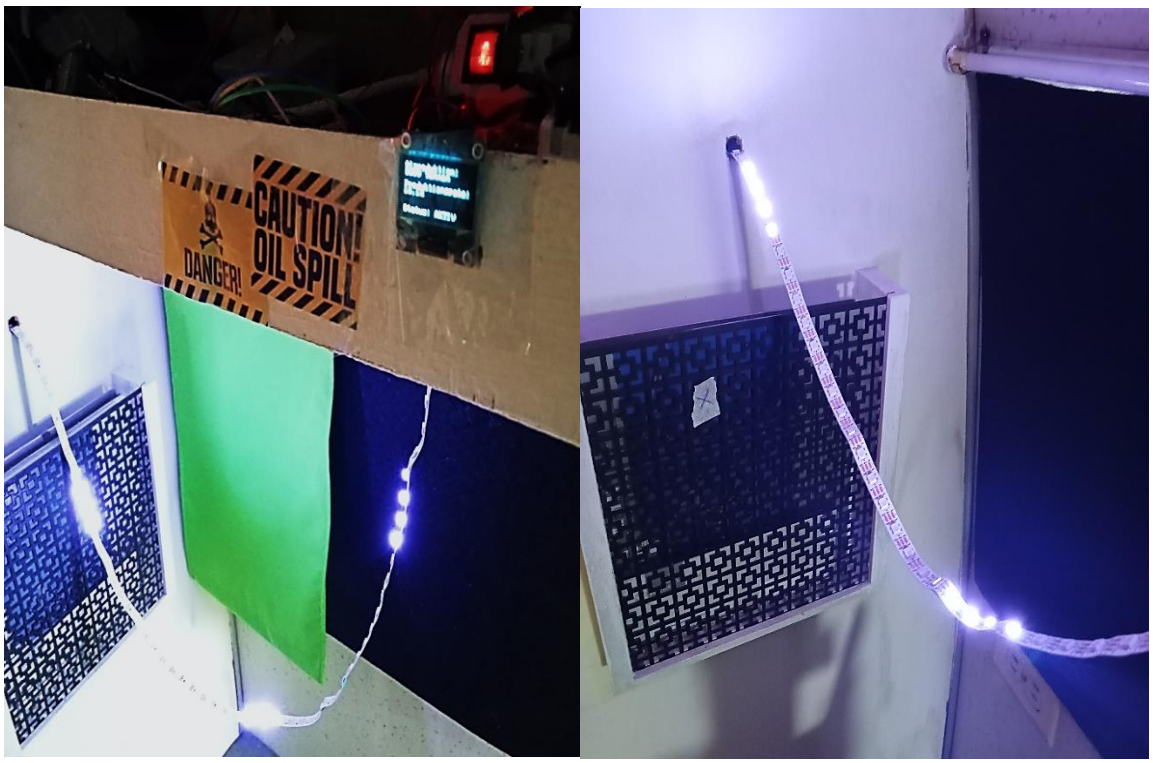


Figure 30: LED strip and warning signs

A fritzing snippet may be seen in figure 31 depicting how all electronic parts are connected. The connection to the Heart ESP32, both signal and ground cable, had to be through a hole drilled into the separating closet wall. Beyond the soldered connections onto the keypad and the LED strip, all connections were made with jumper cables as to avoid drastic entanglement and allow for the client to remove as well as add certain parts with no difficulty.

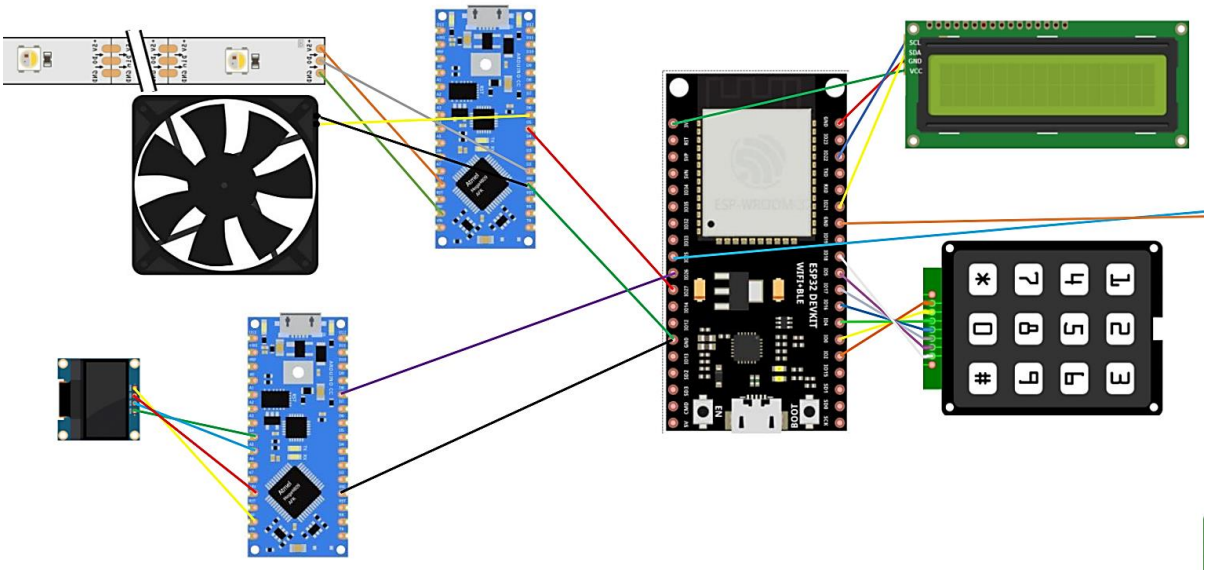


Figure 31: Pin code section fritzing snippet

6.3.2 Posters

The precise posters employed from which the secret code is to be extracted may be found in the aforementioned github repository, the files have been printed as-is on simple paper and glued to the inside of the door with transparent tape, as depicted in figure 32. Moreover, colour-typed post-its are employed to pose the question to the player of which the solution will yield the secret code. Green contains German text, while blue contains English text to improve inclusivity. It is assumed that with English translations of the instructions, non-German speaking players may find the solution in the German poster text. The colour palette blue and green was chosen to respect the clients pre-set palette for the overall installation.

All of the posters are thematically pertained to the thematic of oil consumption and the effects thereof in some manner; The passwords are the percentage of greenhouse gas emissions due to heating in 2016 (19), the year when oil consumption per person per day is expected to reach 2.5L (2050) and the amount of cars remaining (1), as the overarching theme which connects both the closet and the shelf parts must be oil consumption. These numbers are to be inserted in respective order, meaning there are many minor passwords which the player must give. This choice was made by the author from the learned material of Fotaris' workshop (chapter 2.3) as players should be given constant minor victories to remain engaged.

The Arduino code is programmed so that passwords may be facilely replaced, in alternate versions of Herz der Zukunft, these posters may therefore be reworked if desired.

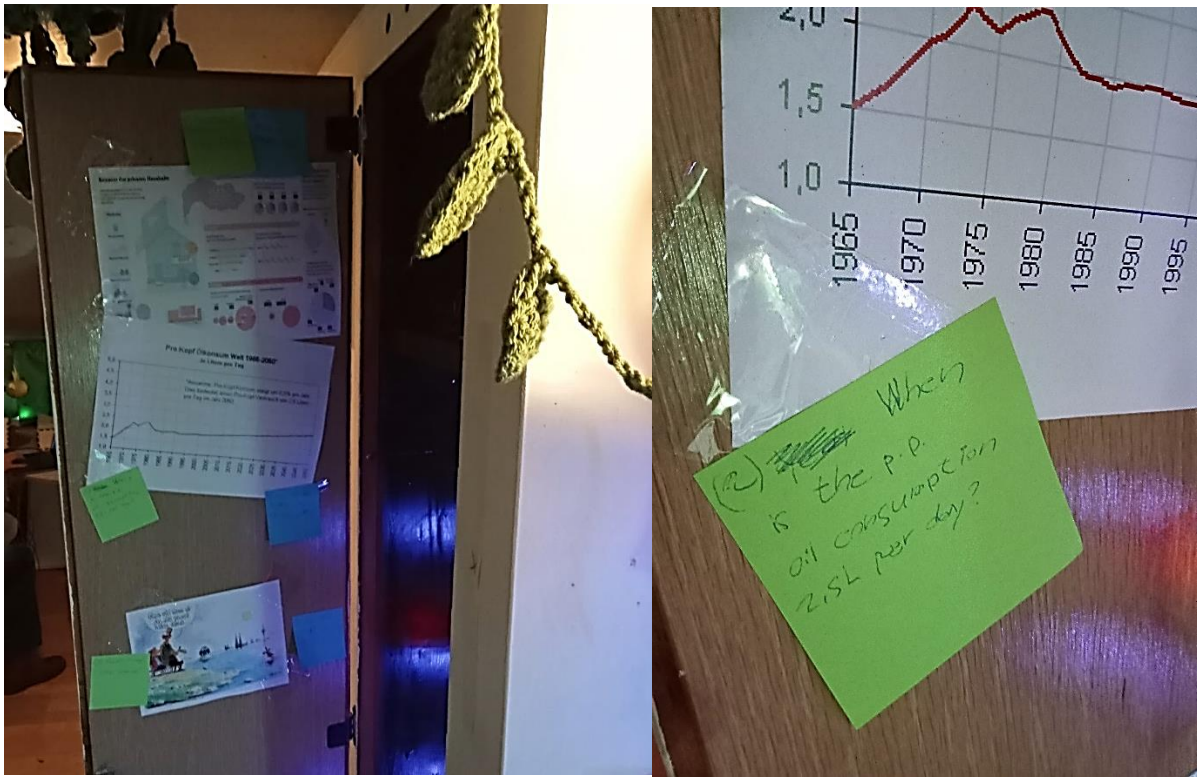


Figure 32: Posters as employed in the final installation

6.3.3 Additionalities

As may be noted from figure 30, additional components have been added from the original specification plan, notably the ventil and the oled screen. The ventil is a minor decorative piece which merely remains spinning until the Arduino nano receives the shutdown signal, after which it will annule similarly to the LED strip. The ventil further enhances the mechanical feel of the model factory and gives a visual cue of deactivation.

The model factory was finally not employed due to the invisibility behind the shelf frame as well as the fact that it is deemed not representative enough to truly embody a factory by the author. Instead, an oled screen is inserted depicting the amount in tonnes of oil produced, the production rate and active status of the fictional oil factory as depicted in figure 33.

This Arduino also awaits a shutdown signal from the Keypad ESP32 after which the tonnes will cease to accumulate, the rate decreases to 0 and the status becomes “inactive”. It is necessary to employ a further microcontroller for this purpose, as oled screens require large amounts of computing power to update the screen contents, which would disrupt the LED flow if implemented in a shared microcontroller.

Figure 33: Oled presenting oil production status

6.4 Heart section

From henceforth, the recorded assembly of the heart artefact and accompanying sound system will be elucidated. As presented in the fritzing snippet in figure 34, the heart section consists of a capsule, coated in silicone, and a sound system closely connected to it. Due to physical limitations, the physical heart is distanced approximately 1.5m away from the microcontroller, respectively longer cables are therefore required for all connections that lead from the Heart ESP32 into the bottle, as well as ground connections to the Raspberry Pi.

Lastly, it must be ensured that the Raspberry Pi receives a constant 2.5A power supply, otherwise it may abort abruptly. Enough iterations of this will eventually damage it's micro-SD card, therefore duly to be avoided. The power must for this reason also not be suddenly detached from the Pi, a button has been soldered onto the Pi to allow a safe shutdown procedure.

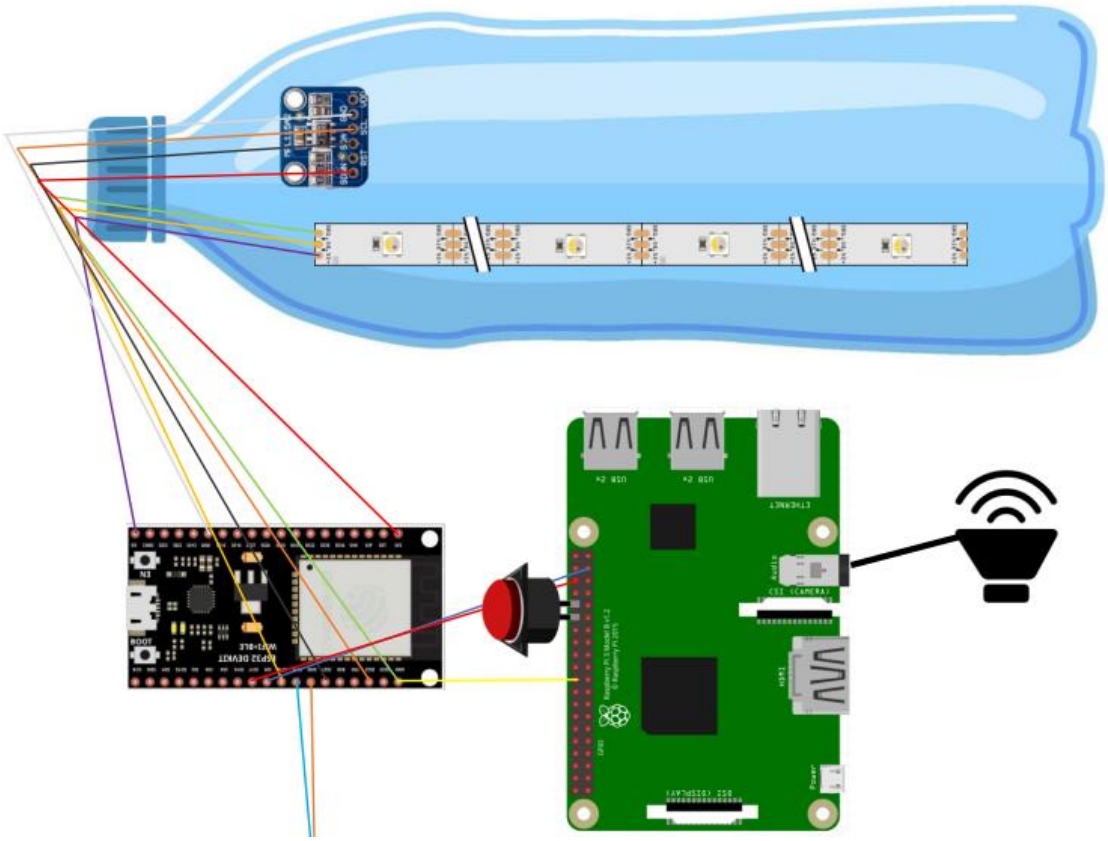


Figure 34: Fritzing of Heart section

6.4.1 Capsule implementation

As priorly mentioned, the heart artefact requires a capsule in which the electronics may reside safe from the pressure of user compressions. For this assembly, a plastic bottle was purchased, emptied and filled with the barometer, LED strip and silicone flakes. Silicone proved to be quite solid in spite of its flexibility and is therefore employed to aid in maintaining the bottle's shape once it is compressed by the user. It furthermore provides additional diffusion of the LED strip as may be seen in figure 35.

The author implores that in the ideal scenario, this encapsulation is entirely isolated as to allow the user perfect control over the heart compressions. In this assembly, the opening of the bottle was covered with a HEMA balloon, tied tight with a rubber band and covered with duct tape. This approach is not fully isolating, leading to the escape of air during a compression.

Due to the silicone inside the bottle, the bottle is expanded upon release and air is replenished, as such, the core functionality of the capsule is not impeached upon as a short-term spike in pressure is still detected upon compression, however, rather than alternating between phase 1 and 2 as demonstrated in figure 22, the heart will slowly technically revert to phase 1 from 2 as the air seeps

out and the pressure decreases, even if the user continues to apply pressure to the heart. As such, the user is required to compress in a certain prerequisited pace for the heart to properly detect this compression and may not press entirely as they desire.

Figure 35: Heart capsule (plastic bottle)

Plastic is a suitable material to encapsulate the electronics, for it is durable, shapable, protective and transparent, however, it is not sustainable for mass production, and as such in conflict with the overall production values of the client. The author therefore encourages future reiterations of Herz der Zukunft to explore alternate material options for this capsule.

6.4.2 Casing

To produce the silicone coating of the heart, Smooth-on's Ecoflex pourable silicone rubber was employed. With this, 8 20cm diameter flat silicone bodies are produced and held together through tin rings to hold the silicone surfaces together. The tin is first employed to puncture through various surfaces, then a ring is formed and soldered close, therewith ensuring that the artifact does not fall apart. Originally, the author intended to glue these surfaces together to create an enclosed body, however, it was discovered that silicone is plethorically smooth to apply glue on its surface.

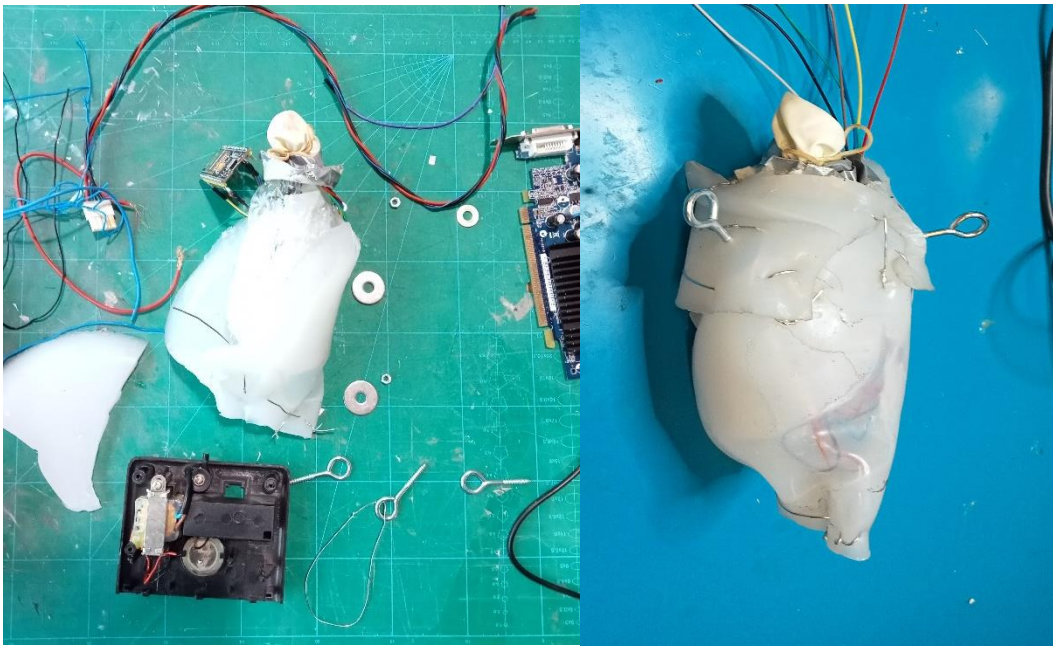


Figure 36: Coating of Herz der Zukunft

Figure 36 demonstrates the procedure of coating the encapsulation in silicone. During this procedure, decorative cables were inserted between the coating and the capsule to grant a machine-like feel to the artifact to pertain to the solarpunk style. In addition to this, eyebolts have been dug into the coat and stabilised with washers to suspend the artifact on the closet ceiling with. Notably this places the gravitational force onto the coat, yet due to the firmness of silicone, this is quite acceptable, although it may not be for other materials.

The balloon remains exposed on the top to grant the air in the capsule mobility, as well as further develop the cyborg-heart feel of the artifact. Additional cables to mimic the arteries of a life heart have been inserted in its proximity as well.

It is worth noting that all that is outside of the capsule is merely decorative and therefore has no technical significance, it may therefore be removed without risking technical system failure. Even so, the shape of the artifact is crucial, for the concept will not be understood if the user does not recognise a heart within it. Furthermore, the heart is meant to be touched by the players, the texture of the material therefore also receives emphasis. Silicone, for instance, is rather sticky and smooth, henceforth engendering a surprise effect when first touched by unsuspecting players, enhancing the emotional reaction of the experience.

The light effects generated by the diffusion of silicone are another reason why silicone is a fitting choice for coating material, as it grants the feel of a core pulsation coursing through the artifact, as may be seen in figure 37. All of this combined renders the heart a unique and impressive artifact to hopefully bewilder the user upon engagement.

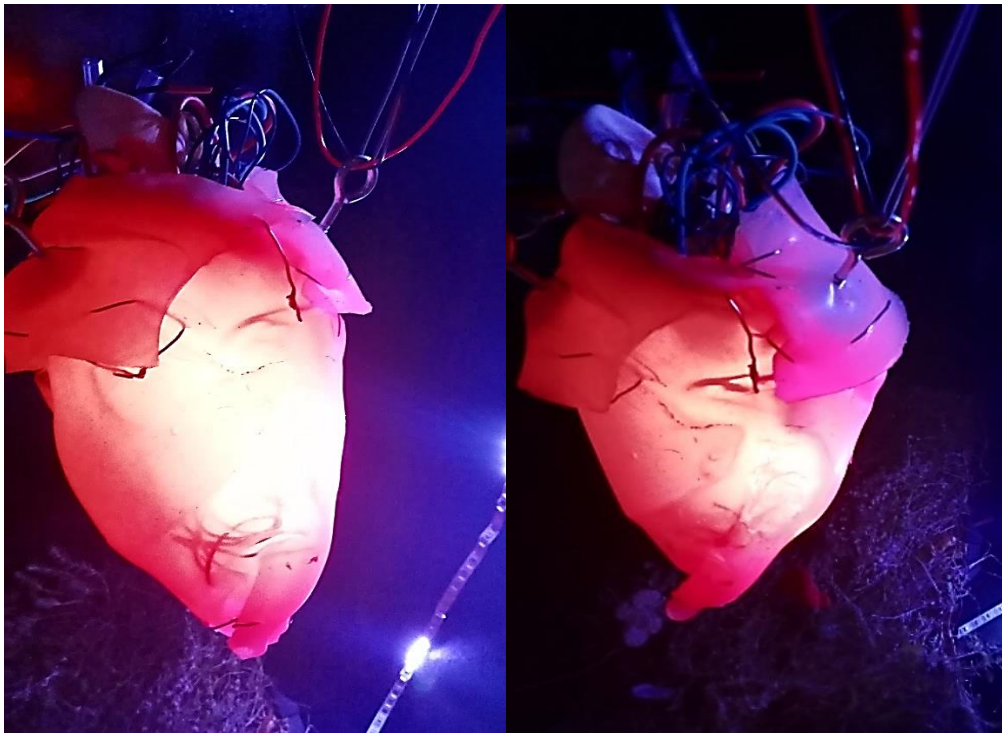


Figure 37: Light effects within Herz der Zukunft

6.4.3 Raspberry Pi 3 sound system

As priorly touched upon, the Raspberry Pi 3 computer employed within this project is inherited from a previous owner and has been programmed before, leading to various challenges and limitations. The Raspberry Pi commences a primary python script upon booting by inserting the command “@reboot python user/home/pi/downloads/main.py” into the crontab protocol. This file then proceeds to activate three further python files through the commands run_script(user/home/pi/downloads/file.py) where file.py is replaced with the file to be opened in a manner depicted in figure 38.

This structure is largely due to the limitation that the sound functionality within the pygame library employed merely allowed for the mixer to play audio files, which limits a file to one sound at the time. Audio files are first initialised to the mixer with pygame.mixer.music.load(filepath) followed by pygame.mixer.music.play().

A common practice to initiate multiple audio files simultaneously is through the play() command, however, this malfunctioned as python rejected the audio files then for reasons that at time of writing remain unclear. Hence, rather than running multiple audio files simultaneously, the program has been built to run multiple python files divided into heart, background (BG) and voice sounds.

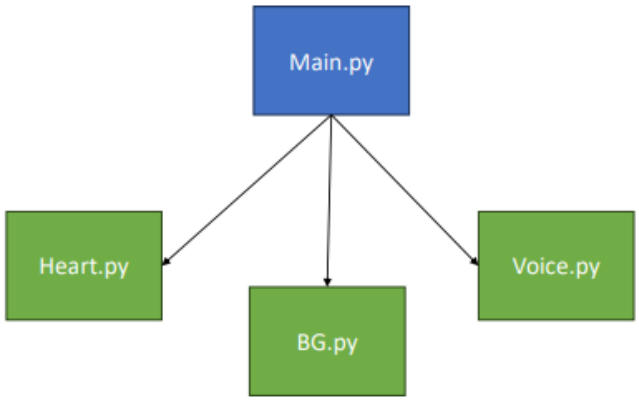


Figure 38: Activation of entire python program

All programs below main.py adapt sounds as the Heart ESP32 cycles through the 3 stages in identical manners. The initial signal expected is a LOW from the heart, during which factory sounds and heart beats will be emitted. Once the Heart ESP32 transmits a HIGH to the Pi after receiving a HIGH from the Keypad ESP32 itself, meaning once it has entered stage 2, all three files alter to sounds appropriate for that stage, meaning a choking heart and medical flatline effects. In this fashion, the Raspberry Pi synchronises with the Heart ESP32 and emits sounds appropriate for the current stage.

All sound-emitting python files contain a “stage” variable that is increased by 1 whenever an alteration in Heart ESP32’s state signal is detected, as may be viewed within figure 39, thus progressing through the stages identical to the Heart ESP32. It is noteworthy that a forth stage, a phantom stage, has been included as well in each python file. This is done for resetting purposes, as resetting the Heart ESP32 in stage 3 will return it to stage 1, which is also in LOW, engendering the Pi to detect no changes and continue emitting stage 3 sounds. Adding a 4th stage and rendering the total amount of stages an even number respects the binary nature of HIGH and LOW signals and allows for the sound system to reinitialise.

Upon reboot, the Heart ESP32 therewith conveys a brief HIGH, then LOW signal to transpass the python files into the 4th stage briefly, then into stage 1 once more. The phantom stage is interpreted by the python program identically to the 3rd stage, it therefore serves no further purpose than rebooting functions.

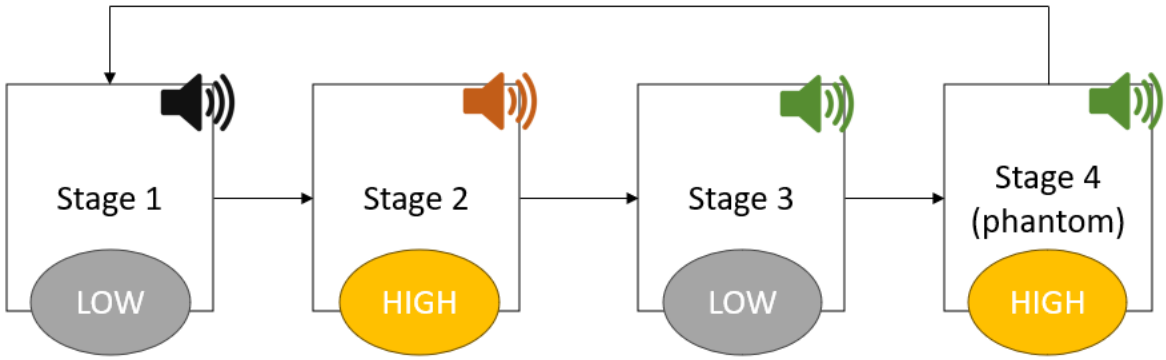


Figure 39:Stages as interpreted within each python file

Moreover, as may be seen in figure 33, a further connection to transmit CPR detection is established which is set to HIGH when a compression is detected, and LOW when it is released once more. Each file also has the functionality to respond to this detection with a brief sound emission, respective of the current stage.

Should the Heart ESP32 and the Pi fall out of sync for whichever reason, a system reboot of the Pi is possible. As aforementioned, a button has been soldered to the Pi to allow for system shutdown without requiring power removal. This is set in main,py, if a LOW is detected on GPIO12 through the button press, the command os.system("shutdown") is initiated. This grants a time limit of one minute before the system truly commences shutdown, although it may not be annulled anymore from outside intervention. A second press of the button initiates os.system("restart"), meaning that the Pi will reboot soon after, not requiring the power to be dis- and reconnected.

For testing purposes, a docking speaker with aux connection is inserted into the Pi.

6.5 Resetting the system

Regrettably, due to the sudden change in implementation schedule, it was not possible to develop a convenient reset method for the entire system. Regardless, the system is resettable in a few manners herewith elucidated. Each method is specific to a certain scenario, the author implores the reader to ensure application of each appropriate case.

If the system is successfully engaged with until stage 3, sound and all remaining in synch:

1. Press the reset button on the Keypad ESP32. This removes the HIGH signal from the Heart ESP32 and automatically resets the two Arduinos (may require multiple presses, engage until LED strip reactivates). If this is not done before resetting the Heart ESP32, it will perceive the pin code puzzle as solved immediately upon reboot and proceed into stage 2.
2. Press the reset button on the Heart ESP32. The heart will reboot and shift the Raspberry Pi in synch as priorly elucidated. The system is herewith prepared to be engaged with once more.

If the sound system fails due to technical errors or the sound and heart have grown asynchronous:

1. Reset the Keypad ESP32 first and then the Heart ESP32 as elucidated in the prior scenario. Before attempting to manually reset the Raspberry Pi, the system must be in its initial phase, otherwise the sound cycle in figure 39 will progress one stage too early and require resetting all over.
2. Press the red button twice to initiate the Raspberry Pi restart, this will require approximately 3 minutes to complete. During this process, maintain the speaker connection, for it indicates when the system has shut down and when it reboots. In the proper case, the sound will be cut after 2 minutes from when the button was pressed twice, then the desired stage 1 sounds will commence after a minor intermission of silence.

In each case, the latter reset procedure is generally applicable, however, due to its lengthy time requirement, it is recommended to attempt to realise the primary reset procedure, for this one may be performed in a handful of seconds. In absolute desperation, the power may also be removed from all devices and reinserted, but this should be reserved as an absolute last resort, as it will damage the Pi over time.

As may be deduced, resetting the system requires physical access to the individual microcontrollers, the author therefore recommends to not entrench the electronics beyond facile reach, especially if the system must be reset various times within a short time span. Indeed, the system in its current form lacks a proper reinitialization protocol, future iterations of Herz der Zukunft are therefore encouraged to develop such further.

7: Evaluation

The final phase of the creative technology design process is a formal evaluation to determine whether the designed system indeed adheres to its design most salient requirements, functional as well as non-functional, and to what extent it accomplishes its purpose. The requirements of Herz der Zukunft are herewith evaluated upon the documented prototype.

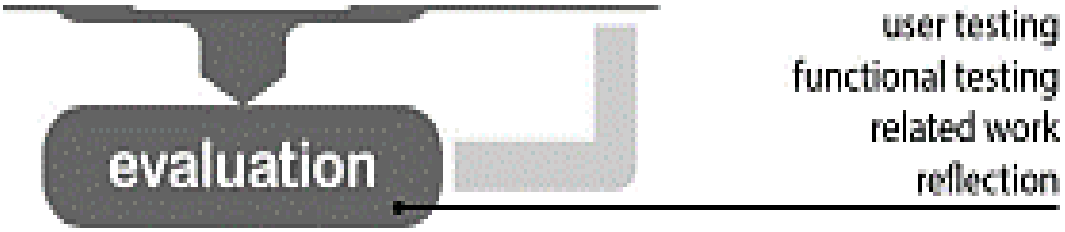


Figure 40: Realisation within creative technology

7.1 Aim and expectation of evaluation

The time given for the evaluation was simultaneous with that of the implementation, meaning one week. Considering that the time reserved for evaluation was shortened even further due to technical failure, the requirements evaluated were kept to the most essential. To reiterate from the specification chapter, the most salient aspect of the Herz der Zukunft installation is the user-experience (UX), as such, the evaluation primarily lays emphasis on evaluating to what extent the UX was developed as intended, as well as system stability aspects that may compromise the experience.

Specifically, there are 3 aspects of the UX that are studied herewith; The symbolic interpretation, the memorability and the possible after-affect upon the user. With this, RQ 1.2, 2.4 and 4.3 are addressed respectively. The collected client and user requirements will be only partially addressed due to the aforementioned time shortage, meaning not all of RQ 3.4 may be evaluated to its full extent. Moreover, due to the short-term availability of the Airstream, no long-term durability or UX effects of the puzzle could be studied.

As such, the functional requirements formatted as evaluation questions studied are:

1. Firmness: To what extent may the physical installation subject itself to multiple uses in one day while remaining intact? (RQ 3.4)
2. Continuity: How often does the system fail upon continuous use? (RQ 3.4)

Non-functional requirements:

3. Intuitiveness: To what extent are the purpose as well as the interaction intuitively understood? (RQ 1.2)
4. Welcome: To what extent does the user experience pleasant feelings during the experience as opposed to stress? (RQ 4.3)
5. Inclusivity: To what extent is the experience's design inclusive of non-German speakers? (RQ 3.3)
6. Impressionability: To what extent does the experience evoke a powerful emotional reaction among its users? (RQ 2.4)
7. Impact: How is the user's view of climate change influenced by the experience? (RQ 4.3)
8. Time: What is the required time to complete a run-through of the entire system? (RQ 3.4)
9. Collaboration: To what extent does the puzzle stimulate collaboration within a team? (RQ 3.4)

7.2 Evaluation plan

The reason why the evaluation could merely occur during the timespan in which the Airstream was physically present on campus is that the environment in which the puzzle finds itself is a crucial aspect which allows for immersivity. The results from the literature research support that immersion through the environment are non-negligible components of the UX and therefore, testing the true final prototype is deemed only feasible within the Airstream environment. The evaluation conditions are set to resemble the final prototype's true usage as much as feasible to answer the enumerated evaluation questions appropriately.

All questions listed priorly could be merely quantitively recorded, however, due to the short evaluation period, and therewith likely reduced number of participants as well as inspection means, it is desirable to obtain qualitative data as well to understand the results more profoundly. One trial will be done per group with differentiation of groups consisting of persons of high German proficiency and those of lower, all other aspects such as gender, age etcetera are to be randomised.

As quantitative recordings, participants are asked to fill out a pre- and post-survey to understand whether the experience has had an effect on their perception of climate change (RQ 4.3). In the pre-survey, the participant's emotional stance towards climate change along with personal data such as their level of German and nationality are requested. No further personal data than this are recorded to protect the privacy of participants. In the post-survey, the stance towards the climate crisis is requested once more to observe a change. Moreover, participants are

questioned on the UX in the form of Likert scales formatted and rating scale choice questions. In addition to this, the researcher initiates timing-measurements regarding the time taken by a group to reach the solution and counts the amount of times when the system fails to operate as intended. Considering the latter, two types of failures are differentiated; One kind that does not force the experience to be aborted and one that does so.

As qualitative recordings, the researcher will be present during the play session hidden away from the perception of the participants, yet close enough to observe and perceive intercommunication between participants as to denote the progression of the users, as well as which emotions they express at which given time during the experience. The precise location is the lavatory as depicted in figure 16. The notations in mention are recorded on a smartphone through text in the notes application. Further qualitative data will be collected in the aforementioned survey through open-ended questions regarding certain aspects of the experience.

7.3 Recruitment of participants

As elucidated in chapter 5.7, the audience of the Escape Climate Crisis EER encompasses all adults aged 16 and onwards. The only relevant quality on which participants are therefore differentiated by in the documented experiment is their level of German, it is therewith attempted to balance non-German speakers and native speakers accordingly by inquiring on their language proficiency priorly. Other aspects, such as age, gender and such are randomised to the researchers ability.

Participants are primarily recruited from the vicinity of the University of Twente campus, encompassing persons such as fellow students, bypassers and further social connections of the researchers. In addition to this, calls are made within larger forums and group chats to appeal to individuals to pass by the Airstream. No strict selection procedure is applied, all those of age who wish to participate may do so.

7.4 Method

It is noteworthy that the experiment herewith described did not unfold singularly. The projects initiated by Mark Ziegelhöfer and Hilke van den Born were evaluated in series with the one of Herz der Zukunft. As such, test persons who participated in Herz der Zukunft did so after having engaged with two other EER puzzles just before. This was done to mimic the true sequencing that would be applied in the EER whence Herz der Zukunft will find itself and thus remain truer to the final experience.

7.4.1 Experiment procedure

Participants are briefed upon the intent of the experiment as well as its procedure, however, not on the contents of the puzzle as the surprise effect is to be recorded. After this introduction, they are provided with consent forms to formally state their agreement and provided with an information brochure which they may read and keep if they wish. The experiment commences once the signed consent forms have been collected and safekept.

Before engaging with the prototype, the participants are asked to complete the pre-survey provided to them by either scanning a QR code on their personal mobile devices or through a provided laptop. As they complete this survey, they are not distracted by outsiders, all other puzzles within the airstream are deactivated and no one else is present to allow the participants to concentrate.

After all have completed the pre-survey, the vicinity as well as time limit of the puzzle is shown. In the true game session, Herz der Zukunft would come as second last puzzle in the sequencing (figure 14), players would therefore have decent insight at that point where they must search. Furthermore, due to the naked state of the prototype considering the time shortage to properly install decorations, participants are also briefed on what they may touch and what they may not. Lastly, participants are informed that they may ask for two hints at most if they believe to be truly lost, a procedure akin to in the true EER.

The experience envelops closely as elucidated in the storyboard (figure 23), where the closet contains a lock which opens upon inserting the word “Mutig” (German for “Brave”). The measurements taken by the researcher commence the moment that the current group receives this password, meaning that the timer is initiated and the researcher retreats to their hidden coven from whence they commence to record notes. The experiment terminates when the players have rescued the heart and the audio message finishes informing them of this, meaning step 11 in the mentioned storyboard. From here, the timer is halted and no more notations are made, the users are furthermore informed that the puzzle has been completed.

Lastly, the participants are asked to complete the post-survey in a similar fashion to how the pre-survey is completed. After this, participants are kindly thanked for their time, the experiment concludes herewith. All the herewith described has been conveyed and approved by the EEMCS’ ethics committee.

7.4.2 Quantitative data

The researcher initiates a timer from start to finish of the interaction and records a variable for each group to answer evaluation question 7. Taking the collected numbers of all teams, an average may be calculated, as well as comments made on the standard deviation and the effect of which speaking German has on the time required. In addition to this, the researcher retains numerically how often the installation fails per group to comment on the system's functionality and thus addressing evaluation question 2. Here, it is differentiated between a minor bug, where the session may continue, and a failure, where the session must come to a halt and the issue resolved.

Furthermore, to obtain quantitative results on the UX, rating scale as well as Likert scale formatted questions are employed all within the range 0-10, with 5 as neutral answer. To answer evaluation question 3, the question presented is:

- To what extent did you find the puzzle intuitive?
    - ➔ With this question, an insight is granted as to what extent the users feel disoriented during the experience. Whether the users truly succeed in navigating through the puzzle is determined by the time and observations taken.

To answer question 4, as well as 6:

- To what extent did you have enough time to solve the puzzle?
- I was surprised by what I found in the closet. (Disagree/agree)
- I felt excited during the experience. (Disagree/agree)
- I felt anxious during the experience. (Disagree/agree)
    - ➔ Due to the various emotions meant to be evoked, the positivity of excitement and negativity of anxiety are inquired from the user. Furthermore, it is tested whether the heart artifact truly creates the desired shock effect. Lastly, it is assumed that if users believe they were not given sufficient time to complete the puzzle, that the experience engenders frustration, dissatisfaction and panic.

To answer question 7, the two questions below are posed twice; Once before, and once after the experiment.

- To what extent do you see climate change as a threat to you personally?
- To what extent do you believe you have the ability to influence climate change?

➔ These questions pertain directly to the research question of this text. An alteration in threat perception towards climate change aligns with the BCT "reframing" and as such, it may be assumed that a change in intent has taken place. In addition to this, the self-perceived realization capacity has altered, thus affecting the intent toward climate action.

To answer question 9:

- I felt my contribution to the group mattered. (Disagree/Agree)
  - ➔ This question is included to further study the teamwork development catalysed by the puzzled.

7.4.3 Qualitative data

As the researcher hides beyond the sight of the participants, notations are taken with attention upon various aspects pertaining to the evaluation questions, for instance:

- What aspects of the puzzle do users exclaim trouble with? (Question 3)
- What are the overall feelings that users express during the experience? (Question 4)
- How often do users exclaim to be lost due to the language? (Question 5)
- How strong are the emotions expressed by the users? (Question 6)
- When does the group collaborate the most and when the least? (Question 9)

From the notes taken during these sessions, analysis will be performed and presented as results, commenting upon how these findings answer each specific evaluation question.

Furthermore, the survey contains multiple open-ended questions allowing for the participant to develop their answers more clearly and state their opinions. To answer evaluation question 3 further, one open ended question is posed:

- What do you believe the installation is about?
  - ➔ This questions serves to determine whether users interpret the installation as intended.

To specifically understand whether the heart artifact evokes an emotional reaction (question 6), the question is posed:

- What were your thoughts on the heart artifact?

After the final play session has concluded, the researcher will inspect the installation thoroughly and denote whether certain parts of it have been damaged or worn out significantly. If so, the

damage is denoted and comments are made regarding the firmness of the installation to address evaluation question 1.

Finally, additional question are included to allow the participants to voice their opinions more clearly and state what their experience was. Although valuable information on the UX, these are not directly pertaining to the evaluation questions:

- What stuck out the most during the experience?
- What could be improved in the installation?
- Do you have final comments for us?

7.5 Results

On the 11th of January from 11:00 onwards, user testing was conducted with 6 groups with each testing session requiring an average of 20 minutes. A total of 14 persons were recruited to participate in the experiment, with 5 native German speakers and 9 with minimal linguistic proficiency, all the recorded data from these sessions may be found in Appendix J. It is worth noting that two of these persons belonged to the client group and therefore did not fill in the survey to avoid desirability bias. Furthermore, due to organisational circumstances, it was not always possible to respect the 3-4 minimal group size. Herewith, the results are sectioned respective of the research question they pertain to.

1. To what extent may the physical installation subject itself to multiple uses in one day while remaining intact?

After 14 persons made use of the prototype, the researcher found no signs of physical damage on neither the artifact nor the electronics.

2. How often does the system fail upon continuous use?

The system did not experience a single minor bug nor failure.

3. To what extent are the purpose as well as the interaction intuitively understood?

From the open ended question, merely 4 persons very clearly state that the installation treats the theme of energy consumption. While the remainders do understand that the subject is climate change of some form, it does not appear as though the precise thematic is well interpretable. Likewise from the observations, the thematic was not verbally mentioned among groups, indicating that the focus was not upon this at any time during the prototype employment. In spite of this, the survey question regarding intuitiveness was answered with an average of 8,1, indicating that

although the meaning of the installation went over the users head, they did not feel lost because of it, it thus did not impeach upon the experience.

4. To what extent does the user experience pleasant feelings during the experience as opposed to stress?

It is assumable that the installation did not place excessive time stress on the users, considering that the average answer to the inquiry of whether the players were given enough time is 9,3 with a relatively low spread. The average excitement was rated at 7,9, with a noteworthy spread of 1,78, meaning that opinions are slightly dispersed on this. In addition, the average anxiety claimed is at an average of 5,66, with a considerable spread of 2,5, meaning that whether or not the experience is stressful depends heavily upon the individual. This is supported by the observations made, as certain individuals appeared to become exhilarated from the heart artifact, a certain number of users also expressed discomfort at having to engage with it.

5. To what extent is the experience intuitive to non-German speakers?

The aforementioned intuitiveness statistic which is rated individually from 7 and onwards, includes German speakers as well as non-German speakers, meaning that the intuitiveness is ranked high among all participants. From observations, non-German speakers did have struggles relating the terms to each other within the poster puzzle (one group overcame this by employing a translating app). Such groups took considerably longer time and made use of hints to complete the puzzle, whereas groups which included native Germans had little issue with this and resolved the puzzles on average swifter. In addition to this, not entirely grasping the written text engendered frustration among certain participants. While therefore all groups were able to complete the puzzle within the given time limit, non-German speakers struggled more to do so.

6. To what extent does the experience evoke a powerful emotional reaction among its users?

Employing the same statistical results as in evaluation question 4, the averages for surprise, excitement and anxiety may be compared to the neutral value, 5, to draw conclusions. Surprise received an average ranking of 7,66 with a spread of 2,01, meaning that while overall surprise was high, certain individuals experienced it more while others did not. Excitement ranked with an average of 7,9 quite high as well, anxiety was deemed lower at 5,66, while there were notable individual differences.

From the observations, it is certain that users present emotional reactions during the experience, particularly concerning the heart artifact. Some uttered surprise along with slight disgust upon touching the heart, from quotes such as “Eww, it’s super slimy!”, the texture of silicone appears to

be striking among users. Furthermore, many found the organ symbolism to be striking, perchance even plethorically so as one participant dubbed it grotesque. From open-ended responses, most praised the heart to be the most memorable aspect of the experience, two persons even made the relation to saving the world and reanimating the heart. It is worth stating that individuals have varying reactions to the installation, but whether positively or negatively, the installation appears to leave an impression on users.

7. How is the user's view of climate change influenced by the experience?

To test for significant changes in the pre-and post-survey questions regarding the user's fear towards climate change as well as their perception of having a stake in how the climate crisis unfolds, a paired t-test is performed on the results. For this test, normality is assumed for all data employed. Calculations were performed to validate the normality of the datasets employed, at significance level 0.05 no significant deviations from normality were found for any data herewith employed.

The p-values obtained from this calculation are 0,6761 for the analysis on threat perception and 0,1669 for the analysis on capability perception. Although the latter is considerably more diverged than its predecessor, both of these values are not statistically significant with the standard significance level of 0.05.

8. What is the required time to complete a run-through of the entire system?

As aforementioned, all groups completed the puzzle within the 15 minutes time limit, though group 3, a non-German group, required all their hints for this. The average time taken for the completion of Herz der Zukunft is 8 minutes 42,6 seconds with a considerable spread ranging from minimum 4 minutes 6 seconds to maximum 12 minutes and 48 seconds.

9. To what extent does the puzzle stimulate collaboration within a team?

The average ranking to the question to what extent each individual felt involved in their groups yields an average value of 7,5 with a considerable spread of 2,1. On average, participants therefore declare that they found themselves to be quite engaged within the group, although considerable exceptions exist within this reading.

From observations, it was revealed that the pin code puzzle is the focal point at which group members are driven to collaborate the most. The fact that multiple passwords are to be inserted is not immediately understood by users and therefore requires multiple attempts as well as idea

sharing to unveil. Similarly, the first password is not immediately understood and requires communication to discover the solution, especially among non-German speakers. Although the heart artifact does inspire emotion in the users, it does not require idea sharing nor teamwork to reanimate the heart, although team members did sometimes tend to encourage the person animating, thus emotionally investing themselves in the action.

7.6 Limitations

The listed results do come with certain limitations to consider. For one, the results of interpretability (question 3) are to be regarded critically, as the survey likely partly shaped the view of the participant, considering that the pre-survey questions both concerned sustainability. While many persons hence understood that the installation revolves around the thematic of climate change, this view is certainly partly shaped by the information given prior, meaning that merely the answers which understood the relation between energy consumption and the prototype may be considered comprehended. Regrettably, the nature of pre-and post-survey questions require that they are immediately posed in succession of the experience as to remain unbiased, therewith biasing the interpretability question.

In addition to this, 4 out of the 12 survey participants have already been affiliated with the project once before in the form of testing an early version or being up-to-date on the development of the prototype, results to questions such as to what extent these individuals were surprised or to what extent they found the installation intuitive are therefore likely biased, where the true value likely lies higher and lower respectively had completely unprepared participants been selected.

Moreover, due to schedule disruptions, the survey was merely completed by 12 participants, all of which were associated with the university of Twente in some form. A pool of 12 survey participants may be considered quite limited, the results herewith presented may therefore not be entirely representative of the entire user base for which the product is designed. Future evaluations may dedicate efforts to recruiting larger amounts of participants to ensure that the results are representative.

8: Discussion

From the evaluation, it became clear that the first assembly of Herz der Zukunft contains strong, as well as weak points. For one, the installation fails at presenting the message of climate change clearly to its user, answering RQ 1.2 in the negative. Although the greater amount of persons understood it had some relation to climate change and its direness, no relation to individual action is made nor precise oil consumption. As Fotaris [6] elucidates, EERs do not serve to convey precise information, yet a manner must regardless be devised such that users comprehend that the encompassing theme of the experience is individual climate action, as otherwise the perception of climate action may not be altered and thus the desired behaviour change "reframing" is forfeited.

In spite of this, results to RQ 2.4 presented that the installation in its current form contains aspects that are deemed memorable to users. Users overall express above-neutral emotions to the interactions designed, particularly to the heart artifact, and tend to collaborate to solve the puzzle. Considering that emotional engagement is correlated to information renitence, as discussed in chapter 2.1.2, it is assumable that due to the emotional response recorded, the participants will remember the installation. Regrettably, this study does not possess the means to evaluate whether the installation is remembered over longer periods of time, such as 6 months or up to a year and can therefore make no definite claims on the long-term impact of a singular visit. Future iterations of Herz der Zukunft are hence encouraged to perform studies on the long-term effect of the product's employment.

Unfortunately, there was insufficient time to fully answer RQ 3.4 in its entirety, it is therefore commendable that future versions continue the evaluation of the user and client requirements, particularly from the client's side there remain open questions such as to what extent the product is employable by persons of reduced technical knowledge and whether the system is truly non-hazardous to the environment. What may be stated now is that the first assembly, a final prototype, of Herz der Zukunft is employable by users in the short-term, for it contains no experience-halting bugs and is adequately challenging that users may complete it within the given time limit. Even so, the system is not yet optimized and will require further work to meet all the user and client requirements better.

Moreover, the results of RQ 4.3 indicate that the current version of Herz der Zukunft does not succeed in altering the user's view of climate change nor their own involvement within it. To truly evaluate this, long-term studies would need to be undergone, yet if in the short-term already no change is detected in intention towards climate change, it does not promise well for future

behaviour change as elaborated upon in chapter 2.1.2 and figure 4. It is not certain whether this lack stems from an overall unsuitability of EER puzzles to motivate behaviour change or if an EER may accomplish this if along with the emotional response the personal significance and overarching theme is recognised, which, as aforementioned, is not the case for the current prototype. Future iterations of Herz der Zukunft must therefore primarily accomplish to establish the thematic as well as individual significance clearly to users, then evaluate to what extent behaviour change is attainable.

In light of the results of the evaluation, the design choices that shape Herz der Zukunft may be revisited and their appropriateness discussed. Primarily, concerning the material of Herz der Zukunft, alterations should be made to adhere closer to the functional and non-functional requirements established in chapter 5.7. It was evaluated whether the system prevails after two days of usage, it is however not certain whether the system survives upon years of usage. For its intended final usage, it is worth revisiting the material choices that were made, such as jumper cables and oled screens, as these failed quite often outside of user testing. One choice that is noteworthily well received however, is the silicone casing of the heart, spurring desired emotional reactions from users and thus rendering it a commendable material choice for future models as well.

Certain parts may optimally be replaced altogether, such as for instance the ESP32 microcontrollers. These were originally chosen due to their Wi-Fi and Bluetooth connectivity, later kept into consideration due to their equivalent volt setting as the Raspberry Pi, it is however not excludable that more fitting microcontrollers exist that may serve this purpose more adequately. As such, all parts of the prototype may be considered placeholders that potentially could be optimised through other electronics that may have escape the authors consideration during the ideation phase.

In addition to this, the manner of programming may also be optimised in future iterations of Herz der Zukunft. For instance, the LED strips within the heart as well as the response time of the keypad are delayed, possibly due to programming imperfections within the Arduino code, the final product should therefore revisit the code and optimise it to enhance the UX. Adding to this, the Raspberry Pi was largely programmed in the manner that it was due to hardware damage, unknown prior device setup and the author’s inexperience with such a device, the final version should therefore revisit the sound system programming and devise a system that is perfectly synchronous between devices by for instance employing a I2C communication or Bluetooth. The communication system depicted in figure 39 is not optimal for it desynchronises quite facilely.

These considerations may be taken for the final product if the overarching concept is to be kept identical, however, the larger design choices may also be reconsidered for various reasons. For one, the pin code puzzle aspect came with certain debatable negativities. As Fotaris elucidated in his workshop (chapter 2.3), a puzzle should have as little cultural or textual reliance as possible. It appears that, due to the inclusivity imperfection observed, text must truly be kept to a minimum, as frustrations occurred over the current version of the keypad puzzle. Inclusivity should not be neglected for a product such as this, considering that the assumption that all users will speak German is likely erroneous. As Joseph C. asserts, “the normativity of the One (the product) is found in the obtrusiveness of persons rather than artifacts when there is a mismatch” [28, page 7], meaning that the excluded will disconnect themselves from the message, when the precise opposite is the aim.

Even so, the current version is successful in encouraging teamwork among groups, arguably precisely because it is at times more complex and incomprehensible, thus requiring collaboration to unveil the solution. As such, maintaining a bisectional interaction containing a more complex information search puzzle followed by a more facile, hands-on emotional experience remains suitable. The challenge therewith lies in constructing a puzzle that may convey the same depth and precision of information that text may to maintain the challenge of the puzzle, or even enlarge it. It may be worth considering, for instance, to employ imagery or 3D shapes instead and to replace the keypad interaction with a more elaborate contraption that comes with a steeper learning curve. With linguistic comprehension, the puzzle is solved quite rapidly, if the inclusivity gap is therefore bridged, it is assumed that the puzzle may be rendered more complex.

In addition to this, the installation is designed for targeted information retention concerning climate change, as evoking playful and empowering emotions is futile if the users is not able to relate these feelings to the climate catastrophe. Regrettably, the user evaluation revealed that the installation is not well designed to present its message clearly. As Fotaris elucidated further, EERs do not serve to convey concrete information, presenting the thematic in a text puzzle therefore proves to be a poor design choice and should be revised.

In addition to this, due to the experienced time shortage, the first iteration of Herz der Zukunft has little decorations pertaining to oil consumption. From the user interviews, it was revealed, however, that impressive decorations are greatly appreciated and retained over longer periods of time, the author therefore strongly recommends to dedicate more time and resources to décor in future versions of Herz der Zukunft, or such similar initiatives, to develop the surroundings so that they may impress and immerse further.

The heart aspect of the puzzle may also be redesigned to adhere to the memorability criteria better. While the artifact is effective in triggering emotional reactions and therewith establishing affinity as well as memorability, its interaction is quite court. Future iterations of Herz der Zukunft are encouraged to continue with this heart artifact, expanding the interaction in an even more memorable manner by including further variations of interactions to reanimate the heart, such as for instance a defibrillation interaction or an oil extraction puzzle.

9: Conclusion

Returning to the original purpose of this text, the intent of this project was to answer the question how an educational escape room piece may be manufactured which treats the climate catastrophe in such a manner that its users become willing to reconsider their behaviour patterns towards the ecological. This was done by producing a prototype to be installed in a pre-existing educational escape room (EER) provided by an external client affiliated with the initiative Escape climate crisis. To accomplish this, 4 aspects must be considered:

1. Which aspect of the climate crisis is to be most direly represented?
2. How is an effective educational escape room puzzle designed?
3. What are the pre-set requirements which the prototype must adhere to?
4. How may the final prototype persuade users into altering their behaviour?

From literature research, it became apparent that the current most polluting consumption consists of oil combustion for various of human activities such as heating, transportation and manufacturing. The thematic of the installation is therefore focused upon persuading the user to less oil-consuming habits.

To comprehend the design standards behind EER frameworks, more extensive research was conducted in the form of literature analysis, expert and user interviews, as well as attending a workshop hosted by Fotaris [6]. The results from this play a significant role in the design of the UX of Herz der Zukunft, as they elucidated how an enjoyable escape room experience is produced.

Considering that the prototype was to be inserted in a predefined environment, it was further salient to gain insight into where the prototype would find itself, along with which client and user requirements it should abide to. For this, a formal recording of the escape room was performed, as well as client interviews and Fotaris' room2educ8 framework application to contextualise the project. From this, it became clear what the requirements for the product design were.

The final aspect of inducing behaviour change was addressed through a further literature analysis from which was learned that to influence the user, a personal significance of sorts to the thematic must be created, which is most plausible through the creation of an emotionally charged experience, as it leads to affinity with the thematic as well as retention of information. These findings, along with the yielded behaviour change techniques (BCT) framework by Michie [21] establish the desired UX result from users.

As such, the manufacturing of the final prototype begins by the aid of the design process for creative technology by Angelika Mader [18]. During the ideation phase, three concepts are produced by applying the lotus blossom and mind-mapping techniques among 25 total ideas. From all the requirements listed, a selection is made by which the final concept is chosen, along with client and user feedback. This concept was ideated further to consider all possible final forms that the interaction and visuals could take and hence employ the most suitable assembly.

During the specification phase, the final concept, Herz der Zukunft, is established, along with the particular design choices made. With emotionality on the forefront, a heart artifact is chosen, due to its relation with humans and possible shocking first impression it could make. Furthermore, a pin code puzzle is inserted along with climate change posters from whence three secret codes are to be extracted to relate the installation to the overarching theme so that the user may relate the emotions to a specific concept, here oil consumption.

In the realisation phase, installation is produced by the blueprint priorly presented. The Airstream, meaning the physical escape room, arrives at the university of Twente and installation commences on the 8th of January 2024. Regrettably, a significant technical setback is experienced by the author which engenders the final prototype to require 3 days of reparation, forfeiting the time reserved for decoration creation. Even so, a functional final prototype is installed in the Airstream on the 10th.

With the final prototype complete, an evaluation is performed to reveal to what extent Herz der Zukunft conveys the climate crisis to the user as desired. Although the evaluation is subject to considerable limitations, conclusions could be made. The prototype does not succeed in altering user's perception of climate change, nor their own stake in it, assumably due to the fact that users could not interpret this message of the installation. Regardless, the experience evokes the desired positive emotional reaction from users, it hence remains possible that further iterations of this prototype may attain this goal once it becomes clear to the user which behaviour is asked of them.

No conclusive answer may herewith be made to answer the question whether an educational escape room piece may persuade users to more climate friendly behaviour, although insights into such an attempt may herewith be shared. These insights may be of relevance to further individuals who wish to persuade the public or other demographics to more socially desirable behaviour, not necessarily pertaining merely to climate change. The study of persuasive interaction design is one that transcends into other subjects, such as health and social interaction, the techniques and methods applied in this text may be of interest to those

who wish to develop a product to persuade persons to a certain socially desirable yet individually undesirable behaviour.

These results are not merely applicable to persuasion through EER installations, but all future attempts to be made at converting consumers to more climate conscious behaviour. In an age where climate activism, among other forms of activism, is becoming increasingly radicalised, it is worth remembering that effective persuasion only occurs when the other side associates positivity with the thematic. When a debate grows increasingly polarised, the appealed to may refuse to lend their ear and grow entirely deterred from the subject at hand. Play is one manner of creating a positive, open atmosphere where individuals may be approached and addressed on their behaviour, further such manners are employing gentle language, patience and empathy to truly reach the person on the other side.

Herz der Zukunft was fundamentally built with the intent of creating an open environment where individuals may come together and engage in honest, yet unprovoking conversation, the author encourages the reader to employ their imagination and create such similar environments near them through their own means.

Figure 41: Group foto of design team

References

[1] C. Hogan, M. & National Aeronautics and Space administration. (n.d.). *Wildfires* - The Encyclopedia of Earth. Retrieved August 2, 2023, from https://editors.eol.org/eoearth/wiki/Wildfires

[2] C. Horgan, M. & National science foundation. (2021, October 11). *Drought and flooding* - The Encyclopedia of Earth. https://editors.eol.org/eoearth/wiki/Drought_and_flooding

[3] C. Hogan, M. & World wildlife fund. (2022, October 23). *Threats to coral reefs*. The Encyclopedia of Earth. https://editors.eol.org/eoearth/wiki/Threats_to_coral_reefs

[4] U. Cubasch, & G.A. Meehl. (n.d.). Projections of Future Climate Change.

[5] Soares, R. V., Barel, P. S., Leite, C. C., Santos, L. L. D., Specian, F. C., De Carvalho, E. R., Gianotto-Oliveira, R., & Cecílio-Fernandes, D. (2023). Implementation of Escape Room as an educational strategy to strengthen the practice of safe surgery. *Journal of Surgical Education*, *80*(7), 907–911. https://doi.org/10.1016/j.jsurg.2023.04.016

[6] Fotaris, Panagiotis, and Theodoros Mastoras. "Room2Educ8: A Framework for Creating Educational Escape Rooms Based on Design Thinking Principles." *Education Sciences*, vol. 12, no. 11, 29 Oct. 2022, p. 768, https://doi.org/10.3390/educsci12110768.

[7] Pew Research Center. (2020, July 27). *How people worldwide view climate change | Pew Research Center*. https://www.pewresearch.org/short-reads/2019/04/18/a-look-at-how-people-around-the-world-view-climate-change/

[8] Pidwirny, M., & C. Hogan, M. (2021, May 14). *Causes of climate change*. The Encyclopedia of Earth. https://editors.eol.org/eoearth/wiki/Causes_of_climate_change

[9] Bezençon, Valéry, et al. "Escape Addict: A Digital Escape Room for the Prevention of Addictions and Risky Behaviors in Schools." *Computers & Education*, vol. 200, 1

July 2023, p. 104798, www.sciencedirect.com/science/article/pii/S0360131523000751

[10] Clauson, Angela, et al. “An Innovative Escape Room Activity to Assess Student Readiness for Advanced Pharmacy Practice Experiences (APPEs).” *Currents in Pharmacy Teaching and Learning*, vol. 11, no. 7, July 2019, pp. 723–728, https://doi.org/10.1016/j.cptl.2019.03.011

[11] Reuter, Jessica, et al. “How to Create Educational Escape Rooms? Strategies for Creation and Design.” *Eighth International Conference on Technological Ecosystems for Enhancing Multiculturality*, 21 Oct. 2020, https://doi.org/10.1145/3434780.3436664 .

[12] Soares, Renata Vicente, et al. “Implementation of Escape Room as an Educational Strategy to Strengthen the Practice of Safe Surgery.” *Journal of Surgical Education*, vol. 80, no. 7, 1 July 2023, pp. 907–911, www.sciencedirect.com/science/article/pii/S1931720423001356

[13] Veldkamp, Alice. “Escape Education: A Systematic Review on Escape Rooms in Education.” *Educational Research Review*, vol. 31, 1 Nov. 2020, p. 100364, www.sciencedirect.com/science/article/pii/S1747938X20300531, https://doi.org/10.1016/j .edurev.2020.100364.

[14] Kabir, M. R., Habiba, U. E., Khan, W. U., Shah, A., Rahim, S., Farooqi, Z. U. R., Iqbal, M., & Shafiq, M. N. (2023). Climate change due to increasing concentration of carbon dioxide and its impacts on environment in 21st century; a mini review. *Journal of King Saud University - Science*, *35*(5), 102693. https://doi.org/10.1016/j.jksus.2023.102693

[15] Squalli, J., & Adamkiewicz, G. (2023). The spatial distribution of agricultural emissions in the United States: The role of organic farming in mitigating climate change.

Journal of Cleaner Production, *414*, 137678. https://doi.org/10.1016/j.jclepro.2023.137678

[16] Wang, Y., Wang, H., Wang, P., Zhang, X., Zhang, Z., Zhong, Q., Ma, F., Yue, Q., Chen, W., Du, T., & Liang, S. (2023). Cascading impacts of global metal mining on climate change and human health caused by COVID-19 pandemic. *Resources, Conservation and Recycling*, *190*, 106800. https://doi.org/10.1016/j.resconrec.2022.106800

[17] Zhou, Y., Hu, D., Wang, T., Tian, H., & Gan, L. (2023). Decoupling effect and spatial-temporal characteristics of carbon emissions from construction industry in China. *Journal of Cleaner Production*, *419*, 138243. https://doi.org/10.1016/j.jclepro.2023.138243

[18] Mader, A., & Eggink, W. (2014). A DESIGN PROCESS FOR CREATIVE TECHNOLOGY. *ResearchGate*. https://www.researchgate.net/publication/265755092_A_DESIGN_PROCESS_FOR_CREATIVE_TECHNOLOGY/link/541ac2ea0cf25ebee988bfb1/download

[19] Galeote, D. F., Legaki, N. Z., & Hamari, J. (2023). From Traditional to Game-Based Learning of Climate Change: A Media Comparison experiment. *Proceedings of the ACM on Human-computer Interaction*, *7*(CHI PLAY), 503–525. https://doi.org/10.1145/3611039

[20] Paraschivoiu, I., Buchner, J., Praxmarer, R., & Layer-Wagner, T. (2021). Escape the Fake: Development and Evaluation of an Augmented Reality Escape Room Game for Fighting Fake News. *Annual Symposium on Computer-human Interaction and Play*. https://doi.org/10.1145/3450337.3483454

[21] Michie S., NIHR JOURNALS LIBRARY. *City Research Online - Behaviour change techniques: the development and evaluation of a taxonomic method for reporting and describing behaviour change interventions (a suite of five studies involving consensus*

methods, randomised controlled trials and analysis of qualitative data). https://openaccess.city.ac.uk/id/eprint/13435/

[22] Clarke, S., Peel, D. J., Arnab, S., Morini, L., Keegan, H., & Wood, O. (2017). EscapED: A Framework for Creating Educational Escape Rooms and Interactive Games to For Higher/Further Education. *International Journal of Serious Games*, *4*(3). https://doi.org/10.17083/ijsg.v4i3.180

[23] *Handbook of Theories of Social Psychology*. (2011b). Van Lange, Paul a. M. - Higgins, E. Tory - Kruglanski, Arie W. - SAGE Publications Ltd - Torrossa. https://www.torrossa.com/en/resources/an/5017496#page=139

[24] Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-t

[25] Tromp, N., Hekkert, P., & Verbeek, P. P. (2011b). Design for Socially Responsible Behavior: a classification of influence based on intended user experience. *Design Issues*, *27*(3), 3–19. https://doi.org/10.1162/desi_a_00087

[26] Neuteleers, S. (2019). Why Be Cautious with Advocating Private Environmental Duties? Towards a Cooperative Ethos and Expressive Reasons. *Journal of Agricultural & Environmental Ethics*, *32*(4), 547–568. https://doi.org/10.1007/s10806-019-09790-3

[27] Fritsch, J. (2018). Affective interaction design at the end of the world. *IT-University of Copenhagen*. https://doi.org/10.21606/dma.2017.580

[28] Wittkower, D. (2017). Technology and discrimination. *ResearchGate*. https://www.researchgate.net/publication/324727807_Technology_and_discrimination

[29] Cadet, L., & Chainay, H. (2020). Memory of virtual experiences: Role of immersion, emotion and sense of presence. *International Journal of Human-Computer Studies, 144*, 102506. https://doi.org/10.1016/j.ijhcs.2020.102506

[30] Makowski, D., Sperduti, M., Nicolas, S., & Piolino, P. (2017). "Being there" and remembering it: Presence improves memory encoding. *Consciousness and Cognition, 53*, 194–202. https://doi.org/10.1016/j.concog.2017.06.015

Appendix

Appendix A: Client group members interviews (Original German responses)

Respondent 1:

I: Was ist ihre Funktion in dem Projekt?

Also ich bin bisschen so für die Innenausstattung mit zuständig. Also ich guck, dass das ein bisschen hübsch wird und n bisschen im Sinne von Solar Punk so eingerichtet wird und ja versucht da ein bisschen was mit beizutragen und ansonsten ja unterstütze ich den Stefan, wenn es um die Organisation auch geht, also dann, wenn wir uns so treffen, dass ja diese Treffen mit organisiert werden, genau ansonsten... Allgemein versuche ich immer mal Ideen mit einzubringen.

I: In welcher Designsphase befinden Sie sich mit Ihrem Projekt? (Erklären Sie mit room2educ8)

Also ich würde sagen. Hm. Dass wir, na ja, nicht mehr am Anfang, aber in welcher Phase? Also wir haben jetzt ganz viele Ideen gesammelt, und die kommen jetzt langsam in eine Spur, also es kristallisiert sich langsam ein roter Faden heraus, den wir dann auch verfolgen, also bisher war wirklich sehr, sehr viel noch Ideen sammeln und ein bisschen sortieren, dann kamen wieder neue Ideen. Es war ein bisschen diffus und jetzt langsam wird es konkreter.

I: Welche Schwierigkeiten beim Bau der Einrichtung haben Sie bisher überwunden?

Mit der Einrichtung, na ja gut, das ist ja ein sehr altes Ding, der Airstream. Du hast ihn jetzt auch schon gesehen und ja, also wenn man manchmal wenn man irgendwo hin fasst dann zerbröselt das auch gleich, also auf der einen Seite möchte man ja das alte erhalten oder möglichst viel von dem Alten erhalten, aber manches geht eben nicht, also ist das von mir von der Holz ist dann eben oft kaputt und dann muss man das wegmachen. Also ja, einfach diese Kombination, dass man ein bisschen was erhält, aber trotzdem das irgendwie einigermaßen nett aussieht, das ist manchmal ein bisschen schwierig, weil dann kommen halt zum Beispiel, wenn du da drüber streichst, dann kommt noch trotzdem Feuchtigkeit durch und da müsste man einen Riesenaufwand betreiben, damit man das nicht mehr sieht, aber da fragt sich dann, ob die Relation noch passt, also ob sich dieser Aufwand dann auch lohnt, weil am Ende ist es vielleicht dann auch ganz dunkel in diesem Escape und man sieht sowieso nicht. Also. Genau das ist manchmal ein bisschen schwierig.

I: Wie haben Sie den Designprozess bisher erlebt?

Man denkt manchmal an ein ganz tolles, großes Endziel und stellt sich das so schön vor und die Einzelschritte sind dann doch mühsamer und dauern wesentlich länger. Kriegt dann zwar immer mal Unterstützung natürlich und dann wird man eine Ecke doch richtig gut oder cool oder macht auch total Spaß, aber ja, dann sieht man sich um und denkt, Oh irgendwie 95% ist noch nicht erledigt, also da musst du irgendwie nochmal ran und dann spielt auch noch eine Rolle, dass die Rätsel noch nicht stehen, das heißt, man weiß gar nicht so genau, braucht man vielleicht eine Projektionsfläche oder braucht man da eine Ecke oder einen Kasten oder eine Schublade, die dann irgendwie dafür genutzt werden müssen? Und mit der sollte vielleicht besser noch nichts anfangen mit dieser Ecke. Dann ne, also ich hab so das Gefühl, ich mache mal so ein paar Ecken irgendwas, aber keine Ahnung, ob das dann auch wirklich am Ende sinnvoll war.

I: Für welche Benutzererfahrungen entwerfen Sie? (Was soll der Besucher fühlen und wann?)

Naja, ich möchte, dass die Atmosphäre irgendwie cool ist, also dass das ne. Wir haben uns ja am Anfang auch dieses Solar Punk geeinigt und das ist natürlich total schwer umzusetzen in so einem alten Wohnwagen. Aber man kann ja trotzdem ein bisschen die Stimmung verursachen und das wäre so ein Ziel, dass die sich da so ein bisschen ja in der Zukunft auch fühlen und trotzdem noch an der Vergangenheit hängen, dass sie so dieses, ja dieses Gefühl bekommen.

I: Wie haben die Endnutzer bisher auf den Prototyp des Busses reagiert?

Die waren eigentlich die meisten, fanden das ziemlich cool. Also so diesen Stream überhaupt und sind dann auch reingegangen und haben sich das innen angeguckt. Ja, die waren einfach schon auch überrascht, weil man sowas ja nicht alle Tage sieht, ich glaube das ist so ein wichtiger Ausdruck, dass man denkt, Oh wow, schon ganz cool wenn das was werden kann und… Ja, positiv auf jeden Fall.

I: Wie viel Erfahrung haben Sie persönlich mit Technologie?

Na. Also ziemlich ja, also nichts gar nicht deswegen. Nee, also ich bin Grundschullehrerin, ne und ich komme, also ich benutze das, was ich in meinem beruflichen Umfeld brauche und ansonsten habe ich mit Technologie nicht so viel zu tun, ich nutze es und es muss funktionieren und wenn es nicht funktioniert, dann nervt mich das.

***
I: Wie stellen Sie sich den endgültigen Escape Room vor?

Also. Den stell ich mir ziemlich cool vor und also sehr ansprechend schon mal von außen, dass es wirklich Menschen anzieht, einfach jetzt nur durch, dass er da steht und ja innen dann ja n bisschen geheimnisvoll vielleicht auch ein bisschen creepy und also einfach mit einem hohen Aufforderungscharakter. Und. Ja. Genau, dass man irgendwie den unbedingt spielen möchte. Schon allein, weil man in diesen ersten Reihen möchte, dass man das Mal erlebt.

I: Was wären Sachen, die du cool finden würdest?

Also ich finde zum Beispiel diese ganzen, dass die Küche noch da ist. Ne, das finde ich total klasse und die muss ich in die Spiele finden. Also wäre schön wenn die mit integriert werden, diese Küche, dieser Kühlschrank, dieser Ofen. Sowas dann auch. Vorne haben wir den Tisch jetzt dahin, das finde ich auch ganz wichtig, dass man sich hinsetzen kann, mal, dass man auch diesen Tisch dann auch mal so die einzelnen Lösungen irgendwie vielleicht in der Reihenfolge bringen kann oder dass man sich das nochmal anschauen kann. Unter diesen Tisch hat und auch sitzen kann. Ja dann diese diese Pflanzen, also diese zum Teil echt diesen Efeu der Ossi da immer mit Anschleppt und dann auch dieses, was sich da so häkel also das n bisschen das Gefühl gibt als wäre das eingewachsen und zugewachsen und würde schon sehr lange da irgendwo rumstehen und die Pflanzen erobern sich schon n bisschen so diesen Air Stream. .

I: Welche räumlichen Anforderungen haben Sie für jedes einzelne Escape-Room-Rätsel?

Ja, das ist natürlich begrenzt, ne einfach dadurch, dass er nicht das ist nicht so groß ist wie eine Wohnung jetzt wo man auch Escape Rooms spielt, dann in den Räumen der ein oder 2 Räume dabei sind, aber ich denke trotzdem gibt es hier so eine Einteilung in dem Airstream, also hinten die das Bad was jetzt mal war, da haben wir jetzt den Garten rein also da könnt ihr zum Beispiel ein, ich finde da können wahrscheinlich sogar 2. Oder 3 Rätsel sogar eine Rolle spielen. Also ich denke an den Kühlschrank, an den Ofen und vielleicht oben an dieses Schiebeding. Und da, wo diese Betten oder Bänke sind. Ja, da haben eigentlich ein zweidrittel Platz und vielleicht dann gleich rechts, wo dieser Wassertank noch unten ist. Also. Ja, einfach was der Raum da so hergibt.

I: Du meinst den unter den Tisch?

Mhm Mhm, genau da vielleicht irgendwie noch was, also weil das ja also cool ist, wenn diese alten Dinge damit integriert werden, finde ich, und dann in Kombination mit etwas neuem, wie zum Beispiel dem Marriott Garten. Das also, dass beides eine Rolle spielt, das alte, wie es halt mal war. Und dieses Zukunftsorientierte.

I: Was sind die visuellen oder gestalterischen Anforderungen für jedes Rätsel? (Wie muss es (nicht) aussehen)

Cool wäre das natürlich, wenn man auch noch sowas richtig modernes mit rein brächte, ne? Das finde ich noch. Ganz schön, aber das ist natürlich. Also auch handwerklich irgendwie schwierig, wenn man so richtig was ganz Modernes mitbringt. Wenn ich nicht Plastik und weiß oder irgendwie sowas noch mit reinbringt. Ja.

I: Wie hoch sollte Ihrer Meinung nach die Produktionskomplexität eines jeden Rätsels sein? (Wie viel Technik können Sie bewältigen)

Also es darf nicht zu schwierig und zu komplex sein, denke ich, weil sonst ja, verliert man relativ schnell die Lust daran oder den Nerv. Also es muss irgendwie schon… Ich denke am Anfang vielleicht haben wir gestern auch schon drüber gesprochen und das dachte ich auch schon immer. Also das ist am Anfang einfacher, ist ne und dann kannst du ja etwas komplexer werden oder vielleicht am Anfang auch mehr haptisch oder mit den mit den Sinnen einfach irgendwas erfahren. Also mit diesem Karten kann man ja sehr viel mit dem Geruch aufmachen und dann später, dass es dann technologisch wird, also das schon alle ein bisschen gefordert wird, aber es darf nicht zu schwer sein, also nicht, dass man dann irgendwie keinen Bock mehr hat das zu spielen. Und manchmal, ich spiele selber ja gerne auch Escape Rooms. Es ist so, dass man wirklich, dass es Zufall ist, dass man auf eine Lösung kommt, weil irgendwie dies kreiert haben, die haben halt da gerade in dem Moment so gedacht, aber man kommt als normaler Mensch da überhaupt nicht drauf, hat dann immer nur Zufalls, also ne Zufalls denken, dass man das herausfindet und das finde ich gut, wenn man das n bisschen vermeiden kann, also wenn es wirklich einfach logisch sich erschließt. Das ist jetzt mal zu dieser Lösung finden muss quasi.

I: Gábe es Merkmale, an der man erkennen kann, dass ein Puzzel zu schwer ist?

Hm. Ich glaube, ich merke dann immer erst beim Spielen selber, aber einfach, wenn es vielleicht zu viele möglichkeiten gibt also. Man muss irgendwie schon auf eine Spur gebracht werden, die einen in den richtigen Lösungs Kanal, sag ich mal, führt ne, das kann nicht irgendwie ganz diffus sein, dass jetzt. Weiß ich nicht, dass… Ja, irgendwie muss es so eine Linie in dem Lösungsweg geben. Ich habe jetzt kein Beispiel, irgendwie hab ich kein Beispiel parat, aber vielleicht verstehst du, was ich meine.

I: Was sind weitere Anforderungen, die Sie nennen könnten?

Also. Spaß muss es machen, finde ich. Muss ein bisschen, ja irgendwie auch so, dass man lachen kann. Ich finde es auch wichtig wirklich, dass man was greifen kann, also was begreift, was anfasst und dann eben zusammenfügt, oder? Und das mit den Händen. Das finde ich auch wichtig. Ja, und ich meine, klar, es geht immer darum sollen wir was dabei lernen, also ist es educational oder nur zum Spaß. Ich denke schon, dass man das irgendwie gut verknüpfen kann, ne, also dass man was dabei lernt und trotzdem irgendwie seinen Spaß haben kann oder? Ja, irgendwie halt in so eine bestimmte Stimmung hineinkommen. Also es kann auch irgendwie mal was n bisschen gruseliges durchaus sein, aber dass man einfach das so richtig erlebt hat. Einfach. Vielfältig, ein vielfältiges glaub ich noch ein gutes Wort wie die sein sollten. Genau, weil ich denke, dass die Menschen, die das machen, die sind ja auch total verschieden, ne, und das und das ist ja genau darum im Spiel, dass sie sich ergänzen, also Stefan und ich, das ist immer sehr spannend, also das geht immer richtig heiß her, weil er ganz anders

denkt als ich und also ja, die Menschen, die das machen, sind einfach vielfältig, deswegen sollten die jetzt auch vielfältig sein so.

I: Würdest du sagen, dass Teamwork in ein Puzzle passt?

Ja, ja, ja, ja, unbedingt unbedingt. Ist ganz wichtig, ja, also so aussehen als meinen persönlichen, wenn wir spielen das Halt als Familie, wenn die Kinder mal da sind oder so, dann machen wir sowas und genau das ist total wichtig, weil kristallisieren sich die Charaktere noch einmal richtig raus und auf jeden Fall gibt es ganz wichtig.

I: Wie langlebig (dauerhaft) und robust (fest) sollte das Puzzle sein (Wie oft soll es benutzt werden)?

Also ich mein Ideal ist es natürlich, wenn es total langlebig ist und ganz robust, weil es oft gespielt werden soll. Ne, also das ist ja idealfall wird sehr häufig gespielt und dann ist es natürlich schlecht, wenn man das ständig irgendwie, also man warten muss, ne, also wenn man ständig gucken muss, dass es das alles läuft, das ständig in Ordnung zu erhalten, das ist schon sehr aufwendig. Dann denke ich also, jeder robuster und langlebiger, desto besser.

I: Was ist die Atmosphäre, die Sie für die Erfahrung schaffen wollen?

Geheimnisvoll würde ich sagen. Also ganz spontan fällt mir da geheimnisvoll ein, so ein bisschen, ja, man weiß nicht, was auf einen zukommt, und es ist sehr spannend und irgendwie auch schön und sonderbar. Ich glaube, geheimnisvoll trifft es am besten.

I: Was ist der "rote Faden" (verbindende Merkmale) der Puzzles innerhalb der Installation?

Also ich denke schon, dass man so ne. Klima. Botschaft. Da als roten Faden durch die ganzen Rätsel ziehen kann. Und ich mein, Ich hab noch diese Geschichte im Kopf, ne, also das irgendwie dieser Wohnwagen irgendwo landet von aus irgendwie aus der Vergangenheit und dass es eben irgendjemand berichtet, wie es in der Zukunft wahrscheinlich sein wird, wenn wir unser Verhalten nicht ändern. Ne, also ob das jetzt diese Doktor Dorothy Hartmann ist oder irgendwas anderes, irgendein anderes Wesen, eine Seele oder was auch immer. Aber irgendjemand weiß schon mehr als wir und gibt uns die Info, damit wir mit der was anfangen können. Genau. Es wäre so. Mein roter Faden dadurch.

I: Okay, es ist die Geschichte, die sie alle verbindet.

Genau, die Geschichte und die Rätsel an sich, also inhaltlich die Rätsel jetzt dadurch, dass irgendwie immer was mit Klima zu tun haben, wobei das nicht immer dieser erhobene Zeigefinger sein muss, ne, also o wenn wir jetzt das und das nicht machen, dann passiert das und das, sondern irgendwie halt auch immer, das kann ja auch zwischendurch auch mal was Witziges sein oder was faszinierendes oder irgendwie was Überraschendes, ne? Wo man dann was, wo man sagt, Ach Mensch, echt, so ist es.Mhm. Ja, das ist schwierig. Das ist genau die Forderung, ne, aber… Mhm. Also ich denke, Spaß machen immer Dinge, die dann auch bei denen man handeln muss, ne wenn du irgendwas tun musst und dann passiert etwas. Also keine Ahnung, man drückt dann auf den Knopf und dann kommt irgendwas raus. Also die Form kann Spaß machen und der Inhalt kann ja etwas sein, wovon man dann was lernt oder erfährt. Ja das ist jetzt mal was Neues, hab ich tatsächlich noch nie gehört oder so wusste ich noch gar nicht.

I: Gibt es etwas, das Sie dem Gesagten noch hinzufügen möchten?

Fällt mir jetzt direkt nichts ein? Nee, aber was möchte ich noch sagen? Also ich hoffe, dass das. Ja, dass das irgendwie... Wir sind jetzt eigentlich schon so vielen Menschen begegnet, die das irgendwie gut finden oder die daran Spaß haben oder die dann Potential sehen, das sie eigentlich glaubt, dass das

irgendwie schon eine Spannende, nicht nur eine spannende Reise wird, sondern auch das Ziel wird spannend und dass wir schon irgendwie ein Ziel erreichen, was jetzt so genau für alles ist oder wie das aussehen wird, das kann man. Vielleicht noch nicht so ganz genau sagen, aber es wird einen geben, ein Ziel und darauf bin ich gespannt. Es gibt auch immer Rückschläge oder das irgendwie, was so unruhig ist oder so, das gibt es ja immer, wie in jedem Projekt auch, aber insgesamt ist die Stimmung positiv, also macht doch immer Spaß, wenn wir diese kreativ Wochenenden haben, schöne Atmosphäre und ja, also ich muss auch sagen, durch euch jetzt aus Twente kommt natürlich noch der Schwung rein und das macht Spaß und ich wäre auch gern dabei gewesen jetzt beim letzten Wochenende ja.

I: Vielen Dank für Ihre Zeit.

Respondent 2:

I: Was ist ihre Funktion in dem Projekt?

Ich bin Klimapädagoge und teile so mein…ja mein Wissen mit der Gruppe.

I: In welcher Designsphase befinden Sie sich mit Ihrem Projekt?

In welche von denen hier? Ja, also das kann man natürlich so machen, aber wir machen das jetzt nicht unbedingt so, also es gibt auch andere Modellformen, wir sehen es eher als etwas, wo andere Schritte zurückkommen, diese Phasen sind nie wirklich komplett fertig. Also, wenn wir diese Grafik malen würden, würden wir mehr Nachdruck auf die Rückfrage haben, also dass einige Schritte wieder besucht werden können, weil ein Schritt nie wirklich fertig ist. Eine Phase ist nie wirklich ganz abgeschlossen, sondern Fragen werden immer wieder besucht. Im groben Projektablauf aber sieht man ungefähr auf dem Miro Board, wo unsere Phasen gerade sind und wo wir uns gerade in dem Prozess befinden.

I: Welche Schwierigkeiten beim Bau der Einrichtung haben Sie bisher überwunden?

Schon überwunden? Noch keine. Wir haben die Schwierigkeiten jetzt erst mal alle identifiziert und dann passiert, dass sie nicht mehr in einer solchen Gravitation da sind. Schwierigkeiten bedeuten ja Spannung, Schwierigkeiten bedeuten Unsicherheit. Da haben wir zumindest mal eine Schwierigkeit, schon mal aus dem Weg zu gehen ist die Zielgruppe, also wir wussten, wir wollen keine Kinder, sondern eher junge Erwachsene. Später können wir vielleicht mehrere Gruppen einschließen, aber jetzt ist der Alter das wichtigste. Na ja, wenigstens haben wir schon mal identifiziert, dass es ein sehr intensiver Prozess bleiben wird, um während des Prozesses nicht die Identität des Projektes zu verlieren. Wie man mehrere Ideen einschließen kann in dem Projekt, also dass jeder seine Idee nennen darf und dass das Projekt noch richtig bleibt. Nicht dass ich jetzt zum Beispiel mit einer Idee komme und die anderen sagen “Ja ist nett, aber machen wir jetzt nicht dabei” und dass ich dann sage “Oh, ok, I go”.

I: Welchen Entwurfsprozess verfolgen Sie? (Für Willie) / Wie haben Sie den Designprozess bisher erlebt?

Rapid Prototyping, wir haben schon sehr stark diesen Designszene dabei, damit jeder schnell mitdenken kann und etwas erstellen kann. Haben wir immer dabei. Aber es gibt auch andere vorgedachte design schritte, also den Modus Operandi, wo wir dann eher nach dem visuellen, oder der Haptik schauen, also selbst evaluieren, wie die Dinger ankommen. Es ist wichtig, in diesen Schritten zu bewahren, was genau der Fokuspunkt ist, also soll es um Struktur gehen, um Technik, soll es funny sein? So.

I: Für welche Benutzererfahrungen entwerfen Sie? (Was soll der Besucher fühlen und wann?)

Es soll die Möglichkeit entstehen, dass das erlebte schon irgendwie in der Anlage integriert wird, also das eigene Erfahrene, die Verständnis, mit in den Escape Room gebracht wird. Man soll seinen Eigene Erfahrungen und Erkenntnisse mit hineinbringen und in dem Spiel benutzten können.um sich selbst in den Puzzels zu erkennen oder um eine Information zu generieren.

I: Wie haben die Endnutzer bisher auf den Prototyp des Busses reagiert?

In erster Linie ist da natürlich die Hülle, also das Artefakt ist natürlich ein Eyecatcher. Es hat Menschen schon inspiriert und löst schon Fragen aus, so ein Oh! Und ein Ah! Und Darf ich mal rein? So, das Äußere wirkt schon sehr verlockend für Zuwanderer. Die erste Reaktion war also absolut

positiv in der Tat. Jeder sagt: "Das ist ein unheimlich toller, inspirierender Spielraum mit einer hohen Authentizität."

I: Wie viel Erfahrung haben Sie persönlich mit Technologie?

Staubsauger, Haarfön und Rasierer. Also wir sind dann eher im Konsumerbereich. Also, ich kann eine Drohne fliegen lassen, aber sie nicht programmieren. Einen Arduino bekomme ich noch programmiert, aber das ist ja nicht schwer, das kann jeder Schüler. Konsumerebene, aber die Technologie kann ich schon ein wenig evaluieren, also ich weiß, wo sie nützlich wäre, und wo eher nicht, und wie sie zu kombinieren wäre. Aber ich hätte jetzt zum Beispiel keine Freude daran, einen Roboter zu programmieren oder so. Wenn bei Alex (Roboter) jetzt ein Licht angehen würde, wäre ich jetzt nicht so begeistert.

I: Wie stellen Sie sich den endgültigen Escape Room vor?

Auf jeden Fall zwei ebenen, eine Grupper wird draussen sein und eine drinnen. Wir werden dann versuchen um auch andere Animationen zu besorgen und zu beleben. Wir wollen auch die Möglichkeit bieten, um von innen nach aussen zu kucken und von aussen nach innen. In dem Modi Operandi haben wir noch nicht ganz festgelegt, was genau passieren wird, also wie die letztendliche Form aussieht. Es soll so sein, dass das Thema, Klimawandel, Klimakrise, spielerisch erlebt werden soll, und es soll die möglichkeit geben, dies nachher noch einmal zu besprechen. Also in groben Linien sollte es so sein in der Tat. Und das Beste wäre natürlich, wenn die das auch in ihrem Alltag mitnehmen. Wenn wir mehrere Gruppen hätten, dann könnten wir auch eine Gruppe drinnen haben während die anderen schon mal reingeht und die könnten einander dann so beobachten, das wäre auch nice.

I: Welche räumlichen Anforderungen haben Sie für jedes einzelne Escape-Room-Rätsel?

Diese Anforderungen ergeben sich ja aus dem Design des Innenraums, also wir haben noch viele originale Teile von der Ursprünglichen Einrichtung woran man bauen könnte, zum Beispiel der Ofen, der Kühlschrank, das Bett, die Dusche, also damit schmiegt sich das Bett schon an der Umgebung an und so wird dann schlussendlich das Labor geformt.

I: Was sind die visuellen oder gestalterischen Anforderungen für jedes Rätsel? (Wie muss es (nicht) aussehen)

Das wird sehr vielfältig sein, weil zum Beispiel von Licht nach Dunkel oder von verschiedenen Farben wie von Grün nach Rot soll sich da irgendwie ein Verband äußern, also dass man deutlich erkennen kann, diese Sachen haben etwas miteinander zu tun. Und es soll die Atmosphäre leicht stimulieren beim Eintritt.

I: Wie hoch sollte Ihrer Meinung nach die Produktionskomplexität eines jeden Rätsels sein?

Also, es gibt natürlich die Gefahr, dass wenn ein Puzzle zu kompliziert ist, dass eine Gruppe dann stuck wird und erstarrt, also, frozen irgendwie, und dass die danach dann abreisen. Bei so einem Spiel braucht man immer Interaktion, also andauernd muss irgendwie eine Belohnung rauskommen, sonst erstarren die Spieler. Das kann man lösen indem man den Gamemaster aktiv macht und die Hinweise gibt, oder man gibt ihnen einen Joker, also dass sie einmal fragen dürfen, wie sie genau ein Puzzle lösen sollen. Wenn Spieler lange an einem Puzzle hängen und ständig dieselbe Iteration wiederholen, dann ist das ein gutes Zeichen, dass sie feststecken. Aber selbst dann kann es sein, dass sie es auf einmal Zufälligerweise aah! Machen und es verstehen. Aber gut, es ist trotzdem wichtig, um pünktlich einzuschreiten, sonst, they knock on the door and say we come out.

I: Was sind weitere Anforderungen, die Sie nennen könnten?

Es soll eine eigene Identität haben, aber gleichzeitig soll nicht vergessen werden, dass es Teil etwas größerem ist, also die Frage ist dann natürlich, inwieweit ein Puzzle alleinstehend sein kann und wie weit es passen soll, weil die Informationen eines Puzzles werden ja zu dem nächsten überträgt. In gewissen Maßen soll ein Puzzle also auch seine Nachbarn nachträglichen. Frage ist auch was der Platz sein wird in der Story, also muss es gelöst werden oder ist er nur zur Stimulation? So was könnte auch.

I: Wie langlebig (dauerhaft) und robust (fest) sollte das Puzzle sein (Wie oft soll es benutzt werden)?

Es soll in der Tat eine Hands-on Experience sein, also es wird mehrere Male angefasst werden und sollte das überstehen können. Es soll auch reproduzierbar sein, also nicht so komplex, dass die Einzelteile nicht reversierbar sind. Die Spezifikation ist ja auch so, dass sobald man Technik einbringt, ist es eine Fehlerquelle, also wenn der Strom jetzt weg ist, ob das rätsel dann noch funktioniert, oder wenn das Programm fehlschlägt, wäre es gut wenn es einen Weg gäbe, dies zu Überbrücken, also das nicht das ganze Spiel unspielbar wird.

I: Inwieweit sollte das Puzzle reparierbar sein?

In der Materialität, es soll so wenig wie möglich unersetzliche Teile geben, also nichts, womit ein Zerbruch das Puzzle komplett unverwendbar wird.

I: Was ist die Atmosphäre, die Sie für die Erfahrung schaffen wollen?

Es gibt zwei Themen die sich vermischen in der Installation, einerseits The end of Time, andererseits The bringer of Hope, The bringer of Love, also so dass die Stimmung ein wenig ernst ist, aber gleichzeitig hoffnungsvoll, weil die Spieler die Welt ja mit ihrer eigenen Verbinden, soll es nicht so sein, dass eine unausweichbare Dystopie dargestellt wird, sondern dass die Welt besser gemacht werden kann.

I: Was ist der "rote Faden" (verbindende Merkmale) der Puzzles innerhalb der Installation?

Vernetzungen machen immer Sinn, aber es sollte nicht zwingend sein. Wir haben als grundsätzliche Ausrichtung Solarpunk, was eher eine Art Revolution sein soll. Mensch ist Natur, und das soll sich irgendwie in den Puzzles auch widerspiegeln, diese unterliegende Botschaft. Aber ich weiß nicht, ob sowas in der Makrostruktur passen würde.

I: Gibt es etwas, das Sie dem Gesagten noch hinzufügen möchten?

Jeder Protagonist, der sich mit der Sache beschäftigt, wird Teil von dieser Gruppe, egal, wie lange oder wie viel er oder sie sich damit bemüht. Und jeder legt dann ein Teil be in dieser Anlage, was es ein sehr besonderes Projekt für mich. Und dass ich so viele tolle Leute begegnet bin und mit zusammenarbeite, finde ich auch umhauend.

I: Vielen Dank für Ihre Zeit.

Respondent 3:

I: Was ist ihre Funktion in dem Projekt?

Eine gute Frage also: Ich bin heute einer der Mitwirkenden, aber jetzt ohne spezielle Aufgabe also nicht wie der Willi oder so oder Stefan, der also der Willi als Leiter, Stephan, der quasi der Finanzier, wenn man so will ist. Und bin halt. Also ich bin noch relativ neu, auch in dem in diesem Bereich Abwaschbar Escape Romski. Gespielt, aber noch keinen, der beim entwickelt. Also das heißt, ich bin da einfach so als einer der Mitwirkenden nicht mal so.

I: In welcher Designsphase befinden Sie sich mit Ihrem Projekt?

Oh, das ist eine gute Frage. Also es sind ja jetzt schon die ersten Workshops gewesen. Ich war bei dem bei erst bei einem auch wichtig dabei, ansonsten halt nur online. Wir haben jetzt eben halt zum Beispiel verschiedene Spiele, uns einfach mal so ausgedacht und sind immer noch dabei. Auch, um die Story zu entwickeln. Aber inwieweit die jetzt schon in trockenen Tüchern ist oder ob das noch relativ neu ist, kann ich jetzt selber gar nicht sagen, da bin ich auch gespannt auf den November, wenn wir dann den zweiten Workshop haben, wo ich dabei bin. Wenn wir dann noch so einen Input in Richtung auf die Klima-Wochen noch kriegen und ich denke jetzt, dass du von meinem Gefühl her, das ist eben auch so ist, dass wir schon noch, also auch mit dem.
Wo wir in Nürnberg einmal tatsächlich das Ding auch mal vorgestellt haben: Wie reagieren die Leute auf so einzelne Elemente, die ja schon da waren? Dass man ein bisschen noch so drüber nachdenkt, wie kann man eigentlich diese ganzen Thematiken, die dahinter stehen, dann auch darüber bringen, dass das Spiel wird und die Leute Lust haben, das zu spielen. Und ich glaube, das ist, das ist schon sehr wichtig, das der andere Punkt, wo ich sage, dass wir da noch relativ am Anfang stehen, das ist das, was mich sehr stark interessieren würde, ob man das noch schaffen kann, das Ganze in einem größeren Rahmen zu setzen, also zum Beispiel eben mit dem Computer teil, also der ist nicht unbedingt mit dem Escape Room zu tun haben muss. Aber irgendwie doch. Also die beiden sozusagen eine gemeinsame Einheit bilden könnten. Sowohl die Reichweite zu erweitern als auch die Langfristigkeit, das Problem ja bei Escape Rooms auch mit Workshop und so weiter dann ist, dass man hinterher ja du hast eine Stunde was gemacht und dann wirst du wieder allein gelassen. Und andererseits können tatsächlich aufgrund der Größe des Raumes, also maximal 4 Leute spielen. Das heißt, am Tag hast du vielleicht 16 Leute dann. Wie du in diesem Raum bespielen kannst. Deswegen gibt es ja noch die Überlegungen eben im Außenraum, was dazu zu bauen, also auch Spiele zu machen, die dann innen dann verwertet werden müssen, damit dann auch ganze Schulklassen vorbei gehen können.
Und das weiß ich momentan jetzt gar nicht genau, wie weit da der Stand ist. Und ich denke, ich bin da noch sehr stark darüber am nachdenken, was man da alles machen könnte. Also was aber eben ein bisschen mit dem verhindert, dass ich noch weniger Erfahrung mit Escape Räumen habe. Und deswegen natürlich auch nicht sagen, Hey ja, da habe ich bei dieser, ich bin immer so, das geht also bisschen. Die Input kriegen. Wie geht es überhaupt? Das kann man machen und dann wieder Ideen reingeben, ja wie so ein iterativer Prozess eigentlich.

I: Welche Schwierigkeiten beim Bau der Einrichtung haben Sie bisher überwunden?

Also die anderen mit Sicherheit. Die haben ja schon praktisch das ganze Ding... Äh, nenne ich mal bespielbaren Zustand gebracht. Was ja nicht von Anfang an so war. Also. Gut so, meine Empfindung zumindestens war es ja da muffig drin und das ganze Ding immer ziemlich gerochen haben. Ich hab es ja schon in dem Zustand erst kennengelernt als es schon besser quasi war. Aber da nehm ich schon einige Schwierigkeiten weg, dann ist das ja schon TÜV-fähig. Also das heißt, wir haben ja schon Trailern können. Zweimal. Jetzt hat er es auch schon. War bei euch auch schon das Ding jetzt? Und. Ja, das denke ich mal schon. Was jetzt noch nicht so ganz mir klar ist, also von wegen Schwierigkeiten, es gibt ja halt den Zustand so wie er jetzt ist, wo die ja zum Beispiel mit diesen Moosen und so weiter ja schon ganz tolle Sachen auch gebaut haben. Aber inwieweit das dann

tatsächlich schon der Endzustand ist und ob das jetzt Schwierigkeiten waren oder nicht, wie weit sie jetzt nicht sagen, sagen wir mal von den von den Spielen her, ist glaube ich nicht so wahnsinnig viel, wirklich in einem fertigen Zustand. Also wir sagen kann.
Da sind tatsächlich Schwierigkeiten aufgetreten, weil bei den Prototypen geht es ja meistens relativ einfach sagen OK, so wird es ausschauen, macht der Papp Deckel schwarz drauf oder… Da haben wir noch keine Schwierigkeiten in der tatsächlichen Produktion. Und das, was natürlich eben dann noch kommen wird, was wir ja tatsächlich in Nürnberger nur ganz ansatzweise machen konnten, weil nichts ja noch nicht da war, ist tatsächlich auch dann, die langfristige Bespielbarkeit. Können wir dann also zum Beispiel wir diese Tastatur von einem Hackerspace, wo jetzt auch schon durchsichtige Tasten da sind und man dann eben halt damit mit Licht Symbolen irgendwie arbeiten kann. Wo ich nicht weiß ob das wirklich gespielt wird, aber das ist zumindest angedacht und dann muss man sich natürlich überlegen was passiert, wenn das halt wirklich von 16 Leuten dann täglich bespielt wird. Wie lange hält das durch, wie viele Backing-Systeme man braucht, ist überhaupt eine gute Idee, das wird sicher noch an an einen gewissen Teil dann ausmachen. Von November bis. Ja, dann, wo es eben ja tatsächlich laufen soll, schätz ich mal.

I: Wie haben Sie den Designprozess bisher erlebt?

Ja. Also das ist ganz interessant. Also vor allem bist du jetzt, sagt der der Erste, der das so direkt danach gefragt. Ich kommen ja von einem Studiengang, die so Semesterprojekte gemacht haben. Und da war es dann eigentlich immer so mit so einem, mit dem Ablaufschema. So oder so war das zumindest in den Projekten, von denen immerhin 3 von meinen 4 Projekten auch dann den internen Award gewonnen haben, also von den Nachbarn regen, dann von IHK ausgezeichnet wurden, dass wir uns relativ viel Zeit für die Ideenfindung begeben haben und dann erst begonnen haben, was zu produzieren. Und das ist jetzt hier halt komplett anders herum und ich habe ein bisschen Schwierigkeiten damit, weil ich manchmal denke, OK, jetzt habt ihr schon was produziert, wo man vielleicht besser hätte produzieren können, wenn man noch ein bisschen mehr Zeit gelassen hätte, darüber nachzudenken. Andererseits sagen die ja, OK, wir machen das halt so, also die Leute, die da Erfahrungen haben mit solchen Escape Rooms, die machen das ja nicht wirklich Gaudi, also für mich jetzt gerade eine interessante Erfahrung. Weil ich mir manchmal denke: OK, so wie jetzt das ausschaut, das ist ja ganz nett, aber ist das eigentlich überhaupt nicht produktiv. Wenn man noch mehr darüber diskutiert, hätte da nicht noch was Besseres kommen können? Das, wo ich ein bisschen…
Wir denken ja, OK, schauen wir mal, was rauskommt und er tut und so auch diese Abstimmungsprozesse laufen halt dann manchmal, so also ich sag demokratisch, muss ja nicht sein, aber es muss ein bisschen transparent sein, warum bestimmte Entscheidungen getroffen werden. Das heißt dann eben OK, das haben wir jetzt beschlossen, dann weiß die Teilweise gar nicht, wer das beschlossen hat und warum jetzt das ist und ob man da noch was heißt. Man kann es immer noch jederzeit ändern, aber so einfach ist es dann auch nicht, also. Gut, das ist jetzt ein bisschen das, was negativ ist, was ich aber sehr positiv finden sollte, wenn man sich diese, diese Gemeinschaft, die da war bei dem ersten Workshop und da ich ja dann von den online Dingern kenne, wende ich an sich schon was Positives und, ja, das ist auf jeden Fall zielführend.
Wo man eben also gemeinsamen Strang zieht, dass man sagt: Ja, liegt halt diese Thematik am Herzen. Aber wie gesagt, die Ausführung auf deutlich, da würde ich mir ein bisschen mehr Präsenz wünschen.

I: Für welche Benutzererfahrungen entwerfen Sie? (Was soll der Besucher fühlen und wann?)

Äh, also das ist für mich jetzt eben natürlich auch nicht so ganz klar . Sie hätten, weil ich jetzt so wenig Erfahrung mit Escape Rooms noch habe, also die Paar, die ich gespielt habe. Wir haben dann in in Nürnberg hatte ich dann die Gelegenheit, einen zu spielen und dann selber nochmal anzuleiten, was also auch nochmal ganz anders ist. Ähm. Da ist mir da noch nicht so ganz klar, wie stark sich diese Zielgruppen unterscheiden. Aber die Spiele, die wir jetzt hatten, das war das nicht, wie ihn bei euch auch mit dabei hatten. Es war Kiste mit dem Escape Room zum Thema Humboldt, wo ich sage OK, der wurde ja von Schülern entwickelt und lässt sich sowohl für Erwachsene als auch für wahrscheinlich nicht ganz jungen Schülern, aber auf jeden Fall für Schüler auch spielen, wo ich sag,

das da ist mir noch nicht ganz klar, ob wir da tatsächlich für die Gruppen unterschiedliches machen müssen und was mir noch nicht so ganz klar ist, ich hatte ja diesen Zielrichter mir ausgedacht. Oder so ein Trichter, eigentlich nur wo, wo das, was dann bedeutet, erst im Workshop dann kommen würde. Und den haben die ja dann eingestuft als nicht relevant für die Thematik, obwohl ich eben es sage, Ihnen das eigentlich ganz wichtiger Aspekt sein könnte oder müsste, wo ich aber sage, ich weiß es nicht, ob man überhaupt diese Spiele mit so einem mit so einem pädagogischen Hintergrund Aufladen kann?
Und wie man da vorgeht. Also meine Idee war praktisch, dass man was macht und denkt, OK, aha, da gibt es verschiedene Standorte und wenn ich den Richtigen erwische, dann passiert was und würde dann in den Workshop eben halt den Transfer mit reinnehmen, ohne dass du es am Anfang weißt. Ich habe aber keine Ahnung, weil ich auch Pädagoge bin, ob das jetzt richtiges Konzept ist oder nicht, aber das war halt, das war die Überlegung dabei. Und das ist halt eben genau die schwierig. Ich, OK, ich hab mir das ja extra dafür ausgedacht, habe ich gesagt hab. Ja, das könnte jetzt sowas sein, aber ich weiß es halt nicht. Und dann kam dann irgendwie, man muss ja Ideen sterben lassen wo ich dann sag: Hab ich kein Problem damit, ich habe wirklich sehr viele Ideen, nur hätte ich dann gerne gewusst, warum die stirbt und die Begründung. Weil sie gesagt haben, dass es quasi jetzt Nachrangiges wäre, fand ich halt dann irgendwie nicht nachvollziehbar. Zum Beispiel und aber, aber das ist so das, wo ich sag, bin selber einfach am umschauen, lass mich aber gerne auch belehren, wenn die sagen ja. Für die Zielgruppe, die wir haben, wissen wir ja eigentlich, glaube ich nicht ganz genau, aber ich schätze mal, ich, ich denke halt immer so, 15-16 jährige, also noch bisschen Spielelement quasi wichtig sind. Aber die haben auch keinen Bock, jetzt irgendwie wirklich wissenschaftlich zu arbeiten, die aber trotzdem schon Verständnis haben. Das ist jetzt mal das, wo ich im Hinterkopf behalte. Ob das überhaupt die richtige Methode ist, ob das überhaupt passt und was für denen entwickelt werden muss. Wie gesagt, da muss ich mich halt auch an die Expertise der Pädagogen dann halten.

I: Wie haben die Endnutzer bisher auf den Prototyp des Busses reagiert?

Also das war für mich sehr spannend, weil da waren auch so Typen. Also wir waren ja am Bahnhofsvorplatz in Nürnberg. Und das Publikum, das da vorbeiläuft, ist jetzt. Möglicherweise nicht vollständig die Zielgruppe also. Das heißt, ich nehme mal an, dass wir. Mit Schulen dann vor allem, da mal Realschule aufhört bedienen. Also in Deutschland hat die Mittel, also die mittlere Ausbildungsebene bis Gymnasium. Und nicht unbedingt jetzt die ganz andere, wobei das sicher auch funktioniert. Und wir hatten ja dann solche Sachen, wie die Leute irgendwie mitkriegen, was wir da machen und dann sagen ja, die AFD aber hat ja schon bewiesen, dass er alles sparen ist, weil das eine, und dann war aber das das andere. Ähm, dass da Leute waren, wo ich mir gedacht habe, OK. Er hat ein bisschen sowieso, sag ich mal, ausgeschaut, so wie Leute, die halt am Bahnhof rumhängen. Also nicht wirklich super gepflegt haben wir das mal so und ich hab den aber trotzdem halt dann mit reingeführt. Ich bleibe aber auf jeden Fall dabei und lerne jetzt quasi nicht alleine. Und der ist ja total ausgeflippt. Und das “Wow, der Tropfen Jugend da und also ich finde einfach toll!” und ich hab dann gemerkt, dass der da so Enthusiast an dem an dem Gerät selber, aber den hat er natürlich die sonstige Ausstattung nicht interessiert, sondern eigentlich quasi der der Urzustand des Gerätes.
Und dann gab es halt viele daneben, vor allem um jüngere, mittelalter Frauen, die das dann total spannend banden wie diese, also vor allem hinten mit dem mit dem Pflanzen Gerüche da sind, einfach so. Sowas in der Haupttisch ist ja nicht olfaktorisch, also halt einfach erlebnismäßig es mit drin war. Unbedingter Killer, das gefällt Ihnen ganz gut und für mich selber ist es halt so, dass ich sag OK, ich bin jetzt vollständig klaustrophobisch veranlagt oder etwas größer macht nicht wirklich so wahnsinnig Spaß da stehend in dem Teil rumzulaufen. OK, gut, also irgendwo hocken könnte irgendwas tun, wäre es mir deutlich lieber und da sag ich so OK ja, hängt dann davon ab, welche Aufgabe man hat.. Aber die Leute, die da waren, waren schon begeistert nur von der Innenaufstellung.

I: Wie viel Erfahrung haben Sie persönlich mit Technologie?

Na gut, was heißt Technologie? Also ich bin Jahrgang 66 und ich habe mir eigentlich als Kind schon wieder Mikroprozessoren und ähnlichem Zeug interessiert und das war damals noch gar nicht so einfach, Informationen zu kriegen und wollte eigentlich Umweltschutz studieren, in ein technisches Studium, also ich bin dann eben keine Umwelt Ingenieur geworden, weil ich mit der Chemie nicht so kann, sondern Physikingenieur geworden. Ich habe meine. Diplomarbeit damals auf Matari programmiert, der hat jetzt ein Professor, der für Atari Musikprogramm entwickelt hat und da hat man einmal Diplomarbeiten halt, dort teils Sachen dazu gemacht. Dann war ich in der in der Bau Physik tätig und 20 Jahre in einer Technologie Firma als Qualitätsmanager also. Und dabei dann auch teilweise, weil man immer wieder bei den Auditor aufgefallen ist, dass in unserer Datenbank Scheiße ist. Und die hatten zwar super Datenbank Leute, aber die waren immer in die Projekte und hat natürlich keiner gemacht. Und das habe ich dann auch angefangen, wirklich einer Datenbank, unsere HP System Optimierungen mit zu machen, also das 20 Jahre und jetzt im Studium hatten wir ja auch wieder, also bin ich natürlich immer indische Unterschiede rein, aber ich selber sagen wir das was so manche Politiker jetzt sagen wie die Technologie wird uns retten, war vielleicht der Vorstellung von mir ein paar 30 Jahren als ich fertig wurde mit dem Studium über 20 Jahren ich aber sage nein wir brauchen andere Lösungen, die Technologie alleine wird uns nicht retten. Sondern wenn, dann, wenn wir es zufällig was finden, was unterstützen kann, kann die Technologie schon ein Teil sein, die uns hilft. Aber eigentlich muss ich das Bewusstsein Wandel geben, dahingehend, dass ich einfach ein anderer Umgang mit den Ressourcen, also die, die Maja Göpel so also hier in mitbegründerin von Stein Future in Deutschland, die hat immer schönes Bild gebracht. Wir haben ein Wirtschaftssystem, das wir Förderband ist. Wo halt vorne die U Bahn drauf kommen, dann wird es umgebaut und am Ende vom Ganzen wird ganz oben am obersten Punkt einfach auf den Müllberg gekippt. Und diese Vorstellung ist ja technologisch, wenn man so will. Ich komme aus der Stadt, wo es viel zu Förderbänder ist, welchen zum Kiesgruben häufig waren.Das ist teilweise recht lang, aber irgendwann gibt es halt oben auf die Halde und was wir tun müssen ist praktisch halt diesen Kreislauf zu schließen. Deswegen ist es kann nicht rein mit Technologie machen, aber R Technologie Erfahrung bei mir viel da auch mit wie immer Technologie anderen Leuten rüber bringt weil ich dann teilweise auch in der Firma machte. OK war sowieso technologielastig, aber trotzdem halt bestimmte Sachen auch mit den Personal Dame oder so wo man halt gesagt OK weiß nicht wie E System passiert oder wie das funktioniert. Aber im wesentlichen halt eigentlich theoretisch, sagen wir mal.

***
I: Wie stellen Sie sich den endgültigen Escape Room vor?

Ja. Also von dem äußerlichen her finde ich eigentlich recht gut, wenn der gar nicht so sonderlich anders ist, als eben so ein Wohnwagen ausschaut, eventuell über den sogar versucht mal wieder hochgeladen, polieren also ein bisschen so, statt blinken, dass ein neuer ausschaut, wobei ich aber gar nicht unbedingt sein müsste. Weil man ja diese Story hat, dass der ja irgendwie aus der Zukunft kommt, da kann er natürlich schon ein bisschen in Mitleidenschaft gezogen sein.
Und im Inneren hat der Besucher diese Vorstellung, können wir dann auf diesen Solarpunk dann letztlich gekommen oder Steampunk Überlegungen, dass man feststellt, dass das Gerät mehr ist als nur ein Wohnwagen, sondern dass das ganze Ding eben auch quasi eine KI oder was auch immer ist, also vielleicht sogar eben mit den mit den Möglichkeiten der vorgestellter Biotechnologie. Ich hatte dann einmal bei der Recherche, was ich spannend fand, wo die dann sagen, dass man in die DNA auch Daten speichern kann. Also, da gibt es Überlegungen.
Wo die dann sogar sagen, das geht dann über so wie beim Honig oder sogar über 1000 Jahre eigentlich das Zeug einlagern, ohne dass es kaputt geht. Also 5000 Jahre haben Sie gesagt. Wo man einfach sagt, dass da Technologie drin ist aus der Zukunft. Die uns jetzt erst einmal heraus tun, wieder pflanzen und irgendwann im Laufe des Dings kommt das ganze Ding ist eine Einheit, eine ein etwas, was lebt, was Technologie verschmolzen, sowie Cyborg aber nicht so gruselig. Also ich finde Cyborg, wenn du irgendwas sagst, also eingebaute Kamera, das finde ich eher gruselig, aber wenn jetzt die Pflanze, die quasi irgendwie mit dem Ding korrespondiert oder dem Energie helfen kann. Ähm, dann fände ich das eigentlich recht spannend und das würde dann vom Ausschauen jetzt gar nicht so viel von dem unterscheiden, was wir haben.

Und die andere Aspekt ist, dass man eben durchaus auch als Teil des Spiels mit einbauen kann, dass man merkt, dass das Ding nicht mehr vollständig ist, dass irgendwas kaputt gegangen ist bei dem Transfer durch die Zeit. Praktisch Used Look und auch eben diese, das ist an irgendeiner Stelle gibt und dass auch in der Spielen wieder einbauen kann, irgendwas zu reparieren, irgendwie 3 klemmen umklemmen oder weiß der Geier oder irgendeinen Teil austauschen muss es wieder in Gang zu bringen. Also so in der Art. Natürlich schon immer so, dass diese Überlegungen soll bespielbar sein und es soll auch eben langfristig bespielbar sein. Das es gewisse Robustheit hat, sollte es natürlich auch, wenn man nicht die Leute erstmal 3 Stunden einweisen und dann überhaupt sich in dem Ding bewegen können. Also da muss schon eine gewisse Robustheit auch vorhanden sein.

I: Welche räumlichen Anforderungen haben Sie für jedes einzelne Escape-Room-Rätsel?

Also interessant fände ich jetzt, wenn es auch, Spiele geben, die relativ begrenzten Raum einnehmen. Und es kann auch Spiele geben, die sich über das ganze Ding verteilen. Aber ich sag OK finde ich jetzt ein Teil, das... Da weiß ich aber nicht, wie das dann halt von der Spielbarkeit her ist. Also das sind dann so Punkte, die sich mir entziehen, ob das möglich ist. Aber finde ich an sich sehr spannend und das andere war immer so, dass wir gesagt haben, wir sollten nicht von einer Person alleine gelöst werden können, also noch immer auch Spiele dabei die andere Leute. Benötigen. Was mir jetzt so einfällt, das habe ich mal für einen Kindergeburtstag gemacht. Da wusste ich dann, dass meine Tochter nicht die Schnellste ist und dann eben, wenn jetzt an ihrem Geburtstag jemand anderer das Objekt der Begierde zuerst kriegt, das ist sehr viel Unruhe so schaffen würde, dann habe ich praktisch die 2 Gruppen eingeteilt. Und die machen dann zum Pille Spiel und müssen sie dann lotsen. Also da wird sichergestellt, dass die beiden Spieler also oder halt die beiden Spielgruppen net an dem Zielort sein können, weil die Person lotsen kommt dahinter, nur wenn beide Richtungen sozusagen übereinstimmen. Richtige Koordinaten und sowas könnte ich mir da in gewisser Weise auch vorstellen, dass man eben sagt OK. Wenn es jemanden gibt, der sehr schnell die Sachen durchschaut und sagt, das müssen wir jetzt tun, dass er dann immer in Interaktion treten muss und sagen, OK, kannst du mal da drüben das ID eine Taste drücken und du auf der anderen Seite und ich kann hier dann irgendwas machen. Sowas wäre dann auch schon cooles Ding. Ich will den ganzen Raum auch irgendwie ausnutzen, aber das muss nicht bei jedem Spiel sein, aber bei den einen oder anderen Spielen wäre das schon gut.

I: Was sind die visuellen oder gestalterischen Anforderungen für jedes Rätsel? (Wie muss es (nicht) aussehen)

Oh, das ist mal... Denn jetzt im Einzelnen angeschaut, bin ich da nicht so wirklich visueller Mensch. Wenn ich aber gefragt, werde, was sehe ich, wenn ich was sehe? Ich sag immer meistens nichts, ist nicht vollständig richtig. Ich hab dann schon so bitte auch Vorstellungen wie das ausschaut, aber es ist für mich nicht das Wichtigste, diese Punkte, sondern mehr so dieses Look and Feel ist, wo ich sage. Man soll sich eigentlich ganz gerne darin aufhalten, soll aber also gleichzeitig ja dieses Spielelement, dass man hat nur eine Stunde, das kann sich schon auch irgendwie bemerkbar machen.

I: Wie hoch sollte Ihrer Meinung nach die Produktionskomplexität eines jeden Rätsels sein? (Wie viel Technik können Sie bewältigen)

Oh gute Frage. Also, es hängt halt davon ab, wenn ich jetzt zum Beispiel an diese Tastaturen denke, die ich ja zum Beispiel selber auch zusammengelötet hab, in der Hacker Space als Workshop. Theoretisch könnte man sowas dann natürlich auch in den Außen Workshops mitnehmen. Also, dass man sagt, OK, da gibt es jemanden. Keine Ahnung wie das dann umsetzbar wäre, aber also die Hackers Base hat das ja die dann so kleine Lötkolben haben und dann baust du da irgendwas. Finde ich natürlich auch spannend, wenn das quasi live passieren würde. Äh, es müsste halt immer was sein, was jetzt nicht so kompliziert ist, dass es, wenn es kaputt ist und nicht mehr reparierbar ist. Also oder eben halt zumindestens dann halt mehrere gleichartige Teile davon existieren. Ist jetzt so von von dem her. Ansonsten hängt es halt einfach wirklich davon ab, ob die ,die es schaffen können, also wieviel

Geld man hat. Also wenn jetzt irgendwas cool ausschaut und wer sagt: “Hey, das ist aber absolut geil.” Und das muss genauso sein, darf es sicher mehr kosten. Gleichzeitig ist aber eben ja der GAG an den ganzen von meiner Vorstellung dieses Solar oder Steampunkmäßige, dass das ja auch durchaus gebrauchte Teile sein können, dass man sagt, es schaut so aus, als hätte die auf den Schrottplätzen der Zeit sich die Sachen zusammengebaut, um ihr System aufzubauen, diese Dorothy. Daher bevorzuge ich Recyclingmaterialien auf jeden Fall, aber das heißt ja noch lange nicht, dass man da nicht viel Arbeit reinstecken muss. Also ich würde jetzt mal sagen, vom Material her sollte jetzt nicht so hochwertig sein, aber es hängt immer davon ab, was das jeweilige Endprodukt ist. Von der Arbeitszeit kann ein bisschen aufwendiger sein, weil man ja das ja auch macht, also das ist ja auch ein Teil, dass man miteinander was baut.

I: Was sind weitere Anforderungen, die Sie nennen könnten?

Na ja, also das waren ja eben schon ein paar Sachen, die ich genannt habe. Also das ist ein eine in Bezug auf die Fähigkeiten, in dem Workshop haben können würden, sollten idealerweise da sein. Da war jemand, der genau hingeschaut hat, da war jemand, der was weiß ich mit den anderen zusammen, der kreativ ist, solche Sachen schon ein bisschen mit abdeckt. Dann möglicherweise tatsächlich auch diese Fähigkeit, zu sagen “Aha”, und das ist ja so ehrlich, wie eben zum Beispiel bei den Punkten oder irgendwas.
Aber was erklärt, was dann tatsächlich mit dem Klimawandel zu tun hat? Und das andere sage ich immer, es sollte irgendwann gewiss ethischen Anspruch haben, also die zwar selber gemacht, aber schon dem Merkmal einer Person ähneln. Und eben halt deswegen Pflanzen mit drin und ein bisschen floristische Elemente, keine Ahnung.

I: Gibt es etwas, das Sie dem Gesagten noch hinzufügen möchten?

Joa, also ich denke jetzt ist so ziemlich alles gesagt worden. Für mich ist es eben noch interessant, wie man es schaffen kann, das noch einen größeren Kontext einbetten, also man sagt so ein. Computerspiele haben etwas mit unserem Ding zu tun, aber nicht, wie gesagt, man muss nicht den den Raum gespielt haben im Computerspiel zu sein und umgekehrt halt so, dass man sagt, ja, das sind weitere Bausteine oder so quasi vertiefende Elemente, das finde ich spannend oder eben auch diese community Gedanke.

I: Vielen Dank für Ihre Zeit.

Respondent 4:

I: Was ist ihre Funktion in dem Projekt?

Meine Funktion ist das ich der Projektleiter bin von dem Airstream Projekt, und ich bin auch der einzige, der es finanziert.

I: In welcher Designsphase befinden Sie sich mit Ihrem Projekt?

Ungefähr zwischen den ersten drei. Emphasise haben wir fertig. Leider haben wir es nicht genau wissenschaftlich begangen, also wurden sie nicht seriell abgearbeitet, aber eher willkürlich. Die ersten drei wurden schon mal angefangen, aber keine ist jetzt wirklich ganz fertig.

I: Welche Schwierigkeiten beim Bau der Einrichtung haben Sie bisher überwunden?

Als erstes musste der Wagen transportbereit gemacht werden, also das die Einrichtung belebbar war und das der Wagen fahren konnte, sagen wir mal die basics der basics. Weiter haben wir auch die Designgrundlagen können belegen, also Solarpunk halt, das ist uns auch gelungen. Weiter haben wir auch Stromversorgung eingerichtet, dass alle Lebensnotwendigkeiten versorgt werden, so wie duschen und so, das haben wir alles hingekriegt ja.

I: Welchen Entwurfsprozess verfolgen Sie?

Wir haben einen Gamemaster, der von mir selbst bezahlt wird, der sich mit dem Design beschäftigt, Vor ihm war auch noch ein anderer aus einem Verein, der sich auch damit auseinandergesetzt hat. Die sind transparent damit, weil ich das auch selber spannend finde, aber ich glaube die verfolgen eher keine Prozedur so wie sie jetzt ein Akademiker geschrieben und bewiesen hat, ich glaube die bauen eher auf ihre Erfahrungen von was funktioniert und was funktioniert nicht. Abe auch sie haben etwas genannt in der Richtung von Evaluierung, dass man sich immer eine zweite Meinung holen soll, kann ja zum Beispiel sein, dass man glaubt, eine Idee ist sehr gut und dann gesagt bekommt, war langweilig, und dass dann in der Tat auch Ideen gekillt werden müssen, haben wir schon oft miterlebt. Wir haben schon rapid Prototyping Sessions unternommen, also sind alle mal zusammengekommen und haben mit Pappe par Ideen generiert, da haben wir gemerkt, dass wegen denen verschieden Hintergründen nicht jeder so schnell eine Idee bedenken kann. Das Gamedesign doch schwerer ist als man denkt, haben wir auch festgestellt ja.

I: Für welche Benutzererfahrungen entwerfen Sie? (Was soll der Besucher fühlen und wann?)

Es gibt drei Gruppen von Kunden: Ein Staat, wo dann für eine gewisse Zeit der Bus auf einem Plaza steht und von dem Publikum besucht werden kann, individuelle Gruppen, die den Escape Room für eine Stunde buchen können und als letztes Unternehmen, die sich transformieren wollen und mit dem Airstream spielerisch erfahren wollen, wie man klimabewusst handeln kann. Und weiter auch noch edukative Einrichtungen sowie Schulen und so, aber keine Kinder, das ergibt Problemen mit denen Eltern und shocking Material, also die User sind immer Erwachsene über 16. Also die Kunden sind Business und die User sind dann die Erwachsenen.

I: Wie haben die Endnutzer bisher auf den Prototyp des Busses reagiert?

Der Aistream zieht Menschen an wie Licht Insekten, es hat eine sehr spezielle, ungewohnte Form, sieht aus wie aus der Zeit gefallen.Es ist ja ein sehr besonderes Model was heutzutage nicht mehr hergestellt wird, mit einer ikonischen Form die an Flugzeugbau erinnert Das ist der erste Eindruck. Der zweite Eindruck ist enttäuschung so von “Ach so, der ist noch gar nicht fertig, ich kann ihn noch nicht spielen.” Aber wir haben noch gar keine Ablehnung bekommen, immer wenn Menschen den

Airstream besuchen, sind sie positiv, bieten auch gerne mal an, mitzuhelfen, sagen dass ihnen die Form sehr gefällt. Es hat ja auch etwas mysteriösisches, irgendetwas mit Fliegerei.

I: Wie viel Erfahrung haben Sie persönlich mit Technologie?

Also ich bin keine Technical Person, ich bin eine Person Person. Was ich gut kann, ist hoch performante Teams zusammenstellen. Ich bin weiter auch gut darin, user journeys zu evaluieren, weil ich mich gut in die Schuhe des Nutzers setzen kann. Also ich besitze eine bestimmte Beurteilungskompetenz, kann's aber nicht selbst bauen, wenn das die Frage ist.

***

I: Wie stellen Sie sich den endgültigen Escape Room vor?

Es soll ein tolles Spielerlebnis sein, wo eine Gruppe in 60 Minuten ein Rätsel lösen soll. Thema ist halt Klimawandel, eine Klimakrise in der wir alle stärker ins handeln kommen sollen. Dieser Raum, den gibt es, um die Wahrscheinlichkeit, dass jemand in seinem Alltag anders handelt, nur um einen mili Prozent, mal bescheiden, zu erhöhen. Also, dass die Informationen, die eine Person in diesem Escape Room mit sich nimmt, dann später zum Beispiel in einem Unternehmen, wenn ich wählen kann zwischen A und B, dass ich dann mehr richtung B kippe. Und das schönste wäre natürlich, wenn Menschen dadurch inspiriert werden könnten. Also, das ist ungefähr der Why es diesen Raum gibt.

I: Welche räumlichen Anforderungen haben Sie für jedes einzelne Escape-Room-Rätsel?

Wie du siehst, ist die originale Kern Einrichtung erhalten, so der Ofen, der Kühlschrank und so. Ich könnte mir gut vorstellen, dass solche Plätze geeignet wären für Puzzles. Wäre wahrscheinlich gut, wenn irgendwie Themen behalten, so wie ein Ofen zum Beispiel etwas mit Hitze zu tun hat, und ein Kühlschrank etwas mit Ernährung. Ich fände es selbst interessant, wenn diese Orte auch selbst eine Transformation untergehen würden, so wie der Rest des Raums. Wir dachten weiter auch übrigens darüber nach, um wieder eine Trennung einzuführen. An diesen Orten da gab es zwei Türen, die wie entfernt haben, weil der Raum sonst zu klein war für vier, aber ich könnte mir gut vorstellen, dass das für Spieler spannend und motivierend ist, wenn sie merken: Hey, der war doch von außen größer!", und sich dann in den letzen Raum begeben müssen. Aber ansonst, Boden, Decke, nichts ist ausgeschlossen, alles ist nutzbar.

I: Was sind die visuellen oder gestalterischen Anforderungen für jedes Rätsel? (Wie muss es (nicht) aussehen)

Also der Style soll halt ganz deutlich Solarpunk sein, das ist ein älteres Konzept was sich auf die Versöhnung zwischen Technologie und Natur bezieht. Auch in einer solchen Welt kann man teil der Lösung sein, aber auch Teil des Problems, aber was mir sehr gefallen würde, wäre wenn zum Beispiel das ein Computer, oder eine Maschine so aussieht, als hätte sie Blätter. Und eher neues plastik meiden, ausser wenn es nicht anders gänge. Wir haben den Wagen erst mal weis angemalt, und versuchen in der richtung von weis, grau und grün zu bleiben. Dann sticht eine Rote Lampe auch mehr heraus, und können Spieler besser geleitet werden für Hints, kann ich mir vorstellen. So können Signalfarben dann punktuell eingesetzt werden. Was ich mir hier nicht vorstellen kann, wären größe Flächen von Rot und Gelb und so, das würde Solarpunk ziemlich widersprechen. Silber ist auch ne tolle Farbe, weil der Bus selbst ja auch silber ist, aber eher puristisch mit den Farben stell ich mir das vor.

I: Wie hoch sollte Ihrer Meinung nach die Produktionskomplexität eines jeden Rätsels sein? (Wie viel Technik können Sie bewältigen)

Also, es wird ja schlussendlich etwas sein zum Anfassen und Angrabbeln, deswegen spielt die Robustheit eine große Rolle. So wenig wie möglich soll absteckbar sein, weil wenn sie können,

machen Menschen alles kaputt. Ich hab selbst auch während dem Prototyping Sachen versehentlich kaputt gemacht, das passiert. Man könnte ja zum Beispiel etwas Zerbrechliches auch hinter Plexiglas verstecken, so dass die halt nicht rankommen. Da würde ich sagen, liegt die Komplexität eher im hinteren Vorhang. Das Schlimmste wäre natürlich, wenn ein Rätsel jetzt ausfällt und nichts mehr geht, dass das ganze Spiel platt geht. Da wäre es gut, einen Work-around zu haben, dass es noch klappen würde, zum Beispiel der Gamemaster eine Kode bekommt und die weitergibt an den Spieler.

I: Was sind weitere Anforderungen, die Sie nennen könnten?

Ich bin ja beruflich Klimaadviseur und sag immer: “Klimakrise ist Kommunikationskrise.”. In unserem Alltag hören wir schon genug über die Klimakrise, wir haben festgestellt, dass mit der Pädagogik sich nur noch die wenigsten darauf einlassen, und leider nicht die, die wir erreichen wollen. Das ist der Grund, warum wir durch Spiel eine Intuition aufbauen möchten, es soll nicht nur von Fakten ausgehen, also eher spannend und kurzweilig. Der Spaß soll nie unter der Komplexität gestellt werden, es soll in dem Sinn nicht unbedingt ein informativer Escape Room werden, dann hätte ich lieber etwas weniger Informationen darin verwebt, als dass jetzt der Spaß aufgegeben wird.

I: Wie langlebig und robust sollte das Puzzle sein (Wie oft soll es benutzt werden)?

Also, es soll so robust wie möglich sein. Soll runterfallen können und nicht direkt kaputtgehen, oder wenn jemand drauf tritt. Es soll auch schon reproduzierbar sein, nicht dass, wenn etwas zerbricht, es nicht mehr hergestellt kann werden. Sollte auch keine großartige Neuprogrammierung benötigen die wir nicht untergehen können. Also, wir rechnen damit um ungefähr 3-5 Jahre konstantes Nutzen, für diese Zeit soll es halten und gut funktionieren. Nach diesem Zeitpunkt werden wir auch versuchen, zu Scalen, also wäre schön, wenn es abwärtskompatibel wäre, aber dies muss nicht unbedingt sein.

I: Inwieweit sollten die Materialien des Puzzles austauschbar sein?

Es gibt bei uns Menschen in der Gruppe, die könnten so etwas wieder reparieren, aber generell, jeh einfacher desto besser. Es soll auch eine Minimalanforderung sein, dass eine Dokumentation dabei ist, der ein normal sterblicher Mensch begreifen kann. Also, je weniger, desto besser.

I: Inwieweit sollte das Puzzle reparierbar sein?

Ja, soll reparierbar sein. Entweder es soll eine Möglichkeit geben, dass das Spiel weitergehen kann ohne dem Puzzle oder halt ein Work-around.

I: Was ist die Atmosphäre, die Sie für die Erfahrung schaffen wollen?

Es soll ja schlussendlich mit Solarpunk, also die Wiederversöhnung von Mensch und Technik zu tun haben. Es wird so sein, dass sie in einem dunklen Raum treten werden, dann gehen langsam die Lichter an, also so Tension halt. Wir könnten auch so LED streifen verwenden um in der Dunkelheit zu leiten. So, ich denk grad halt nach, ne. Was wichtig ist, der Airstream ist ja ein Reisemobil, so symbolisiert ja eine Art reise, und das soll sich irgendwie auch widerspiegeln, dieses Reisegefühl. Eine solche Reise kann ja örtlich sein, kann aber auch zeitlich sein. Dann wäre es auch eine Idee, um irgendwo ein Art Reisetagebuch oder so zu bewahren, wo man dann über all die verlorenen Plätze lesen kann. Also das Thema einer Art Reise soll schon aufgefangen werden. Ich kann mir auch vorstellen, dass Räume sich über Zeit verändern werden, durch die Zeitreise. So kann man sich fragen, wie sieht dieser Ort aus in 40 Jahren. Wir hatten die Idee, um lauter screens vor dem Fenster zu hängen, dann könnte man so sehen: “Ach, die Kirche da, die ist jetzt anders”, oder so.Also, so impliziert es das Gefühl von Reise irgendwie an. Eine Zeitreise ist ja eigendlich einen Sprung, man ist auf einmal von einem Ort in den nächsten. Da gab es auch lauter Zeitreisparadoxen, die wir noch nicht gelöst haben, jetzt machen wir das mal mit dem Video so. Impliziert soll das Gefühl von Reise präsent sein. Dann fragt man sich natürlich auch, welche Reise, zum Beispiel das Idee mit der Seele,

ist auch ne Reise irgendwie. Hat was mit Mysterium. Darum, irgendwie wäre es schön, wenn das Thema Reise darin verwoben wäre.

I: Was ist der "rote Faden" des Puzzles innerhalb der Installation?

Also, Spaß un Unterhaltsamkeit wären schon mal die ersten. In 60 minuten die Rätsel lösen und dabei ein gutes Gefühl erzeugen, zusammen Spaß haben wäre eine. Dann gibt es ja auch einige Themen, die stets zurückkehren, so wie halt Thema Klima, und das kann dann sein in der Form von Ressourcen, also Wasser undso, kann aber auch Umwelt sein, das Verhältnis als Spezies zur Umwelt könnte auch was sein, ne. Und auch das Thema reisen soll halt an manchen Orten spürbar sein. Der letze Link wäre dann, wie bekommen wir die Botschaft implizit rüber. Ich glaube, wir machen das mit dem Thema reisen, hängt das so zusammen. Wenn jetzt einer sagt “Hey, wir Menschen sind am sterben, ihr müsst euer Benehmen ändern”, da hat kein Mensch Bock drauf. Deswegen sollen alle Puzzels diese Botschaft irgendwie implizit, und indirekt rüberbringen. Die Frage ist dann natürlich, wie kann sie in so einem Puzzel eingepackt werden, ohne dass es aufdringlich rüberkommt.

I: Gibt es etwas, das Sie dem Gesagten noch hinzufügen möchten?

Ja, es ist wichtig, dass ihr die Ideen, die ihr habt, schon mal in der Gruppe andockt, damit wir anfangen können, produktiv zu prototypen. Also, wir treffen uns ja am 27. Oktober, es wäre gut, wenn ihr dann schon eine gewisse Idee, also besser 3 sogar, was ihr zusammenstellen möchtet, damit wir die Rätselhierarchien bestimmen können. Also, das wären dann die Interfaces, die Orte und der Input-Output.

I: Vielen Dank für Ihre Zeit.

Respondent 5:

I: Was ist ihre Funktion in dem Projekt?

Meine Funktion ist, ich moderiere den Kreativprozess und bringe meine Expertise ein als erfahrener Spieldesigner. Ich versuche, viele Ideen zusammenzubringen zu einem Ergebnis.

I: In welcher Designphase befinden Sie sich mit Ihrem Projekt? (Erklären Sie mit room2educ8)

Ich denke, wir sind noch in der Grobkonzept Phase, wir haben Ideen und versuchen daraus ein Konzept zu bauen.

I: Welche Schwierigkeiten beim Bau der Einrichtung haben Sie bisher überwunden?

Ich denke, eine große Schwierigkeit, sind viele verschiedene Vorstellungen, wie viel man arbeiten möchte, wann und was. Mit dieser Gruppe ist es halt ein wenig chaotisch, weil die meisten sind ja Ehrenamtlich dabei, was heißt, dass ihnen nur den Spaß motiviert. Es gab zum Beispiel eine Person, die gerne den Kreativprozess leiten wollte, und da gab es einen Konflikt. Ich habe ihr dann gesagt, dass das nicht geht, dass sie entweder mir das überlässt und sie kann mitmachen, oder sie muss gehen, und die hat sich dann für das zweite entschieden.

I: Inwiefern gab es da einen Konflikt?

Ja, also die hat mich ständig unterbrochen und gesagt, was wir stattdessen machen sollen, und das ging nicht so. Aber insgesamt ist es schwierig, mit diesen Leuten zu arbeiten, weil sie keine Erfahrung mit dem Entwurf von EERs haben. Genau also, weil diese bei dieser Gruppe ist der Jan der einzige, der schon Escape Rooms entworfen hat und ich natürlich. Und Marco, der am Anfang noch mit dabei war, ist jetzt nicht mehr mit dabei oder nicht mehr aktiv und deswegen, ja, es sind. Das sind die Leute sind motiviert, aber sie haben noch keine Erfahrungen damit und deswegen ist es sind wir, was die Rätsel angeht, sind wir weiter hinten im Zeitplan, als ich eigentlich dachte. Also wir haben schon so ein bisschen so Dekor gemacht und technische Infrastruktur, Strom und so. Genau, aber die Rätsel sind spät dran und es ist auch nicht so leicht mit diesen Leuten das zu machen.

I: Welchen Entwurfsprozess verfolgen Sie? (Für Willie) / Wie haben Sie den Designprozess bisher erlebt?

Also wir, wir arbeiten Iterativ. Ich weiß nicht, ob wir… ne, ich denke nicht, dass wir eine offizielle Methode verwenden. Das ist so so. Vielleicht eine Mischung aus verschiedenen Sachen, aber... Ja, ich weiß auch nicht genau, also ich habe noch nie ganz so ganz strikt diese Methoden studiert oder ausprobiert, ich habe. Also viele, viele Sachen habe ich im Rahmen meines Studiums und später dann meiner meiner Arbeit einfach so entwickelt oder mit anderen Kollegen gesehen oder in verschiedenen verschiedenen Teams erfahren. Und ja, es ist keine keine offizielle Methode, sondern es ist ein iteratives, intuitives Verfahren und ich arbeite auch nicht nur ergebnisorientiert. Also weil es so viele Ehrenamtliche sind. Oder weil Ehrenamtliche sind, ist der Spaß wichtig und die Identifikation mit dem Projekt und auch die, die Selbstwirksamkeit, also das Gefühl, dass man etwas beitragen kann und deswegen ist es wichtig, wenn jemand eine Idee vorschlägt die nur ein bisschen oder so halb passt, aber nicht ganz, dass ich das trotzdem nehme und sehr wertschätzend damit umgehe und schaue, wo kann daran gepuzzelt werden.

I: Für welche Benutzererfahrungen entwerfen Sie? (Was soll der Besucher fühlen und wann?)

Ich denke, es soll ein spannendes Gruppenerlebnis sein. Sie sollen ein bisschen Aufregung haben im Bauch und sie sollen sich drauf freuen auf diesen Tag, wo sie dieses Spiel gebucht haben und sie erleben gemeinsam etwas. Also es ist eine Teambuilding Komponente dabei.

Am. Ja, also es soll. Es soll Adrenalin und Dopamin ausgeschüttet werden. Ja. Also es ist und das, aber das Projekt ist ja zweigeteilt. Es gibt zuerst den Escape Room und danach den Anschluss Workshop und der Anschluss Workshop ist ein bisschen gleich Erwachsener.
Also, dass das Spiel am Anfang ist. Ein schnelles, helles Feuer. Und wenn es dann einmal brennt, dann kann man diese Feuer nutzen, um etwas tiefer gehendes, langsameres zu zu starten, und das soll eine Erkenntnis sein. Die Situation ist ernst, aber ich kann etwas ändern. Ich bin ein kleiner Teil, aber es ist wichtig, dass ich als kleiner Teil auch etwas verändere. Also so eine Art Empowerment, so ne Art Selbstreflexion und es soll, es soll Spaß machen, darüber nachzudenken und es soll, wenn man soll, Spaß daran entwickeln, aktiv zu werden.
So motivierend dann in der Richtung.

I: Wie haben die Endnutzer bisher auf den Prototyp des Busses reagiert?

Die Leute sehen das von weitem und sie finden das interessant. Äh, und viele wollen gerne reingehen. Mhm. Bei der Aktion in Nürnberg gab es auch manche, die enttäuscht waren, weil sie dachten, es ist schon alles fertig. Die dachten, es gibt schon. Es gibt schon einen fertigen Escape Room, aber es gab nur eine Kulisse und ja, da gab es manche, die Waren enttäuscht.
Also wir haben sehr viel gutes Feedback bekommen für unser Video, was wir auf Instagram gestellt haben, wo man so das Interieur sieht. Ähm. Und die Leute meinten, es sieht, es sieht toll aus. So. Solarpunk mäßig und das ist das Feedback, das wir bekommen haben. Und dann gibt es noch, wir haben noch etwas getestet von den Nachbereitungen Workshop diese Klima aktions Karten. In 2 Versionen eine Version ist, man kann sie sich einfach nehmen von einem Stand und mitnehmen. Und die andere Version war ein Kartenspiel, wo man sich gegenseitig.
Vorschlägt und aussucht und so, das ist ein bisschen persönlicher, weil man da versucht.
Mehr herauszufinden, was zu einer zu der eigenen Persönlichkeit passt.
Und das hat den Leuten Spaß gemacht, hab ich gesehen und das wollen wir weiter machen und daraus ein Produkt machen, das Teil des Workshops ist. Und vielleicht auch unabhängig davon auch vermarktet werden kann.

I: Wie viel Erfahrung haben Sie persönlich mit Technologie?

Also ich, ich bin auf jeden Fall sehr an Technologie interessiert. Und wir haben hier auch einen ähnlichen Studiengang an der Kunsthochschule in Halle. Ähnlich wie Creative Technology heißt Multimedia wird Reality Design aber beinhaltet auch sowas wie Arduino und Tactical ne Tangible Computing und solche Sachen. Und das schaue ich mir immer an. Also ich bin jetzt kein Technologie Maker oder so ich. Ich kann nicht wirklich programmieren oder so, oder? Hm weil ich hab schon ein paar Sachen versucht habe zu programmieren oder auch gelötet oder so, aber ich bin immer noch Anfänger damit, aber ich bin sehr interessiert und auch ich kann mir Sachen gut vorstellen und verstehen auch. .

I: Was hast du konkret versucht zu programmieren?

Also das ist jetzt schon 10 Jahre her. Haben wir ein Spiel gemacht für Jugendliche, damit sie herausfinden können, was welchen Beruf sie machen wollen. Und wir hatten die Idee, dass es ein Tablet gibt, man kann sich einen Beruf aussuchen und man kann sich fotografieren.
In diesem Beruf mit dem Outfit in einer Szene mit dem Beruf. Und ich habe den Prototyp davon programmiert, auf einem A Windows Tablet und war Quick and Dirty der Prototyp und hat funktioniert und wir haben gesehen, das macht Spaß und dann haben wir im nächsten Schritt einen echten Programmierer beauftragt das nochmal dann sauber zu machen

***
I: Wie stellen Sie sich den endgültigen Escape Room vor?

Ich stelle ihn mir so vor, dass er sehr atmosphärisch ist, das ist eine Mischung aus Solar Punk, Steampunk und Cyberpunk, also so, die man merkt, dass dass diese Inneneinrichtung aus verschiedenen Zeiten zusammengestellt ist, weil es eine Zeitmaschine ist. Nicht nur futuristisch, sondern auch historisch gemischt. Und sehr viel auch mit Pflanzen. Ähm, passend zu Solar Punk und zu zu der Klima-Thematik. Und ich stelle mir vor, dass es einige leichte Rätsel zu Beginn gibt, die den Spielerinnen ein gutes Gefühl geben. Sie merken: Wow, wir schaffen das, wir kommen rein und das ist vielleicht 3 komplexe oder 4 komplexe Rätsel gibt. Und wenn man die alle geknackt hat wird eine Botschaft abgespielt aus der Zukunft, würde so eine Botschaft, die die Spieler belohnt und die Spieler motiviert, jetzt diesen wichtigen Workshop ganz aufmerksam zu verfolgen weil sie etwas bewegen können. Und danach gibt es den Workshop und ich denke, es wird 2 verschiedene Workshops geben. Vielleicht müssen wir noch besprechen.
Ich denke, dass Ossi einen Workshop machen wird für Kinder und Jugendliche machen wird.
Und dass wir mit als Gruppe vielleicht auch für Stefan einen Workshop entwickeln werden, der eher für Erwachsene ist, die sich schon ein bisschen in der also, die ist schon ein bisschen ein Bewusstsein für die Klimaproblematik haben und die jetzt nicht alles ganz neu lernen müssen, sondern die eher nur motiviert werden müssen. Nicht unbedingt belehrt.

I: Aber ich hatte verstanden, dass die Zieldemographie Jugendliche bis Erwachsenen sind, das heißt, dass kinder nicht in den Escape Room dürften.

Also der Escape Room wird, denke ich, für beide Zielgruppen funktionieren.
Auch für Kinder.

I: Welche räumlichen Anforderungen haben Sie für jedes einzelne Escape-Room-Rätsel?

Also man sollte nicht klettern müssen, also nicht, zumindest nicht gefährlich klettern.
Also nicht unbedingt an der Decke was ich mit Räuberleiter hochhalten muss oder so.Das Puzzle kann nicht in dem Stromverteilerkasten rechts neben der Toilette, weil das ist zu und da.
Ja, da ist eben Strom drin. Ich glaube, unterhalb der beiden Betten kommt wahrscheinlich Bettzeug.
Also da vielleicht auch kein Rätsel. Das Wohnmobil muss weiter als Wohnmobil nutzbar sein können, weil die Personen, die damit reisen, dort auch wohnen. Also es muss jetzt nicht aussehen wie ein normales Wohnmobil, es kann wie Escape Room aussehen, aber man sollte trotzdem da schlafen können.

I: Was sind die visuellen oder gestalterischen Anforderungen für jedes Rätsel? (Wie muss es (nicht) aussehen)

Ja, es sollte sich vielleicht an diese Steampunk Cyberpunk Solar Punk Ästhetik ungefähr entlang hangeln, also mit Fokus auf Solar Punk, das heißt Technologie und Natur miteinander vermischen. Das ist so ein bisschen so ein eine Ästhetik, die sich so durch den ersten Dream dann durchziehen wird. Aber es kann auch sein, dass ein Mikroskop darin ist, das einfach nur nach Mikroskop aussieht. Und daneben gibt es eine Pflanze und dann ist es auch, dann ist es auch im MCI quasi. Es muss nicht jedes Objekt alles abdecken also. Also gerade weil diese Geschichte ja ist, dass eine Zeitreise mobil ist und in verschiedenen Jahrhunderten verschiedene Sachen dazugekommen sind, kann es daher eine Varianz geben.

I: Wie hoch sollte Ihrer Meinung nach die Produktionskomplexität eines jeden Rätsels sein? (Wie viel Technik können Sie bewältigen)

Also ich, also meine Erfahrung war, dass es wichtig ist, dass die Sachen sehr resilient sind, weil sie werden viel bewegt werden und es werden verschiedene Leute damit operieren, Spielerinnen als auch verschiedene Betreuer und sie haben keine Zeit, ständig was zu reparieren oder so. Also es ist sehr wichtig, dass es, dass es immer läuft. Und wenn es, wenn es nicht immer laufen kann, dann muss es einen Plan B geben. Also. Wenn das. Keine Ahnung, wenn das Windows Betriebssystem abstürzt und der das Gesicht ist leer. Das projizierte Gesicht und man kann da nichts sehen und hören, dann muss es vielleicht einen Brief geben, der das erklärt und das Spiel trotzdem noch zu Ende spielbar macht. Oder zu Ende.

I: Würdest du sagen, es wäre auch möglich um statische Objekte zu entwerfen? So etwas, was sich nicht bewegen lässt?

Ja, auf jeden Fall. Das ist möglich, also stationäre Objekte. Und sie müssen auch nicht, sie müssen keine mechanische Komponente haben. Sie können auch anders erlebt werden, dass man nur etwas zum Beispiel, könnte sein, dass es ein Loch gibt und man muss etwas spüren.
Und da ist eine Schrift und man muss diese Schrift spüren. Und fertig. Keine mechanische Komponente. Trotzdem ein Rätsel.

I: Was sind weitere Anforderungen, die Sie nennen könnten?

Es ist keine harte Anforderungen. Also uns ist aufgefallen in Nürnberg, dass es können ja immer nur 5 Leute maximal in den ersten rein und spielen und der Air Stream ist dann für vielleicht 45 Minuten oder 5 oder eine Stunde blockiert, und deshalb ist es wichtig, um das um die Leute außen zu sammeln und zu puffern, dass es außen auch Sachen gibt. Und es wäre auch möglich, etwas für außen zu entwickeln, was zur Thematik passt und nicht ein Rätsel aus dem Spiel ist.
Aber jetzt gerade habe ich das Gefühl, es sind so viele Sachen, dass das jetzt erstmal in den Hintergrund tritt und ich wollte das gestern auch noch nicht bringen. Ich hab das Gefühl.
Ah ja, wie andere auch gesagt haben, es sind wir ganz fokussiert sein und vielleicht nicht immer alles wollen. Sondern es ist cool, wenn einfach ein Escape entsteht und es muss nicht das Genre neu definieren und ganz neu ganz anders sein oder so. Es reicht schon, wenn überhaupt am Ende was Cooles rauskommt.

I: Wie langlebig (dauerhaft) und robust (fest) sollte das Puzzle sein (Wie oft soll es benutzt werden)?

Es sollte ein halbes Jahr oder 3 Monate lang benutzt werden können, ohne dass man es reparieren muss. Ja. Also ich denke ich denke es wird wahrscheinlich 2 Jahre verwendet werden oder so oder 3. Aber man sollte es, man kann es ja auch ab und zu reparieren. Aber nicht, aber jetzt nicht. Äh nach jeder Benutzung oder auch nicht nach jeder fünften Benutzung, das wäre zu aufwendig, wenn das passieren würde, wahrscheinlich das Puzzle aussortiert werden. Irgendwie.

I: Was ist die Atmosphäre, die Sie für die Erfahrung schaffen wollen?

Am Anfang ein bisschen gruselig und mystisch. Und zauberhaft. Und am Ende sehr energetisch und motivierend.

I: OK, dann soll es so ein Switch geben in der Atmosphäre so halbwegs oder so?
Ja.

I: Was ist der "rote Faden" (verbindende Merkmale) der Puzzles innerhalb der Installation?

Also ich denke, dass wahrscheinlich jedes Puzzle oder jede Puzzle Kette einen Buchstaben ergibt, den man am Ende eingibt um die Message zu bekommen. Also, und dieser Buchstabe kann sein, dass man ihn fühlt. Es kann sein, dass ein Gegenstand ist, wo der Buchstabe drauf ist, oder es kann mit Laser irgendwohin gemalt werden. Es kann gesprochen werden. Das ist auch schon sicher, dass es ein

Buchstabe sein wird, so dass es nicht mehr in der ideation Phase oder so. Also die Idee, wie sie jetzt ist, funktioniert und sie wird. Wir arbeiten mit ihr, bis es ein großes Problem gibt oder bis jemand eine viel bessere Idee hat, die aber auch auch besser funktioniert. Also ja, ich quasi arbeite so mit der Gruppe, das ein Gesamtentwurf gibt und wir schauen immer dahin, wo es gerade die größten Lücken gibt, die größten Probleme.
Und da gibt es jetzt gerade nicht so ein Problem.

I: Gibt es etwas, das Sie dem Gesagten noch hinzufügen möchten?

Ich weiß, es sind sehr viele Anforderungen und auch gerade das mit dem mit der Robustheit ist schwierig, weil es ist ein ihr Macht ein Studienprojekt und nicht. Ähm, es ist jetzt kein bezahlter Job oder so und ich glaube, ihr könnt etwas machen worauf also ihr Lust habt, ein Rätsel Objekt was ihr toll findet und wir finden einen Weg, dass da rein zu machen und… Genau. Und da freue ich mich drauf. Ich merke auch schon, dass ihr kreativ seid und Lust habt und das ist, das ist ja schön. Ja, lass uns weiter daran arbeiten, das wollte ich noch sagen.

I: Vielen Dank für Ihre Zeit.

Appendix B: Past ER visitor interviews

Participant 1:

Interviewer: Would you tell about the context of the escaperoom, what was the story, who did you go there with?

It was a while ago, so I don't remember very much about it, but it was in my first year, so I went with my circle, a group of six, somewhere in Meppel. What the story was, yes the puzzles I know, but what the story was and what rooms and so on I don't really remember very much what the story was behind it. There was something about a diary, someone had lived there, maybe it was someone who no longer lived or something, but no, I don't remember the whole theme.

Interviewer: Do you remember what elements or details you liked?

I liked the beginning, it was all a bit unexpected, so you were first in a room, that you thought 'okay is it only this one room', but then all of a sudden after you had done a few tasks, the door of the washing machine opened, so I had to open it fully, so not the round hole itself, but the whole front of the washing machine could open, and then you had to crawl through that, and then you were in the next room. I really liked that, because it was so unexpected. I don't exactly remember all the assignments, but there was also one where there was a laser beam, and you had to use some kind of mirror to make sure the laser was in the right place. And there was also another time, but maybe I'm confusing that with another escape room, but there was also another time somewhere that you really had to look under a bed, someone had to lie under it and then you had to tell the rest of them things, so then you really had to work together, which was also fun, you couldn't let just one person solve everything.

Interviewer: Was there anything in the room or in the escaperoom that you would have liked to see different, or where you think: this could have been improved?

Yes there are always things that are just too complicated, that you just don't get to it, or you don't see it, but that's maybe a little too long ago to really mention anything very concrete there.

Interviewer: How would you describe the difficulty of this escaperoom on a scale of 1-10?

Well this one was like, let's see in terms of scale, I think a seven or eight. It was fun, because it was kind of difficult, but then it was manageable, so then it's just achievable then it's the most fun I think.

Interviewer: A lot of escaperooms are decorated, do you think the decoration added to the vibe or the atmosphere?

I think it did have all the details that you could see, who had lived here, all the props, which again maybe makes it confusing, because then you think you have to do something with everything, but yes it does make the atmosphere more real.

Interviewer: Do you remember anything about the use of light in the space? Did they use dark and light?

I don't remember that very well, to my feeling it was dark, if you then went to the next space, that it was lit differently.

Interviewer: And you just mentioned there was a puzzle where you really had to work together as a team, were there any other puzzles where working together was very important?

I don't remember that very well. There was some puzzle where you needed something from the other room, so that you would send someone to the other room, and communicate back and forth. I think, but I don't remember very concrete things.

Interviewer: Lastly, what puzzles did you like best in this escaperoom? What kind of puzzles?

I think so with those lasers and those mirrors, that you had to use all the mirrors together to then get to a (point), that first you had to figure out where that laser was supposed to end up, and then you had everywhere, or then you could open a door somewhere which would free up another mirror and, yeah something like that.

Interviewer: Is there anything else I missed in this interview that you would like to mention?

Don't think so. No I so can't remember that many details.

Participant 2:

Interviewer: You indicated that you once went to an escaperoom, could you maybe explain what that escaperoom was about, was the story line.

It was in Enschede, it was with a group, but I have to say that I don't remember the storyline very well. I must say that I found it mostly very confusing and didn't understand very well what the idea behind it was. There were a lot, there was a lot that you had to find codes and use and fill in, and certain colour combinations with buttons they had, but so I wasn't quite convinced about the storyline.

Interviewer: Do you remember what theme (the escaperoom) was about?

No.

Interviewer: Are there any elements or details in the escaperoom that you remember as those were good, or these I liked.

Yes, that was a staircase and that made sure that, say at the top was a set of buttons, and on each floor was a sign or designation of letters and colours that you had to use to figure out which (button) to press and when. And so you had to memorize that whole thing from top to bottom to figure out what to do at the buttons. You were multiple people, so you could just yell, you had to communicate that. You do have to coordinate that everybody does that, or you have to have somebody who can memorize that really well.

Interviewer: Were there things in the escaperoom that you thought I would have done differently or this could have been done better?

Yes the connection between one step and another step, but I just didn't understand the theme I guess.

Interviewer: So there was consistency if you have to put a word to it?

Yes

Interviewer: Do you have the ability to give it a difficulty rating between 1-10? Did you escape?

Yes, quite late but we did escape. A seven or eight, I think.

Interviewer: So we are doing research on an escaperoom, and one of the things is how you create an atmosphere, do you maybe remember what you thought of the decoration in the escaperoom? Did that contribute to the atmosphere and the storyline, or was that kind of separate?

Yes about the storyline I can't say much, but it was a good atmosphere, they made good use of lights and of darkness. Yeah, that was nice. I have no idea what was with the storyline.

Interviewer: You just said it a little bit, but the next question is indeed about the use of light in the space. How did they use light and did it work well?

Yes they had so for example when you had found a code and you thought, okay which lock should this be on now, and then the lock is barely visible and then you have to look carefully for where the lock is, but they also make sure that there are enough dark places where you are looking but there is nothing there, just to frustrate you. And everything that is lit up, you don't have much to look for there, which is funny but also just irritating. It makes it fun.

Interviewer: Were there moments where it was really crucial to work as a team? You just mentioned the stairs.

Well not quite crucial, because you can just start at the bottom and remember everything when you walk up and then do everything at the top, then you just have to have a good memory. What I found very unfortunate, it was useful to work there as a team, but it was not very clear what the task was, say the link between the buttons that were at the top and the information you were given was not clear enough to convince everyone that what you wanted them to do was also what they were supposed to do. Then it's very difficult to get people to take action.

Interviewer: Do you know how that might have happened? What would you have done to do to do make it clear that that had to be connected.

I think puzzles, say doing similar puzzles but with increasing difficulty. So then first you have that you only see colours or letters and then a combination or something.

Interviewer: The last question is actually which puzzle you liked the most in the escaperoom, which one appealed to you the most?

I'm not so sure about that.

Interviewer: Is there anything else about this escaperoom that you would like to say or want to share?

I found it quite underwhelming, I also sometimes hear stories that people really liked it, but then I think of this, it is more fun for me to do other thing than to do an escaperoom.

Participant 3:

Interviewer: Okay so you indicated that you have visited an escaperoom in the past, could you maybe give me some context, what was the theme of the escaperoom, which whom did you go to the escaperoom?

I once went with some friends from highschool to an escaperoom, it was, I don't know if it has any(specific) theme, you were just in a closed space and you just had to escape. Maybe something with art, but the puzzles were not specifically art-related. And one time I went with my parents and family to an escaperoom, it was more like a (bank) safe that you had to escape from.

Interviewer: Which elements or details in the escaperoom did you like the most? It can be decoration, puzzles, anything that comes to mind.

I think when it just all makes sense, and there are some details which make you feel like you are inside a safe or art room and there is a bit more than just the puzzles, but also that it is not overwhelming so you spend ten minutes staring at something random which is not clearly a puzzle.

Interviewer: Was there anything in these escaperooms where you thought that could be improved, where you thought 'I would improve this' or do this differently?

I know that both escaperooms had the intercom, and I know one, because we were already stuck at something that wasn't a puzzle, I know they called into the room 'this is not a puzzle, go there and there', like they gave hints, which was nice. At the same escaperoom, there was a moment of scare, someone will go in and be like 'whoo hoo' and scream and like go in the other room, there were several rooms, I think four connected to each other, and I did not really like that part, because one of my friends started screaming a lot and I had to calm her down but also my other friends and I was not really comfortable with anyone like anyone in a closed space creeping up on me, which I did not expect, I would change that because I did not like that.

Interviewer: How would you rate the difficulty level of both escape rooms on a level of 1-10?

I think the first one was maybe a six, I was also younger then so that may also help, and the second one maybe a four, but we were with more people and we were all a bit older, and my parents and siblings were there, and they also studied then so, that may also help.

Interviewer: You have already talked about decoration and feeling like you are in a safe. How did the decoration of the escaperooms add to the atmosphere or the vibe?

What do you mean? How did it add?

Interviewer: Where the decorations convincing, did the decorations make you feel like you were in a safe or art-room?

For the first one, the one I did like the earliest with my friends, a bit less. But the second one, the paint on the walls, and the floor was a bit of cement, it just had the rotation lock on the door. And I think everything that was in the room made sense to be in a safe, so the things that were hanging on the wall were money-related or like phone-number related, there was a desk with cupboards and were files and stuff. So it made sense, there was nothing random in there.

Interviewer: Can you remember something about the use of light or darkness in the rooms? Was it intentional, did it work, how was your experience?

In the first one, I don't remember. In the second one, there was something with special kind of ink on the paper, that's it. Maybe in the first one something with if you solved enough puzzles, the lights went on the next room, so you knew you should go there, but I think that is all.

Interviewer: Where there moments in the escaperoom where it was important to work as a team?

I think most things were nice to do with two people, because then you could read something on one side of the room and write it down on the other side of the room, or one had a rhyme on the wall and you had to put the corresponding objects on the other side of the wall. So it was nice talking to each other instead of walking to the other side. Usually there was only one puzzle, sometimes two, that you could do at the same time, so then you are immediately working together since there are not really other things to do, except look for other puzzles that are not there, but we tried.

Interviewer: And lastly, which puzzle did you enjoy the most?

I think the second escaperoom that I did was a bit more numeric, and I think I liked that one more. The first one was a bit more with words, and you had to decipher a rhyme and I think those were less clear when something was a puzzle and what you had to do. Like I don't mind a puzzle being hard, but I would like to know what I have to do for a puzzle, and I think that was clearer in the second (escaperoom), I don't have more specific examples, but those where the things that I liked more.

Interviewer: Is there anything else you would like to tell me about the escaperooms that you played, which I forgot to ask?

No I don't think so.

Participant 4:

Interviewer: Would you talk a little bit about the context of the escaperooms, where was it?

One or all of them?

Interviewer: Do you have several? Let's start with one.

It was in Belgium and the theme was whisky, so the ongoing theme was the brewing process of the whisky and then there were also these barrels and bottles and things that are used to make it. Other than that, it was just a lot of puzzles and looking for things and also going through different rooms, it wasn't a cubicle, but a door opened every time and then you had to wriggle through a wall, crawl under a table to get to the next one.

Interviewer: You say the escaperoom is about whisky, could you call it an educational escaperoom or was it mostly themed?

It was mostly in the theme, you do really go through the whole brewing process, and you needed that in the end to find the solution, but I didn't memorize it so I didn't learn anything from it.

Interviewer: What elements of the escaperoom did you like best, it could be puzzles, details, music?

I think just that there were really different rooms, but it wasn't completely linear, so sometimes you also had to go back to a previous room which kind of gives you more and more places to search, because now you have new information so then other things stand out, that was kind of fun.

Interviewer: Is there anything in the escaperoom of which you thought: this should not have been done, I had done this differently or this can be improved?

Maybe sometimes a little more decoration because a few rooms, there was everything that was there you needed, and it's also kind of nice when stuff is just in the way, but in itself there was also enough to do without the distractions, so it was also fine like that.

Interviewer: How would you describe the difficulty like on a scale of 1-10 and why?

I would say (the escaperoom) was a seven or eight, you did have to think about a few things and it was doable, although we did need a tip, but with that tip we were within time. So just difficult enough that it's still fun.

Interviewer: You mentioned a little bit about the decoration. How did the decoration affect the overall atmosphere or vibe of the escaperoom?

So that did help, because so it was very much in the theme, so it helps very much to reinforce the theme, but as I also mentioned earlier it was fairly bare, which sometimes detracts a little bit from the atmosphere, but the decoration that was there was all good.

Interviewer: We were also wondering about the use of light and dark, how it was done and if it was done the right way?

Yes it was done, in the beginning it was completely dark, there was kind of a sketchy candlestick with a candle, you had to pretty soon, you started in a very small cubicle and then a little later you did get a kind of flashlight and then again two puzzles later the light went on and still not quite light, but well enough lit to be able to read everything decently and that you don't have to use a light to look at things, and so that was fun, that was also another challenge to adapt to the dark and make good use of the light you have.

Interviewer: Were there moments where it was really crucial to work as a team or were actually all the puzzles solvable by one person as well?

It was all solvable by one person in general, I think there were one or two puzzles that you kind of had the decryption in one place and the code somewhere else, so that you then had to consult a little bit, but most of it was just really separate things that you could solve one at a time, so a lot of times we'd all be split up and collecting a number or a key somewhere, and then you'd bring it together afterwards.

Interviewer: Which puzzle did you like the most in the escaperoom?

Pooh. I actually think toward the end, because eventually you had the code, and then there was a chest that you had to open. Earlier, there were sort of all these little Scottish prints that came along, and then they belonged to a certain family, and then that family had a specific whisky and then so to combine and then had the paintings with prints through which you could do exactly the order of the numbers, but in the end the solution was not in that chest, but there was only a different code in it, so you had to press a button somewhere earlier in a room, which opened another door, and there was the solution, so I really liked that at the moment you think you are there, you are not quite there yet.

Interviewer: Is there anything else you would like to say about this escaperoom that I haven't talked about yet?

Well at the end, say the solution was to find a bottle of whisky, which had a key to it, and then at the end you got whisky, which was a nice touch.

Participant 5:

Interviewer: Can you tell me briefly about the context of the escaperoom? What was the story about and where was the escaperoom?

1: It was Alice in Wonderland, here in Enschede, at Escaperoom Enschede.

2: Somewhere in Tilburg, not sure. Something with, no (I don't remember what it was about)

3: Dwingeloo in Drenthe, it was about a local mystery from the village's history.

Interviewer: What elements or details did you like most in the escaperoom? What are things you remembered from the escaperoom?

1: I liked it, they had these little, lots of rooms, so also that little door in Alice in Wonderland where you then have to go in. I hadn't seen the movie myself, so for me it was kind of hard to recognize things. But I think a lot of aspects of the movie came back, you also had something with hats, which you had to put on different sizes and a room with tiles. I think a lot of it came back from the movie, and then you can say something more about it.

2: I think it was a crazy casino that we were in, something with games and puzzles and everyone was thinking very stupidly and I solved that puzzle. That's the only thing I remember.

3: Yes the interaction, lots of different rooms, it was fun, lots to do.

Interviewer: Is there anything you would change about the escaperoom that you would have done differently or really didn't like?

1: I did find it difficult at times, that we couldn't figure it out, we did have a help desk, so we were allowed to call if we couldn't figure it out, but we were with an English-speaking person, and everything was in Dutch, so I had to go on-call and translate for him as well. So maybe that too just something, but other than that, we just didn't make it, which was a shame. Yes it was my first escaperoom experience, but so I think it was anyway that that call was there, then at least you could continue if you got stuck. Other than that, I can't think of anything like that.

2: I don't know, didn't necessarily think anything needed to be changed, but I just didn't like the theme that much. It was too casino-like.

3: Yeah the theme wasn't super strong, but enough to give a bit of a reason for the escape room, other than that the puzzles were so diverse and fun that it didn't matter that much to me.

Interviewer: What difficulty rating would you give the escape room?

1: He was so, considering I haven't seen the movie, I would give it an eight. We came out on some things, but I think it (the escaperoom) was especially more fun if you had seen the movie.

2: So I solved one puzzle, the rest was beyond my knowledge, I'm just not that familiar in a casino. Grade I think is an eight.

3: I would give it an eight, though. Lots of diverse puzzles. Very diverse puzzles. In the end the escape room took quite some time, you had to keep on pushing the whole time.

Interviewer: Was it dark in your escaperoom? And what was the light like?

1: I think it varied by room, at least in the room where we were the longest it was light, but at one point you could see through to another room, there it was still dark, but when we got there that (room) did get light again.

2: With us it was light all the time, no darkness or anything.

3: Ours was just dark, it was an old barn, an old farmhouse that the (escaperoom) was located in, so light suited that.

Interviewer: Were there any moments where it was crucial to work together as a team in this escaperoom? Or were all puzzles solvable individually?

1: No, there was indeed one thing where multiple people did have to do something together, that one had to hold something up in another room so that then in the other room something was released. But overall I think the majority could have been solved individually.

2: Wasn't necessary, you could solve it just fine on your own if you were smart enough.

3: Yes there were things, but not very many. If you had one or two good puzzlers you usually figured it out, it was more that sometimes you could solve two puzzles at once, just for speed.

Interviewer: Which puzzles did you like best?

1: I think when we were in the last room, then you had a kind of phone lying there that had to be released, you saw that, and before that you had all kinds of balls and you had to put them in a hole with certain colour combinations, but we had that, that was maybe also the combination that we had adrenaline at that time because we almost ran out of time, that we suddenly figured out how it worked, you didn't need the knowledge of the film for that either, the combination of that, I don't remember exactly what puzzle it was, but it was something with colour combinations and if it went wrong the ball came back, and if it was right, then the phone opened and then you could get further out of the room.

2: I know mine was about, a little puzzle with playing cards, that's all I can remember. Something with the numbers.

3: I also liked the puzzles where you actually had to do something physical, something tangible that you had to do something with, for example a mens-erger-je-niet game, that you had to play out the game that just said, 'player 1 throws a four, player x that' which was very fun, very creative.

Interviewer: Are there any things you all want to add that I haven't asked about yet?

1: No

2: No

3: No

Appendix C: Expert interviews

Participant 1:

I: What is your experience with escape rooms?

I have played around 120 commercial rooms. The number is still growing of course. I have a company in which we design escape games or games in general for museums but with a special focus on escape games and escape game mechanics. And I am studying at the moment for my master at university in game design about educational escape games. How we could learn from commercial escape games and use them in education.

I: How would you define an escape room?

So, when you talk about an escape room in the old term, then I would say it is an experience for a group. Normally 2-4 people, sometimes more, sometimes less. You have a defined time limit and most importantly you have a goal you have to achieve to get out. But If I talk now about that I always say, still very important is the team, still very important is the challenge they have to overcome together. The goal so that they know what they have to do. But the time and the space or the room is not that important anymore. So spaces could be just a normal room but they also could be a huge factory hall or a small box or a caravan. So that's not that defined anymore. Also the time is not. During the early phase it was always 60 minutes but now you have longer games or you have games without any time restriction as well.

I: What is the goal of an escape room from a design perspective?

So for me, it is that who the people play the game have fun together. So that sounds very obvious but if you design serious games or educational games you know that fun is not always that much in the focus. But I think that an escape game is really standing for fun together and achieving something. So if I am designing an escape game I try to have this in my mind. SO: what kind of challenges can I give them, do they have to work together and how can they complete them in a good way? I want them to have a great experience, I want them to finish in a good mood, to be the heroes of the day or what ever the topic of the story is but they should feel good!

I: Can you describe the process of designing an escape room?

I will tell you about when we design an educational escape game because there is a difference there. If I work with clients normally they always have a topic in mind when they come to me. So as a first step we have a workshop where we talk together about their topic and their wishes. Most of the times the topic is very complex so they are thinking about climate change or something like that. So something that is, even if you just hear a talk about an hour about it, it would be hard to understand the whole topic. So if you play a room of an hour, it is even harder. We talk a lot about the topic and we talk about if there are small side stories that are interesting enough, so that we can use them. This is more brainstorming about topic and stories in the first place.

Then we have a lot about the space. Because that is the other very important thing for us. If we have to design something that has to be outside we have restriction which are very hard. If it has to be in a permanent environment we have to build in another way that if it is just for an exhibition which is there for about six months. We also know how the light situation is, are we in a fire restricted area? This is something which is always very important. We see if they have enough electronic plug ins, this are always the small things but we have to know that in the first place before we start to really brainstorm. Otherwise you have a great idea and then you realize it wont fit through the door or there is no lift near the exhibition room or whatever.

Then we talk about the core questions which they want to have answered. Normally if you work with a museum they already know. I ask them: okay, if the player after one hour player time, walk out of the game what should they remember. What should they tell their coworkers the day after they have played the game? And these questions which they still have in mind after this, are our core questions. When we are designing puzzles or puzzle mechanics we will still always try to remember if these questions are answered by the puzzles.

When we have our core questions we will be brainstorming about puzzle mechanics. And we try, which is really hard and it doesn't work at all, all the time. Sometimes it works and that's amazing but we try to find mechanics which fit the thing they should learn. So if they should explore something we try to find the mechanics which is going fully on the exploring part. Or if it is communication, if they have to find clue than we really look to find something to let them feel how it is to find clues. Not just reading stuff but more like hands on.

When we have defined the mechanics we would like to use then we are going into to the puzzle creation. Than the most important thing: creating paper prototypes for every puzzle. Very early on in the process. We try to test the puzzles, with friends mostly and try if they find out what they have to do. We ask them after wards: what do you think we want you to learn by doing this? If their story fits our story than it is perfect. If they tell something completely in a different way than we have to possibly go over it again.

We have this feedback loop of trying to make the puzzles better and then we start with the truly designing process. But first paper prototype and the paper prototype has to work, then we can really design a puzzle. There are still problems then. Sometimes the mechanic works perfect in a paper prototype but if you want to build it in a larger scale you realize, oh, it does not work like oh, this RFID is no strong enough to come through the thickness of wood or something like that.

Woven through all of these things is the story. So, we have the first brainstorming when we talked about the topic, the stories which are popping up. And all the time when we try to create a puzzle we are challenging if this fits into our very loose but still our over all story. Always ask if it does make sense that the players have to do that at this point in our game.

I: What are elements of an escape room which are necessary for a good user experience?

I think what in a lot of educational escape games are missing, which are normal in commercial escape games is emotional tension. Normally I only see tension because you have a time limit but if you want a really nice game, you also want tension because the story is moving on. Or just the in group pressure like: We should do that now! Or what ever. I think that is something that is, for me, a key factor in every escape game. And the tension does not have to be that hard or all the time. You have to find a balance, how to bring the players through the game.

Also emotion. Because I believe that a lot of educational escape games are more like a test in the school. So if you solve it right, than you are the winner, yay. But I think that in this medium it is so much communication and working together that emotion could be so helpful. It is also very good for learning experiences. It believe that these are the keys in every escape game that you think about which emotions players should have and at which points. So how could we reward them, or how could we stress them out for a moment and then release them again so they have this roller coaster of emotions.

I already said communication. It does not work if there is no communication within the groups. However, it could be an interesting moment if you play with that so they can't communicate for a certain amount of time and then they could. That could be very interesting. Again emotions.

I: What are elements of an escape room, which in your opinion, do not work well?

So you heard it probably already but I think that red herrings are a no go because if I watch players play, they always find their own red herrings. They are already confused so if I try to confuse them even more than I am not a good game designer, in my opinion.

The other thing is that very often it is not clear for the player on what type of puzzle they are working on. So if they know what pieces they need and what puzzles they work on or what the way is, or what the goal is, the flow is much better. They will just go on and very often in games that I consider as not so good we were struggling by: 'What is the thing that we are working on at the moment? A lot of game designers think that they should make the puzzles difficult or if it is too easy for the players to find out which part is working, than the whole thing is too easy. But in my opinion it is not. If you want to create a great flow and atmosphere than you need the players to move on the whole time and have ideas and be inspired. Frustration is a part, you should not avoid frustration at all but only use it small parts and not ten minutes long for the same puzzle.

I: What are challenges you might face during the design of an escape room?

The true answers is normally money and time. It is very often in our kind of creative process. If you normally design a commercial room, you have to rent the room already long before you can open. That is a financial problem. In addition, you face restrictions from the room or the caravan or what ever which you really should have in mind from the beginning. That is also a thing, a lot of first designers kind of forget about it until they realize: 'Oh yeah, there are some fire restrictions'. Keeping all of that in mind is important. You are always very inspired by creating the story and making the puzzle but the hard facts, you cannot deny during the process. To keep them on the map, be consistent with them. Do not lie to yourself about them, you cannot change them so accept them and involve them in your process.

I also see that most game designers should test more. We always test not enough even if we test a lot. Because normally you have a date where you want to open. And you have, in your plan, that your last 3 or 4 weeks are for testing and adapting. Just testing would be nice but you still have to adapt it, so four weeks is a little short. The real life appears and the four weeks shrink together to two weeks or one and a half weeks until the opening. Then you normally conduct a test weekend and that is mostly not enough. I would say, if you design an escape game, take more then four weeks for the testing period. Than it will, in the end, around three weeks of testing.

I: Which educational advantages could escape rooms have in your opinion?

I just talked with my coworker about that because she is a teacher in primary school. She told me that at the moment in schools, there is a lot going on about soft skills. So the students should learn about how to communicate, how to get over frustration, how to find new ways around a problem, how to work in a group. All these things, and even sometimes just how to make a knot, or how to open a knot, how to read a map or something like that. I think educational escape games are perfect for that. The are also very good for the students who are normally not the stars of the class, since they could shine. Maybe their idea is the perfect idea, or maybe they have an input to the group which helps the group going forward. I think that is perfect. It helps also to break down the normal school working day. It could also just be good for teamwork exercises and it gives a new perspective on the topic or a first impression of a topic.

I also that that a lot of educational escape games do not do enough is debriefing in the end. Talk to the students about what they have experienced. What emotions did they have about that? You will have talks with them about the topics, sometimes even talks about very deep topics which you normally would not have.

I: We are designing a mobile escape room in a Airstream caravan, are there any challenges you foresee?

There are some challenges! The first thing I think which I already said is that you have a car that is moving in between the games. You have to think about how to make everything not moving due to the drive. Also, how to design it that the players will not think that your measurement to keep everything in place are part of the puzzle.

The Airstream will probably not be insulated very good, I am not sure about that but it might be very cold in winter and very warm in summer. If you work with technical stuff like Arduinos really make sure that the Arduino can handle the temperature changes.

You also have a tight space. Hiding stuff, under the floor, the ceiling can be a problem. You cannot bring in a second ceiling to hide everything the player should not see. All the cables have to be hidden, this might be difficult.

You also only have one room. You could find solutions by splitting the caravan into smaller pieces or to build some cupboard which can be locked and opened. It is really fun to find ways to create spaces that the player did not expect: under the sofa, the bed or what ever is in there. That is really nice! It is hard to do!

There will probably be also some kind of problem with humidity. If it is raining outside the air in the caravan can get very humid and cause mold and deformation problems within wooden objects. So things which can normally open without a problem, might not open at all due to moisture deformation. Please test your puzzles in different conditions.

The opportunity to move around sounds like a lot of problems but there is also a lot of good stuff going on here! There is a chance of a really really nice escape room due to the caravan!

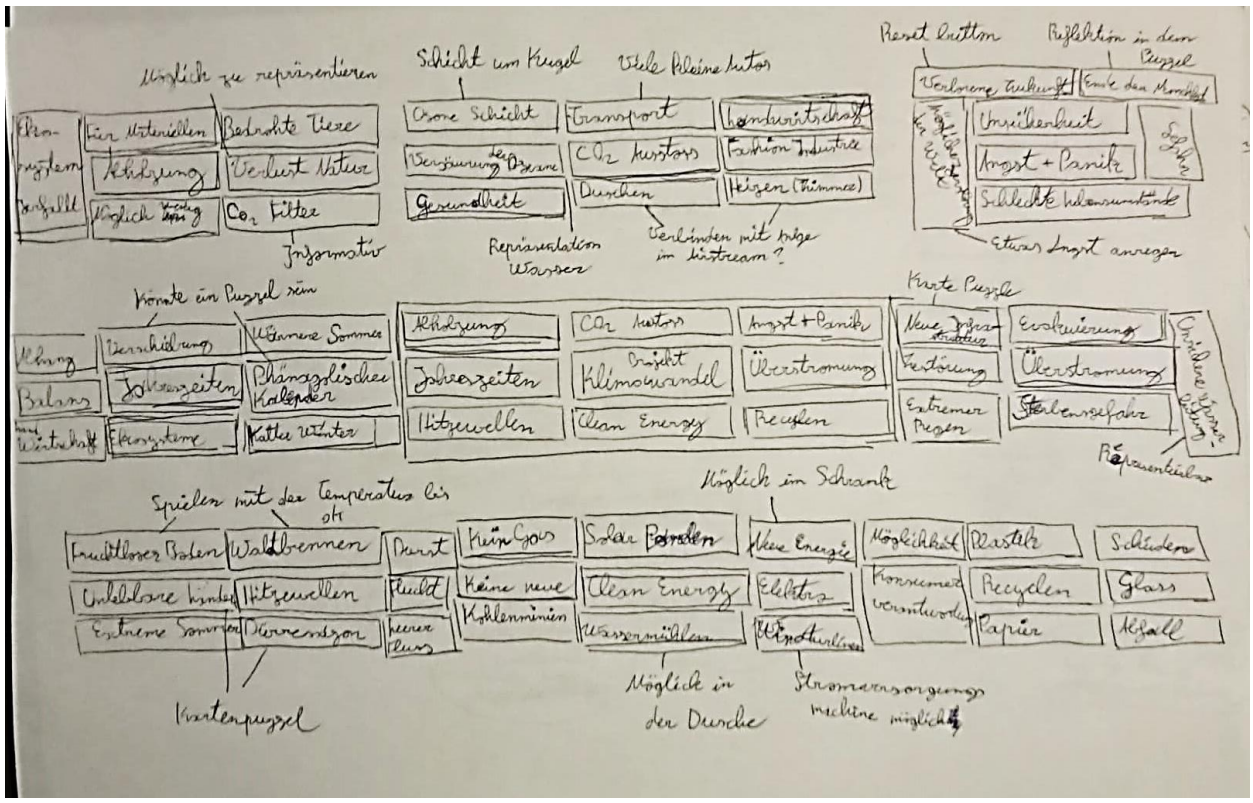
I: What adaptations need to be made in order to create an escape room in a limited space?

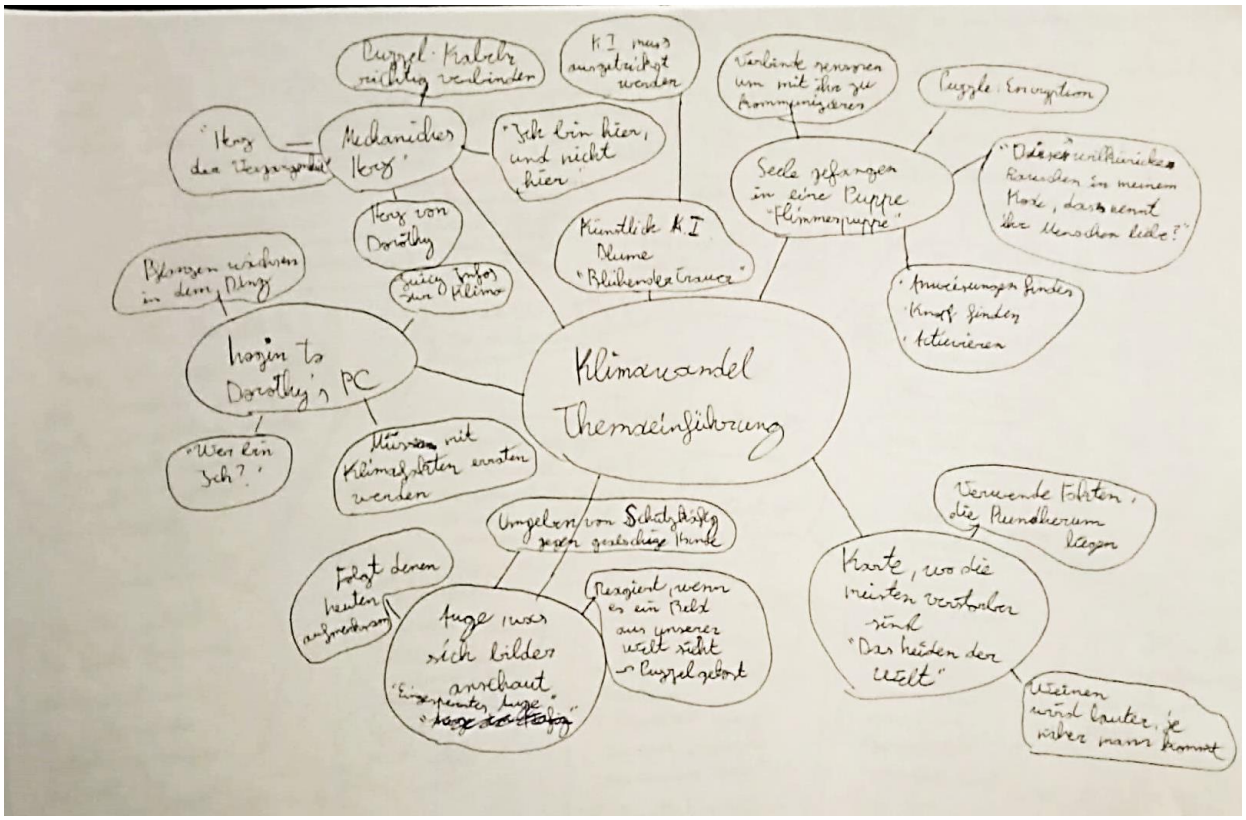
We normally tend to forget about the sizes during the creation process. The space is always bigger in our mind, but the physical objects always takes up more space than expected! I would say: being very close to the room or the space or the box is important. Always directly check if it really fits in, it is very important and helpful. Try to make rough models of the sizes that are available for you!

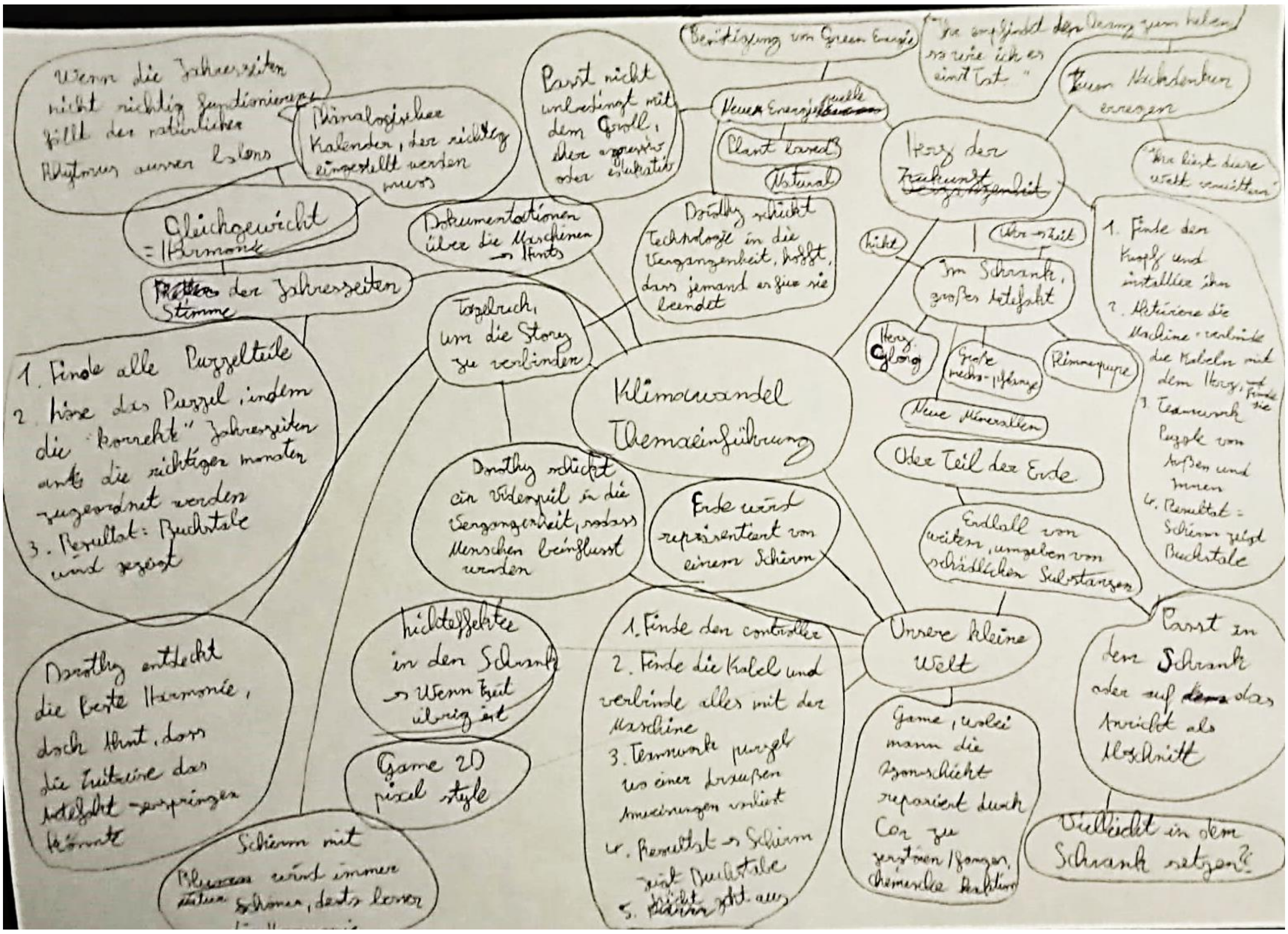
Appendix D: Enumeration of all BCTs

Page	Grouping and BCTs
1	**1. Goals and planning**
	1.1. Goal setting (behavior) 1.2. Problem solving 1.3. Goal setting (outcome) 1.4. Action planning 1.5. Review behavior goal(s) 1.6. Discrepancy between current behavior and goal 1.7. Review outcome goal(s) 1.8. Behavioral contract 1.9. Commitment
3	**2. Feedback and monitoring**
	2.1. Monitoring of behavior by others without feedback 2.2. Feedback on behaviour 2.3. Self-monitoring of behaviour 2.4. Self-monitoring of outcome(s) of behaviour 2.5. Monitoring of outcome(s) of behavior without feedback 2.6. Biofeedback 2.7. Feedback on outcome(s) of behavior
5	**3. Social support**
	3.1. Social support (unspecified) 3.2. Social support (practical) 3.3. Social support (emotional)
6	**4. Shaping knowledge**
	4.1. Instruction on how to perform the behavior 4.2. Information about Antecedents 4.3. Re-attribution 4.4. Behavioral experiments
7	**5. Natural consequences**
	5.1. Information about health consequences 5.2. Salience of consequences 5.3. Information about social and environmental consequences 5.4. Monitoring of emotional consequences 5.5. Anticipated regret 5.6. Information about emotional consequences
8	**6. Comparison of behaviour**
	6.1. Demonstration of the behavior 6.2. Social comparison 6.3. Information about others' approval
9	**7. Associations**
	7.1. Prompts/cues 7.2. Cue signalling reward 7.3. Reduce prompts/cues 7.4. Remove access to the reward 7.5. Remove aversive stimulus 7.6. Satiation 7.7. Exposure 7.8. Associative learning
10	**8. Repetition and substitution**
	8.1. Behavioral practice/rehearsal 8.2. Behavior substitution 8.3. Habit formation 8.4. Habit reversal 8.5. Overcorrection 8.6. Generalisation of target behavior 8.7. Graded tasks
11	**9. Comparison of outcomes**
	9.1. Credible source 9.2. Pros and cons 9.3. Comparative imagining of future outcomes
12	**10. Reward and threat**
	10.1. Material incentive (behavior) 10.2. Material reward (behavior) 10.3. Non-specific reward 10.4. Social reward 10.5. Social incentive 10.6. Non-specific incentive 10.7. Self-incentive 10.8. Incentive (outcome) 10.9. Self-reward 10.10. Reward (outcome) 10.11. Future punishment
15	**11. Regulation**
	11.1. Pharmacological support 11.2. Reduce negative emotions 11.3. Conserving mental resources 11.4. Paradoxical instructions
16	**12. Antecedents**
	12.1. Restructuring the physical environment 12.2. Restructuring the social environment 12.3. Avoidance/reducing exposure to cues for the behavior 12.4. Distraction 12.5. Adding objects to the environment 12.6. Body changes
17	**13. Identity**
	13.1. Identification of self as role model 13.2. Framing/reframing 13.3. Incompatible beliefs 13.4. Valued self-identify 13.5. Identity associated with changed behavior
18	**14. Scheduled consequences**
	14.1. Behavior cost 14.2. Punishment 14.3. Remove reward 14.4. Reward approximation 14.5. Rewarding completion 14.6. Situation-specific reward 14.7. Reward incompatible behavior 14.8. Reward alternative behavior 14.9. Reduce reward frequency 14.10. Remove punishment
19	**15. Self-belief**
	15.1. Verbal persuasion about capability 15.2. Mental rehearsal of successful performance 15.3. Focus on past success 15.4. Self-talk
19	**16. Covert learning**
	16.1. Imaginary punishment 16.2. Imaginary reward 16.3. Vicarious consequences

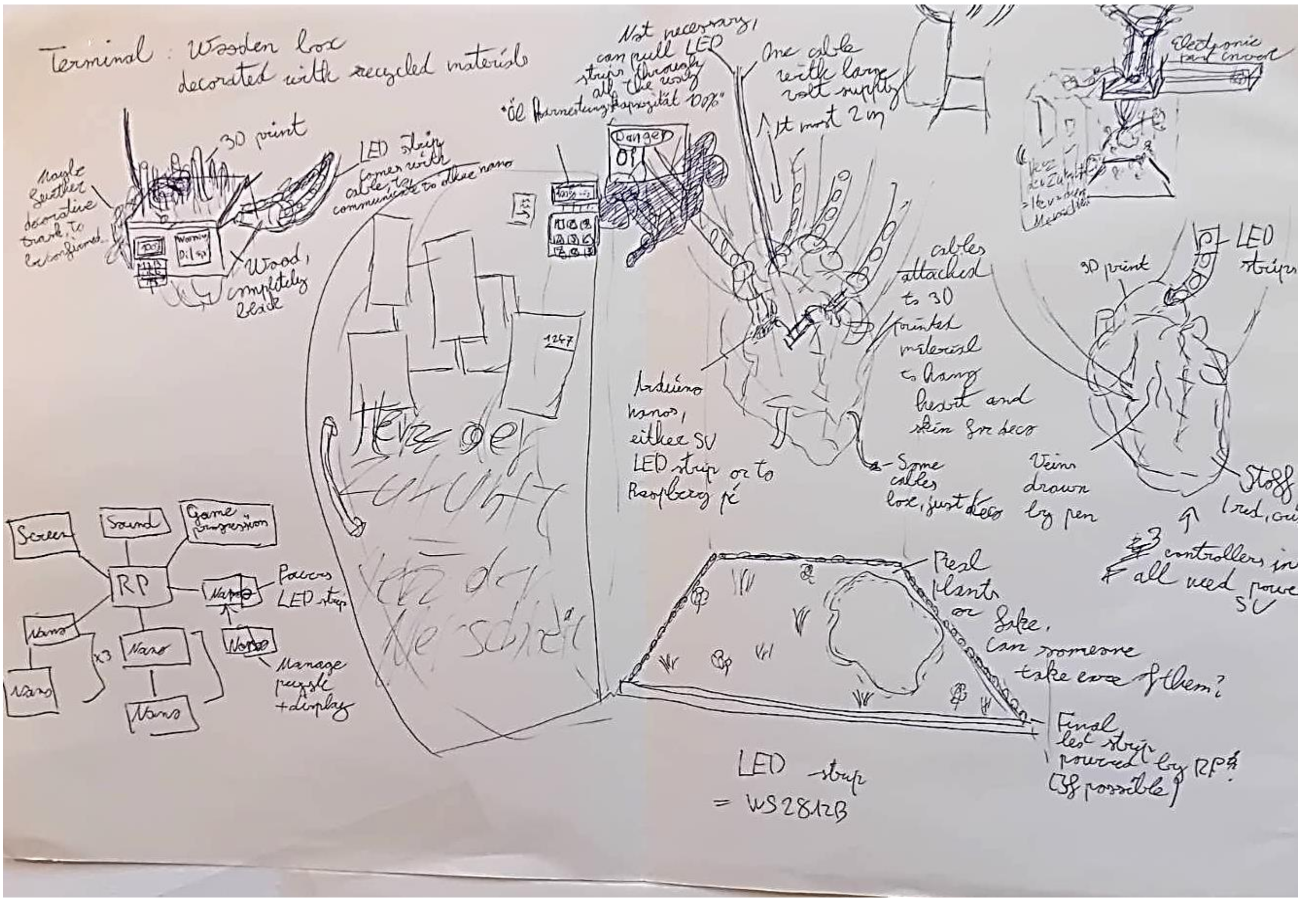
Appendix E: Images of brainstorming



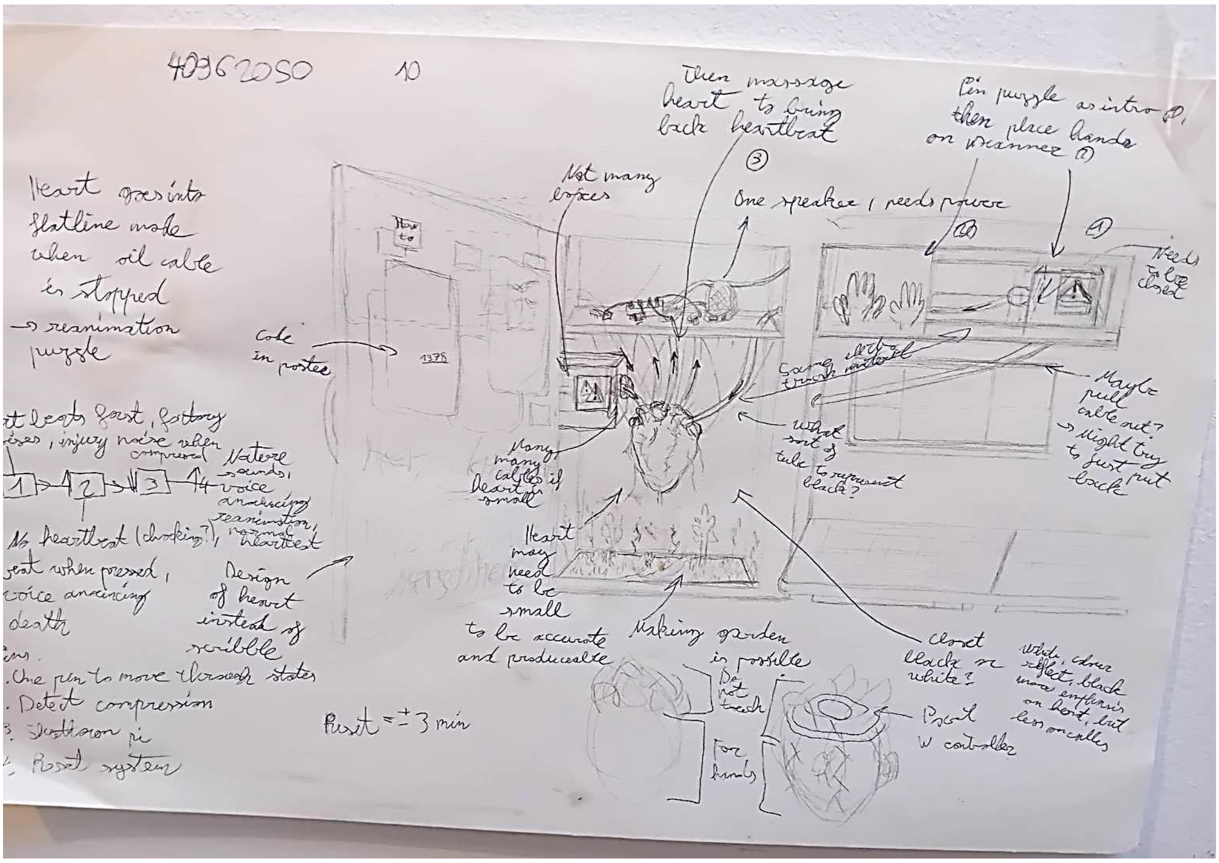




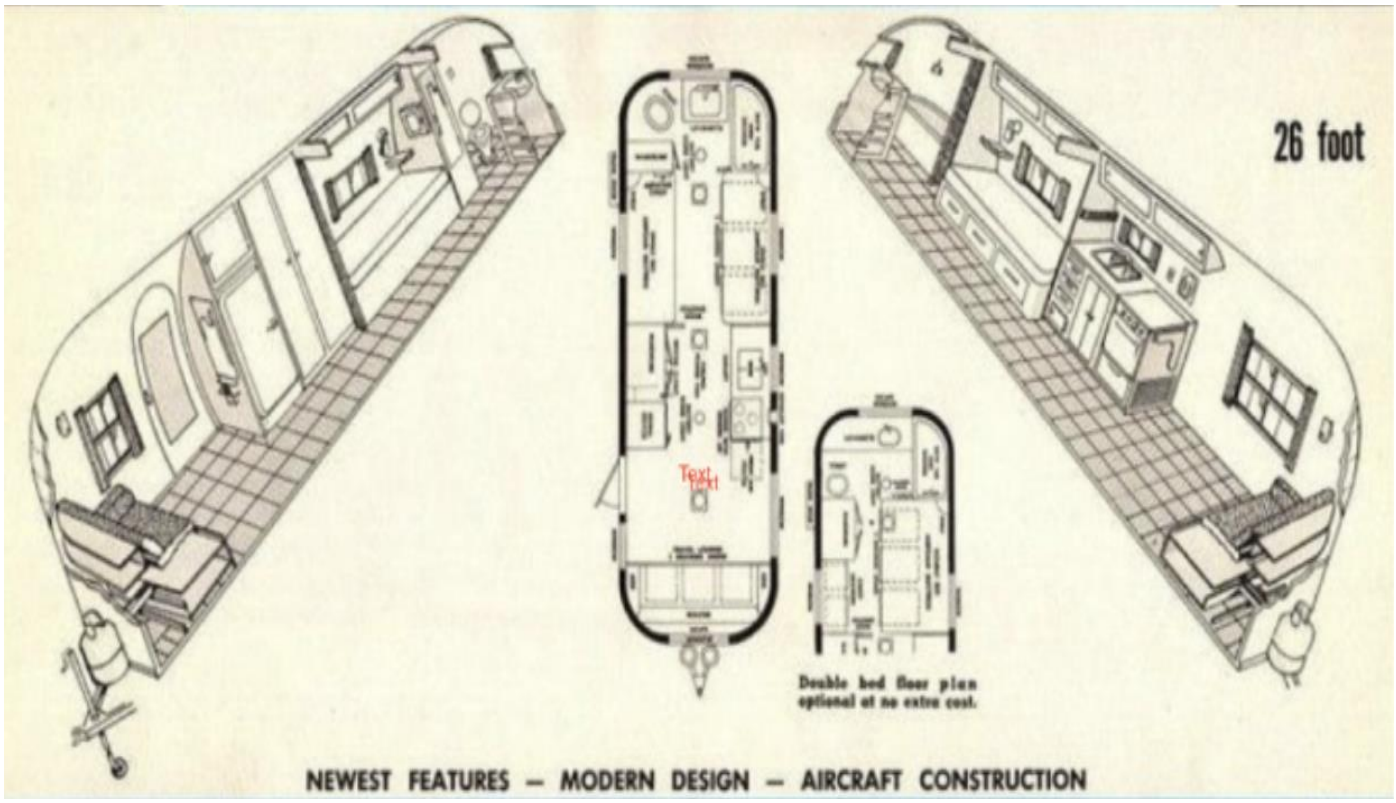
Klimawandel Themaeinführung
Gleichgewicht = Harmonie
Unsere kleine Welt
Oder Teil der Erde
Neue Mineralien
Game 2D pixel style
Im Schrank, großes Artefakt
Dokumentationen über die Maschinen

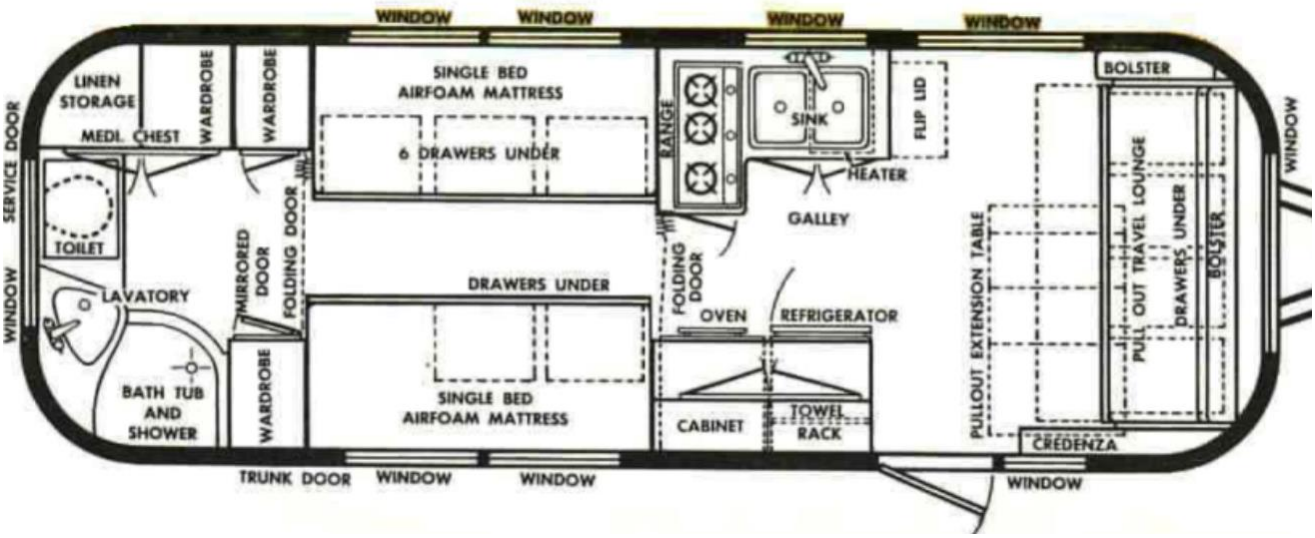


Terminal: Wooden box decorated with recycled materials
3D print
LED strip
Danger
One cable with large volt supply
At most 2m
cables attached to 3D printed material to hang heart and skin for deco
Arduino nanos, either 5V LED strip or to Raspberry pi
Vein drawn by pen
Screen
Sound
Game progression
RP
Nano
Real plants or fake. Can someone take care of them?
LED strip = WS2812B


Then massage heart to bring back heartbeat
Pin puzzle as intro
then place hands on scanner
One speaker, needs power
Heart goes into flatline mode when oil cable is stopped
→ reanimation puzzle
Code in poster
Not many boxes
Heart may need to be small
Making garden is possible
Closet black or white?
Reset = ± 3 min

Appendix F: Visuals, blueprints and pictures of Airstream caravan




WINDOW
WINDOW
WINDOW
WINDOW
LINEN STORAGE
WARDROBE
WARDROBE
SINGLE BED AIRFOAM MATTRESS
6 DRAWERS UNDER
RANGE
SINK
FLIP LID
BOLSTER
SERVICE DOOR
MEDI. CHEST
HEATER
WINDOW
TOILET
FOLDING DOOR
GALLEY
MIRRORED DOOR
FOLDING DOOR
DRAWERS UNDER
PULLOUT EXTENSION TABLE
PULL OUT TRAVEL LOUNGE
DRAWERS UNDER
BOLSTER
WINDOW
LAVATORY
OVEN
REFRIGERATOR
BATH TUB AND SHOWER
WARDROBE
SINGLE BED AIRFOAM MATTRESS
CABINET
TOWEL RACK
CREDENZA
TRUNK DOOR
WINDOW
WINDOW
WINDOW

Appendix G: Personas of end-user and client

1. Core demographic

The persona is Tomas Gibsnich, a 23 year old computer science student in Vienna, Austria, originally from the Rheinland region, Germany, who has already been confronted with the thematic of climate change once prior to engaging with the EER and is therefore aware of its existence.

2. Thought

I've already heard so much preaching about climate change, I wish everyone would just stop talking about it all the time...

3. Current stage of life

Tomas are currently in a stage of his life where he is exploring what he wishes to do later, where he wishes to be, what sort of life he wishes to live etc. Furthermore, this is the first time period where he is away from his parents and truly responsible for his own actions.

4. Knowledge climate change

From news and social media, Tomas has certainly already been made alert of climate change. In addition to this, certain peers may have already engaged themselves in more green behaviour in certain ways from what he remembers. Even so, it has not struck him as salient enough to involve himself, due to lack of motivation and uneasy association with the thematic.

5. Perception of climate change

Tomas has heard of people, whose house has been flooded or who have witnessed forest fires, but in the Rhineland region, such events have not occured yet. He has noticed that summer has been getting warmer, but believes that summers has always been hot. Tomas has therefore not had any significant contact with climate change yet, making it appear as a far-away scary story that does not affect them.

5. Everyday activities

Tomas is primarilly concerned with finishing his master thesis which currently draws most of his attention. He furthermore also has a girlfriend and goes back home to Germany a few times per month. At the university, he enjoys playing football with others and going out for a drink on Fridays. He does not think greatly of what happens farther away in the world.

Persona of possible end-user

Wilberg Heinz

Job Title

EER designer

Age

30 to 54 years

Social Networks

Industry

Entertainment

Organization Size

20-40 volunteers

Preferred Method of Communication

The group largely communicates through various signal groups, and meets once biweek. Emal is also employed to relay messages.

Tools They Need to Do Their Job

* Prototyping and tinkering
* Miro board for organisation
* Airstream caravan (+ necessities)
* Tools for manual work

Job Responsibilities

Primarily, it must be ensured that the advice provided through the activity is indeed correct and will spurr visitors to desirable action. Furthermore, the physical safety of the players must not be compromised during the game and they must not be intimidated through an inappropriate tone

Biggest Challenges

- Navigating inside Relationships & Communications
- Employee Morale
- Problem Solving & Decision Making
- Friendly, persuasive tone towards customers
- Collaboration & Creativity

Goals or Objectives

The goal of the project is to spread the message of climate neutrality in a playful manner, and through this persuade the public to behave more sustainably and become active against climate change.

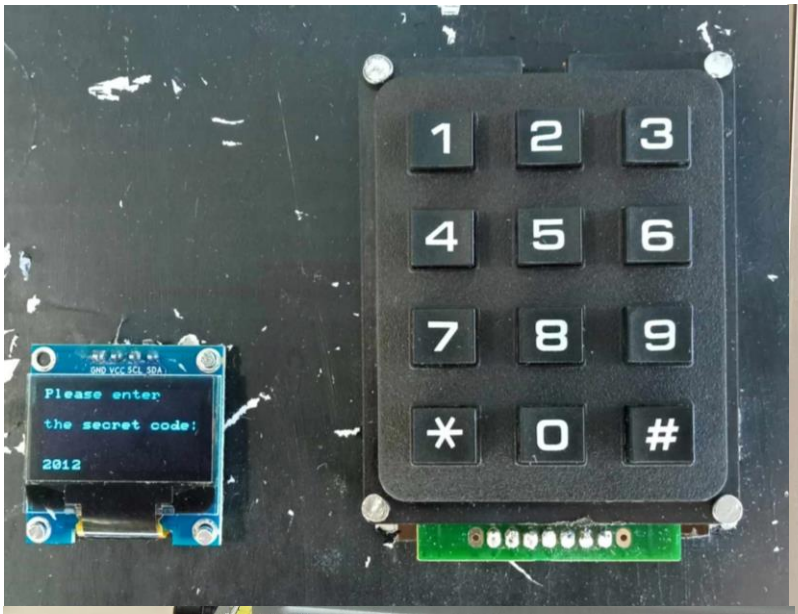
Quote: "Climate neutral by 2030!"

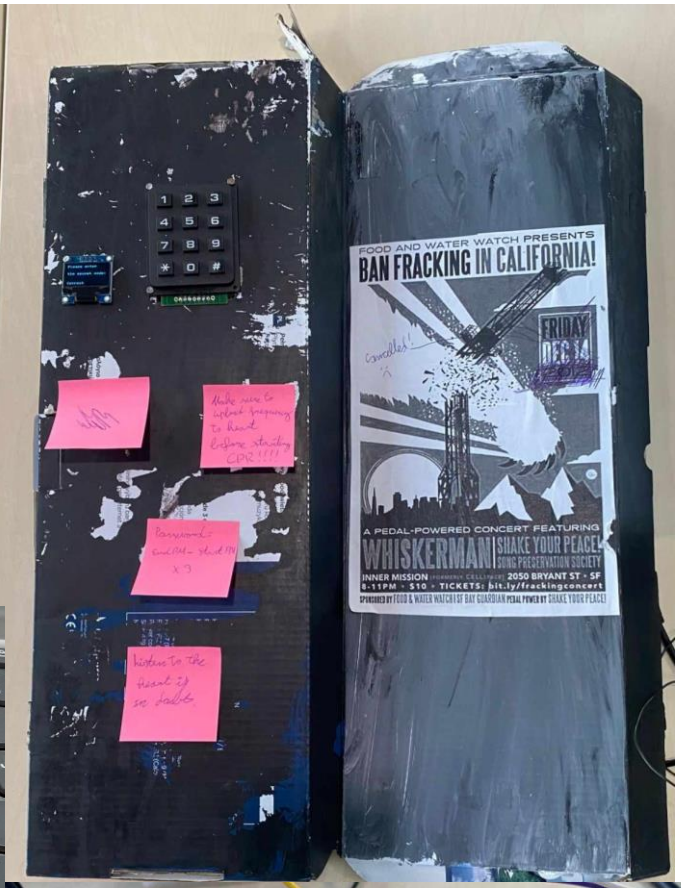
Wishes for final product

The final product should be "cool" and "mysterious", while also pertaining somehow to the furniture of the airstream. The themes of solarpunk, travel, climate change and futurism must be embedded into the design of the puzzles. The puzzles should convey a warning, but avoid a "lecturing tone". Overall, he collaboraters on this project are given much freedom to develop their ideas as they see fit.

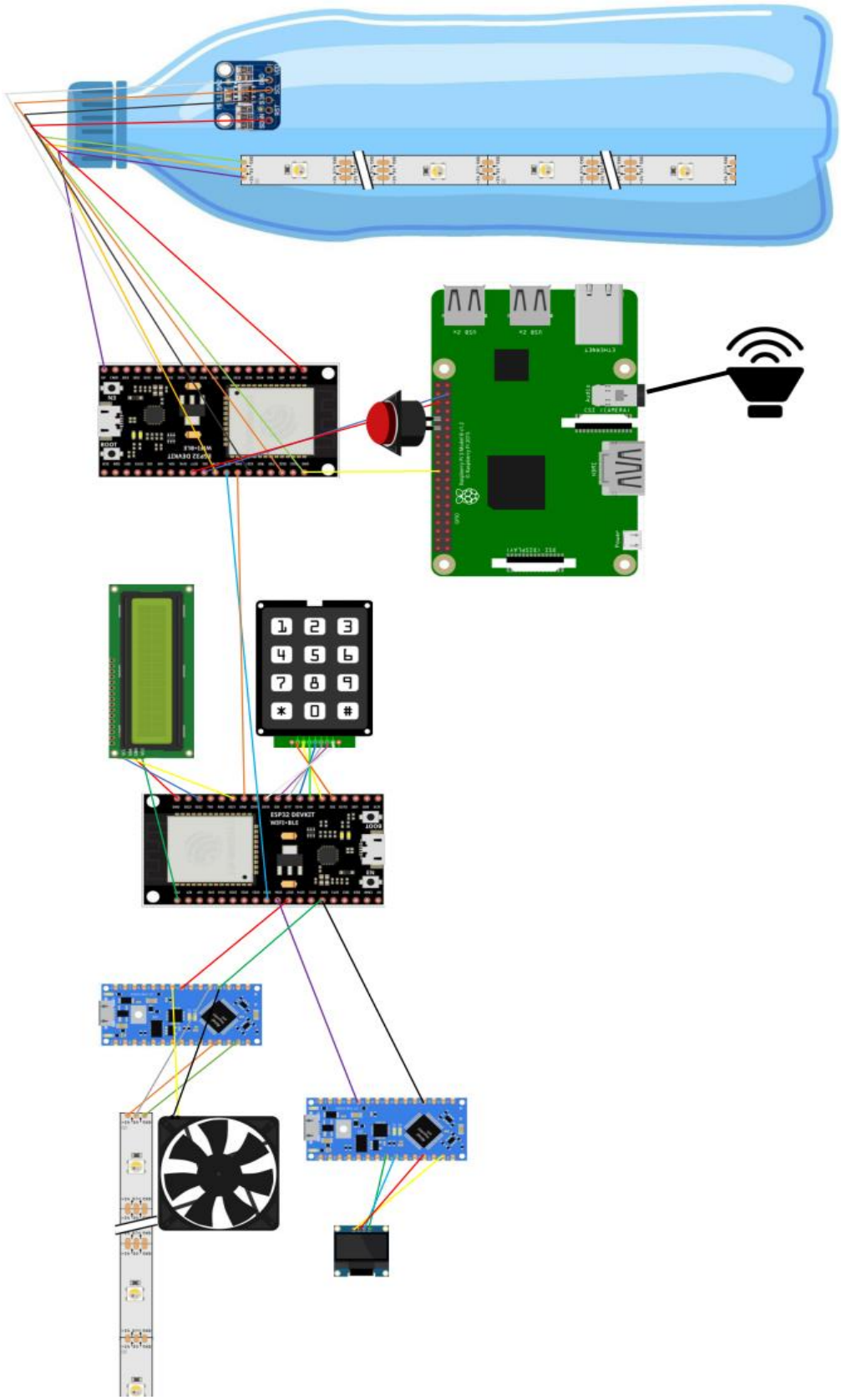
Persona of fused client design group

Appendix H: Further footage of early prototype

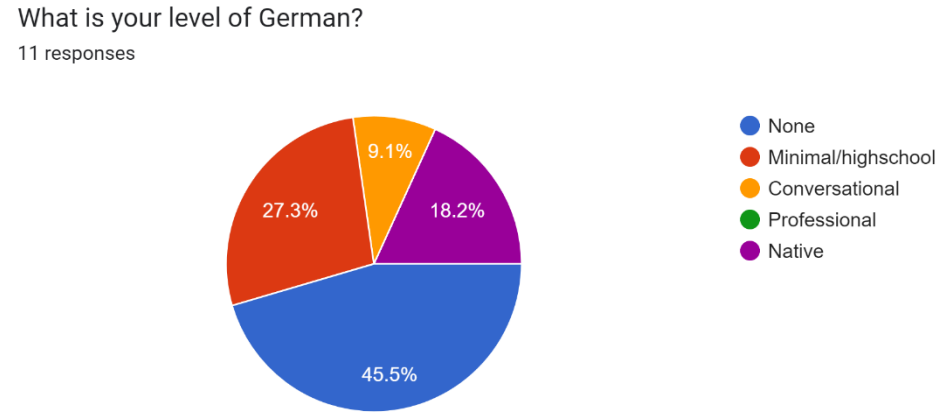


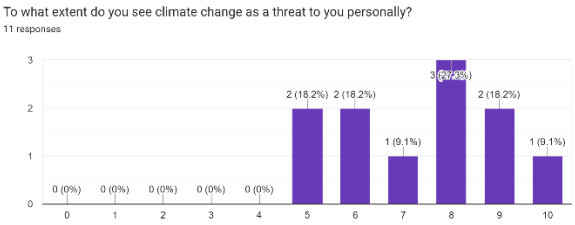


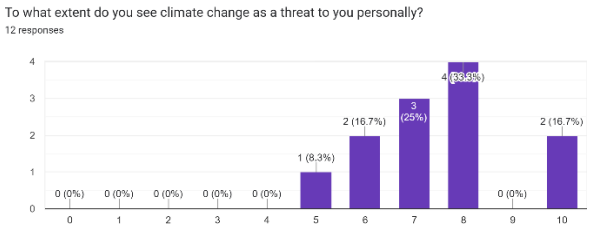
Appendix I: Fritzing diagram of entire circuit

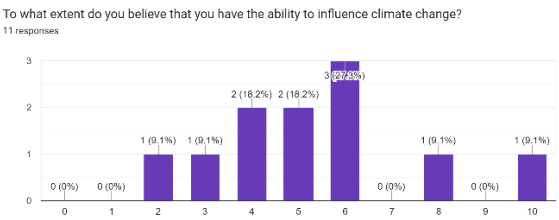


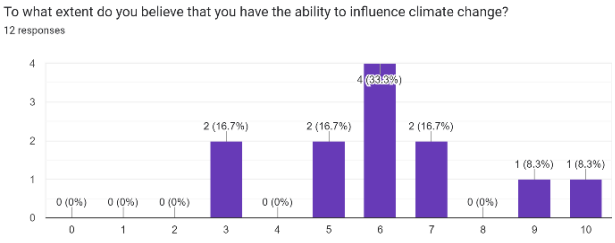
Appendix J: Recorded data of user evaluation











What do you believe is this installation about?

12 responses

Revoking the planet through sustainability

The effects of energy consumption on the welness of the earth

How do your things as an individual influences the climate

The impact of climate change in you personal lives, and the impact we have in the environment

Understanding the impact of climate change

Well i would have answered is was about knowing your footlprint or something but now that you ask me this after the previous question i guess my ability to change climate change

Making people more aware of energy consumption

Carbon emissions

climate change awareness

What stuck out the most during the experience?

12 responses

The high numbers of damage that we cause our only planet and home

The heart Reanimation

The heartbeat and reanimation

The fact that you could interact with the heart. That was really cool

The reanimation of the heart

Sticky heart, got to redo my reanimatie course, if you do something five times and it still doesn't work maybe you did it wrong, read the entire paper before making an assessment

The heart

The beating heart

The heart it looked and felt amazing

The design is l good

The language

the complexity

What were your thoughts on the heart artifact?

12 responses

It was really cool! It personifies our planted and makes it more dramatic

It looked impressive and felt real

It was the best part, it felt most real and urgent to solve with the pulsing light and beat

It was great! Really cool concept

Very creative and good symbolism

Sticky, very nice and cool, taking action and a cool voiceover

Very nice, well built.

Very cool. It made for a interesting physical interaction stimulating the senses

Amazing looked really cool and also felt really cool

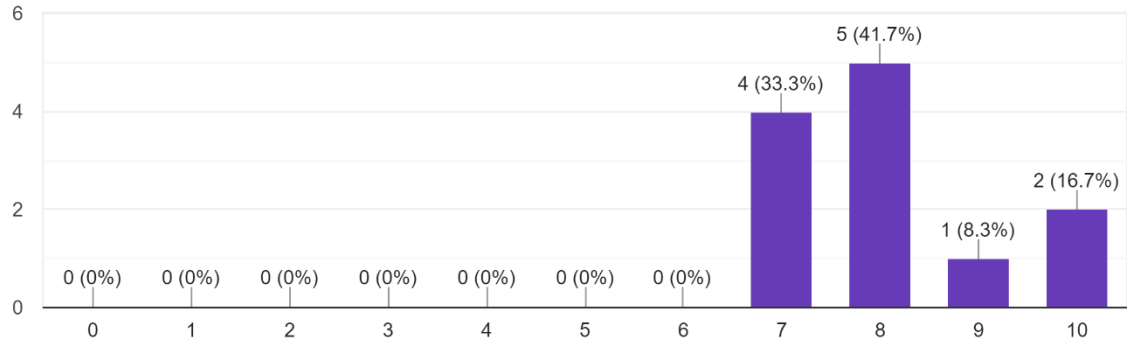
Very nice

Very real

grotesque

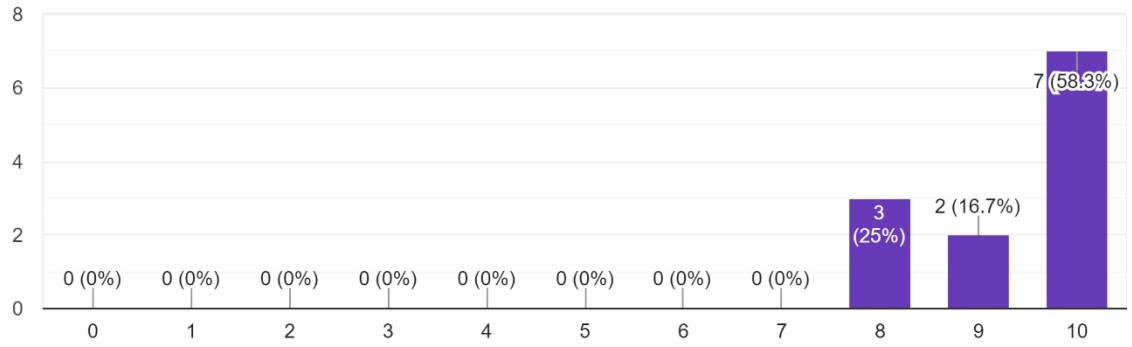
To what extent did you find the puzzle intuitive?

12 responses



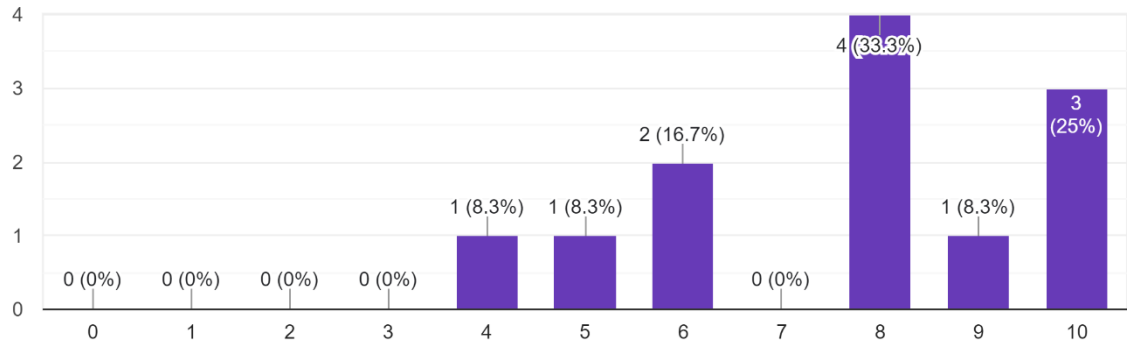
To what extent did you have enough time to solve the puzzle?

12 responses



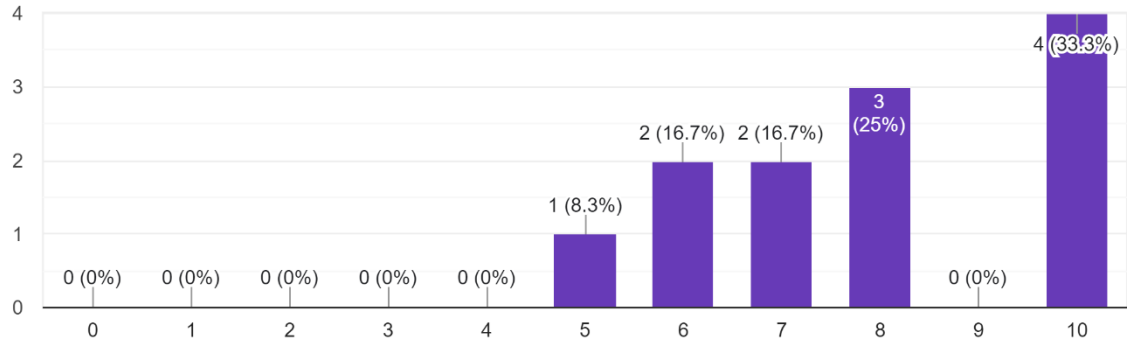
I was surprised by what I found in the closet.

12 responses



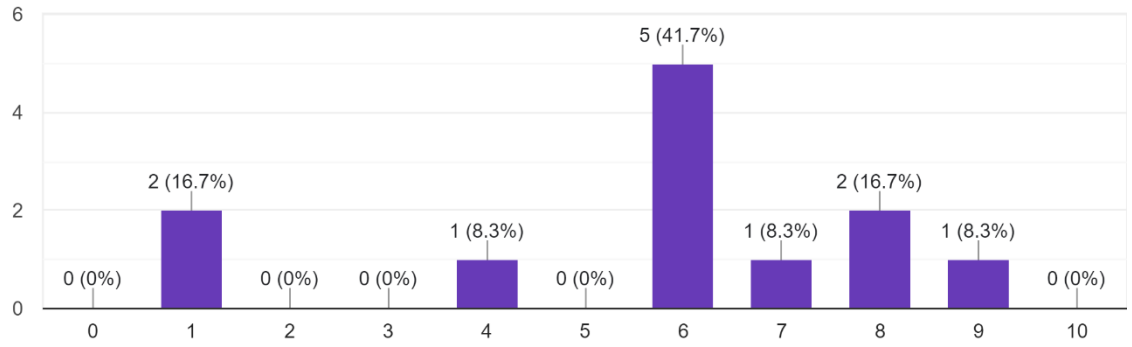
I felt excited during the experience.

12 responses



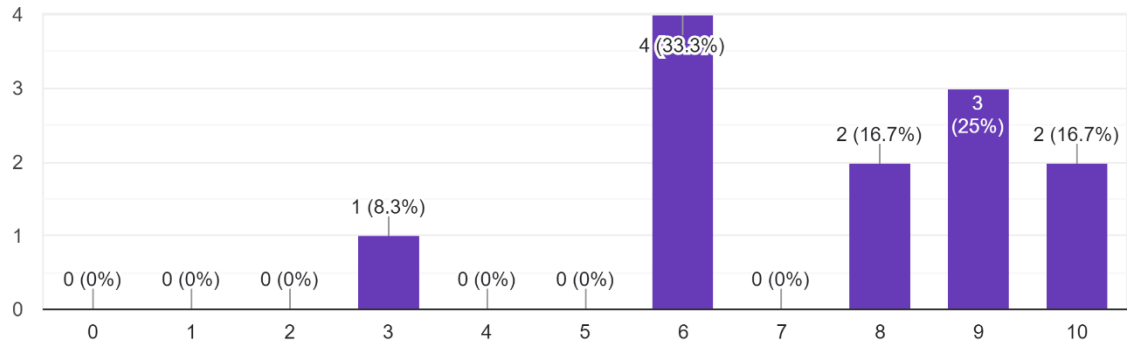
I felt anxious during the experience.

12 responses



I felt like my contribution to the group mattered.

12 responses



What could be improved in this installation?

12 responses

Make make the room a bit darker so it is more dramatic

More complex password gathering

The third Password question could be a bit more difficult

Not sure, I really enjoyed it

The last image could be more intuitive

Making the first question a little more clear

The shelf with wires maybe should be covered. Without explicit instructions, it may seem like it's part of the puzzle

The shelf with wires maybe should be covered. Without explicit instructions, it may seem like it's part of the puzzle

Make sure that the information is well illuminated so that people with bad eye sight can read. Also make the text big enough so that everyone can read it if you're in a group.

The diagram for the first password. We had some trouble actually finding the percentage. Maybe make it a bit easier to find cuz the finding was not very excitingbby itself. Just reading. Should not be too easy either though...

The riddles can be a bit more complicated

Maybe the language

quizz can be more complex

Do you have final comments for us?

8 responses

- It was nice! Good job :)
- It was cool
- Nice doing looks very cool
- -
- Good job, it was very enjoyable and educative.
- Liked it a lot. Maybe make the looking for the passwords a bit more physically interactive? That would make it even better
- Very fun game
- not particularly

Notes:

Test round 1

Persons: 1
Duration: 10:59
German: High

Hesitates for a bit, looks at the posters for quite some time.

Then proceeds to keypad. Not sure how to insert it. Takes some time to make sense of it all.

Gibt zwei Mal falsche Passwörter ein.
After one Tip, she finds the first one.
Findet sie alle schnell nach dem ersten .

Zweifelt ob sie das Herz anfassen soll.
Uh grusselig! Sagt sie

Animierte direkt das herz. Macht weiter auch wenn's schon fertig ist.

Test round 2

Duration: 7:49
Persons: 3
German: Mixed (2 High, one low)

Open closet, know they need a password. Ugh so slimy! It looks pretty cool.

They're working together to find a code. They understand it's three different numbers.

They find 19. Don't put it in right away. They first talk it through. Then they put it in. They're pressing all of them in one. Don't seem to know that it is one at a time. They have all the numbers right.
They think the number of cars is wrong.

They check out the oil production. They're sure the numbers are not wrong.

One figures out it's first one password. Aaaaah moment.

They reanimate the heart. They reanimate too fast. They understand the blinking. They adjust their speed.

Test round 3

Persons: 2
Duration: 12:38
German: None

Open lock quite quickly. It's a heart um ok. Look at text, think it's probably important. They figure out it's three questions and three passwords quite fast. They get the first one wrong.
They debate whether to enter first or all together. Decide to do all together in the end.

They move the factory, to no avail. They do not appear to find the right numbers. After debating, they put in the numbers.

One hint is given that they do not insert the numbers all as one. This makes them try more, but not to much avail. They contemplate some more.

They freak out when the heart dies. They try to reanimate quickly. They adapt to the speed. They do it too fast. Reanimation seems to be interpreted as fast.

They accomplish it in the end.

Test round 4

Participants: 3
Duration: 7:50
German: None

Open door, whoa! Classic heart in a box.
Oh no, we'll have to read Arthur's writing.
They scan the puzzles a bit. They don't understand German completely.
They catch on to heating. Take a moment to scan through the entire data set. They try the gas number first.

They try to find a relation between the oled and the puzzle. Is the code maybe a combination of all 3? One asks. They look at the books. They put in the right one. Percentage doesn't come across as completely clear.

After the first one correct they go fast. Do we have to squish it?? It feels weird. This makes me uncomfortable... I don't know if I'm doing this right. They finish quite fast.

Test round 5

Participants: 3
Duration: 8:56
German: None

Open closet to see heart. That's very inappropriate. It's very grotesque. One does not like. It's all in German. They are having some trouble starting. It's not very English speaking friendly.

They complain a bit. They figure out there's three riddles. They immediately know that they need to put in three passwords. They also go for the cloud number. They think they need to calculate.

One tries to connect it to the heart. Maybe related to heart attack. They fixate much on the 67.6%. they use a translating app. They figure it out with a translation app.

After that it goes fast. Now we have to reanimate. That's very squishy. Go! Go!. They keep going. That's gross. They go fast at first. One implores that it's dying. They do it in the end.

Test round 6

Participants: 2
Duration: 4:06
German: High

They open the lock after unraveling the poem. Ohh Gott. They analyse the puzzles all at once. Struggle a bit with the first one. Aaaah. They put in the numbers very quickly and then reanimate the heart swiftly.

Feedback:

First password was hard since there are multiple options. Maybe the heart should be the main focus. Could get more players involved in the reanimation. The noises from the closet make the experience.

Note on the usage of AI

During the preparation of this work, I used ChatGPT to write snippets of code regarding the employment of the LED strips and the button of the Raspberry Pi. Furthermore, ChatGPT's advice was requested at instances when technical failure was experienced. After using this tool, I thoroughly reviewed and edited the content as needed, taking full responsibility for the final outcome.