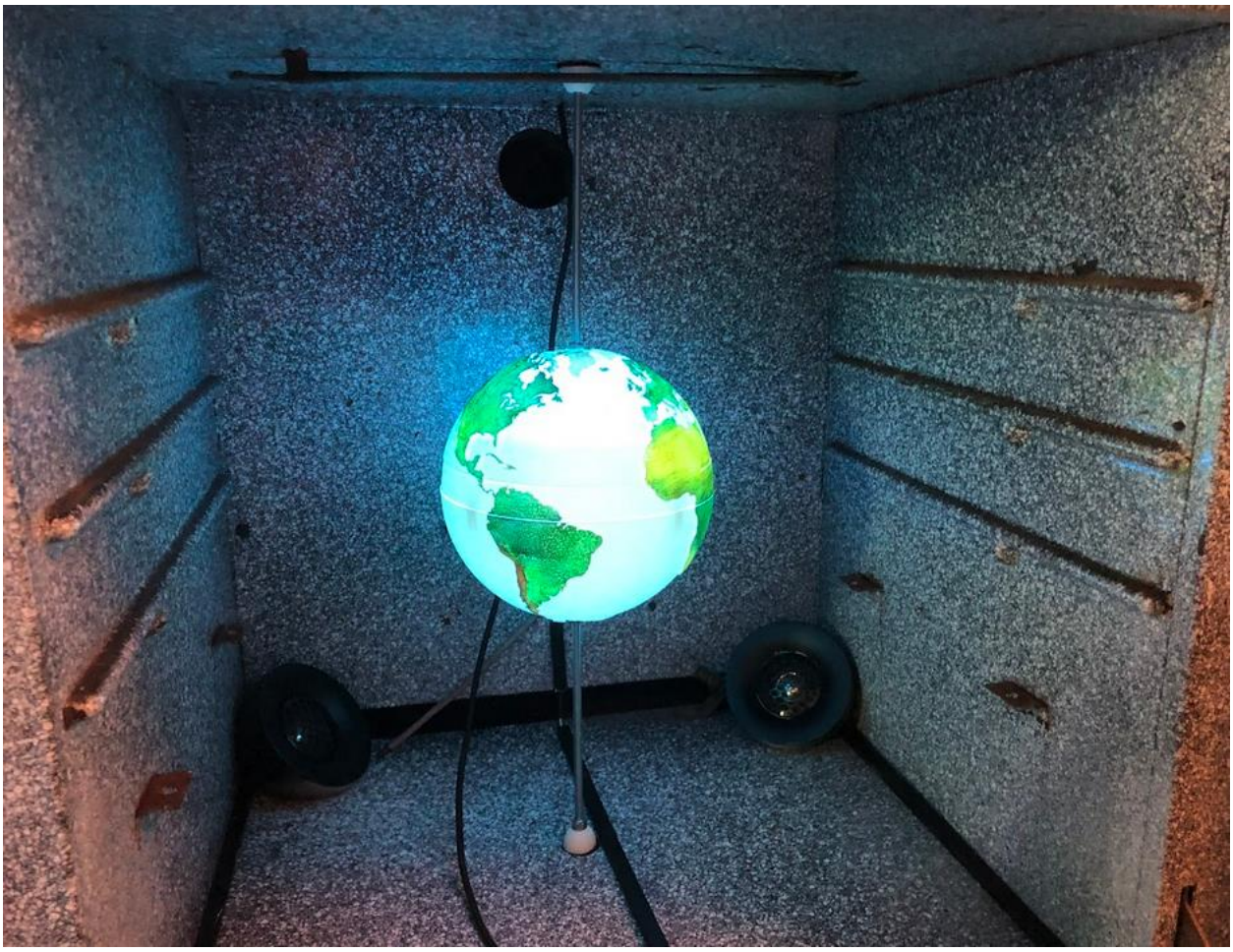
Creating an educational escape room piece about individual climate positive changes in day-to-day life



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Abstract

In order to inspire members of the German general public to make climate positive changes in their day-to-day life, a mobile educational escape room is being created by a team of over thirty enthusiastic volunteers. The aim of this thesis is to design an educational escape room puzzle for a climate crisis escape room inside of an Airstream caravan, which encourages its users to make climate positive changes in day-to-day life.

To find out how an educational escape room piece which encourages its users to make climate positive changes in day-to-day life can be created, research was conducted on how experience can be designed. In addition to this, it was researched how to design for behavioral change and this was linked to climate communication.

After the research was completed, an educational escape room piece was created in which the users find a burning earth inside of an oven. The earth can be saved by placing effective climate measures on top of the oven door. Evaluation of the escape room puzzle suggested a positive outcome with the participants having fun while solving the puzzle. In addition to this, participants indicated to have learned about the effect of climate positive measures on their carbon footprint.

Acknowledgements

During this Bachelor thesis I got a lot of help from a lot of people. First of all, I would like to extend my heartfelt thanks to my supervisor, dr. Angelika Mader and dr. ir Robby van Delden. Thank you for your guidance, your comments and insights and truly enjoyable supervision. My sincere thanks to the client, Stefan Heinrich and all the members of the development team of the climate crisis escape room for your support, inspiring meetings and your willingness to come to the University of Twente not once, but twice. I also would like to acknowledge the contributions of my co-researchers, Arthur van der Torre and Mark Ziegelhöfer. I enjoyed the time we worked together. My sincere thanks go to my family for their steady support during challenging times, and to my boyfriend for his continual encouragement and some technical assistance. Your support has been my anchor throughout this project. Lastly, I would like to thank the participants in the user tests for giving their time and helping with the evaluation of the created escape room puzzle.

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Chapter 1 - Introduction

"We are the first generation to feel the impact of climate change and the last generation that can do something about it." - Barack Obama

These are the words of Barack Obama during the United Nations Climate Change Conference (COP12) which was held in Paris, 2015 [1]. Contrary to Obama's quote, a study from the Centraal Bureau voor de Statistiek (CBS) shows that only thirty percent of Dutch citizens believe that it is not possible to humanly reverse the climate crisis [2] Research conducted by the Intergovernmental Panel on Climate Change (IPCC) states however that it **is** possible to humanly reverse the climate crisis. One of the causes of this discrepancy in beliefs is identified by Wynes and Donners [3] stating that carbon numeracy is lacking, meaning that the relation between the carbon footprint and people and their personal actions is not understood by a part of the participants.

In order to reduce this carbon numeracy, a German based team, called Escape Climate Crisis[1], consisting of over thirty volunteers, is designing an educational escape room. This educational escape room will be built into an Airstream caravan, making it mobile. The aim of the escape room is to playfully spread awareness on the climate crisis and to teach the German general public how one can change its behavior to make climate positive changes in day-to-day life.

1.1 Research questions

The aim of this research is to design and create an educational escape room puzzle which motivates its users to make climate positive changes in day-to-day-life. In addition to this it is necessary that the created piece can be installed into the Airstream. This aim leads to the following research question:

RQ: How can an educational escape room piece, which encourages its users to make climate positive changes in day to day life, be designed?

To support the main research question as formulated above several sub-questions were defined. These sub-questions will be grouped into four categories: Context, Escape Room, Design and Climate Crisis.

[1] https://www.escapeclimatecrisis.de/

1.1.1 Sub-questions - Context

With the first category the context of educational escape rooms will be evaluated. This will be done by answering the following question:

SQ 1.1 What is the context of the to be designed escape room piece?

The context of the to be designed escape room piece will be defined by meeting with the client as well as by analyzing interviews conducted with the client and members of the development team.

1.1.2 Sub-questions - Escape room

The sub-questions for the second category are formulated as follows:

SQ 2.1 What are the key concepts of an escape room?
SQ 2.2 How are educational escape rooms effective in transmitting knowledge?
SQ 2.3 How can an escape room be utilized to encourage behavioral change?

To answer the sub-questions as presented above the structure of escape rooms will be evaluated. In addition to this, several theories regarding learning and interactive experience design will be analyzed by means of a literature review. Lastly, persuasive design principles will be linked to educational escape rooms.

1.1.3 Sub-questions - Design

For the third category the formulated sub-questions are defined as:

SQ 3.1 How to design an educational experience?
SQ 3.2 How can the designed escape room piece be evaluated?

The design space of the escape room piece will be defined after the design requirements are created. The process of designing an educational escape room piece will be evaluated after the design and creation of the escape room puzzle. Lastly, the escape room piece will be tested and evaluated.

1.1.4 Sub-questions - Climate crisis

The last category of questions revolves around the climate crisis and consists of the following questions:

> ***SQ 4.1 How can the climate crisis be communicated effectively?***
>
> ***SQ 4.2 Which climate positive measures can be taken by the general public?***

To answer these sub questions research on the climate crisis will be done. In addition to this, several climate communication strategies will be explored on their effectiveness. Lastly, an overview of the effectiveness of climate actions will be given.

Chapter 2 - Background research

In this chapter the definition of an escape room will be explored and an answer to the *SQ 2.1 What are the key concepts of an escape room?* Will be given. In addition to this, the theory of Game Based Learning (GBL) and its link to educational escape rooms will be analyzed. To find recommendations for the to be created escape room piece, a state of the art will be given which existing educational escape rooms and their effectiveness regarding teaching and learning will be explored. In order to create an escape room piece about the climate crisis it will be investigated which climate positive changes can be made by individuals in day-to-day life.
For this background research the databases of Google Scholar[2] and ACM Digital Library[3] were used.

2.1 What is an escape room?

It is vital to understand the concept of an escape room. According to Ouariach and Elving [2] an escape room can be defined as a small-scale interactive format in which a group of players execute different tasks and solve puzzles to escape out of a room within a given time limit. An escape room is not only limited to a physical room, it can also be held online, on a postcard, in a box, it can even be printed on clothing [4].
When presented with this kind of escape room the goal is not to break out of a room within a given time, but to find the final answers to an end-riddle or puzzle.

2.1.1 Escape room puzzles and game flow

The aim of this Graduation Project is to design an escape room puzzle, therefore the different types of escape room puzzles will be explored. Three categories of escape room puzzles are identified by Fontaris [5]. The first category employs the user's logical and thinking skills by using cognitive puzzles. The second category revolves around physical puzzles which can be utilized to enable the players to overcome challenges by using physical movements or the usage of objects. The last category are Meta-puzzles, these puzzles require the completion of other puzzles and are commonly closely related to the key points in the game narrative [5].

[2] https://scholar.google.com/
[3] https://dl.acm.org/

A total of 31 puzzle types were identified in a white paper by Nicholson [6] Additionally, Fontaris [5] identified 17 puzzle categories. In Table 1 below, the puzzle types found by Nicholson are combined with the puzzle categories as described by Fontaris [5] in order to create a broader overview of the existing possibilities. Please note that the categorization as depicted in Table 1 is based on personal comprehension.

Puzzle category [5]	Explanation puzzle category [5]	Puzzle type [6]
Logical	Critical thinking is required and players are encouraged to use their problem solving skills	Pattern identification and Abstract logical e.g. Sudoku, symbolic substitution with a key e.g. looking up symbols in a book
Words	Words and language are used to create challenges and puzzles	Traditional word puzzles and research using information sources
Mathematical	Mathematical concepts and calculations are used to create puzzles	Counting, Algebra and other mathematics
Code-Breaking	The usage of knowledge in regards to codes and encryption is needed to decipher secret messages	Ciphers without a key
Physical	Physical manipulation of objects in required to solve the puzzle	Assembly of a physical object, undoing knots, physical agility, shape manipulation, hand-eye coordination and physical engagement with actors
Spatial	It is required to use spatial reasoning in order to overcome the challenge	Mazes
Observation	Attention to detail in addition is needed to find hidden clues or the solution to a puzzle	Noticing something ‘obvious’ in the room
Riddles	A riddle is often utilized to create a mysterious atmosphere	Riddles
Sequential	A sequence of steps need to be completed	n.m. (not mentioned)
Memory	Users are required to use their recollection	Knowledge about facts which is not

	abilities and memory	provided in the escape room
Auditorial	Sound and auditory feedback is used	Hearing
Visual	Visual information such as images are used to create the puzzle	Searching for objects in images, light and mirrors
Role-playing	The adoption of a persona or role is needed to solve the puzzle	n.m.
Scavenger hunt	Items need to be found	Searching for hidden objects
Interactive	Interaction with the environment or other members of the company is required	Social engagement with actors, team communication
Lateral thinking	Outside of the box thinking is expected from the players	Using an artifact in an unusual way
Creative	The use of creativity is necessary to come to the solution	n.m.

Table 1 Categorization of puzzle types as presented by Nicholson [6] into puzzle categories as presented by Fotaris [5].

The puzzles related to smell, taste, liquids, touch and strategic thinking [6] were not categorized due to the lack of a suitable puzzle category. It might however be concluded that the category of ‘sense’ could be added to cover the puzzles related to smell, touch and taste.

Similar to puzzle types, different puzzle structures can also be found in escape rooms. Figure 1 illustrates the four puzzle structures which can be found in an escape room. The different types of puzzle structure are the main determinant for the game flow and structure. The most commonly used structure is the linear path meaning that the players are able to solve one puzzle at the time [5]. When a path-based or pyramid structure is adopted in the game flow of an escape room players are able to solve multiple puzzles simultaneously. It is mentioned by Fontaris that a linear path is best to follow in case of an educational escape room. By doing this it can be ensured that all the students participate in every puzzle and that they do not miss important educational information or concepts [5].

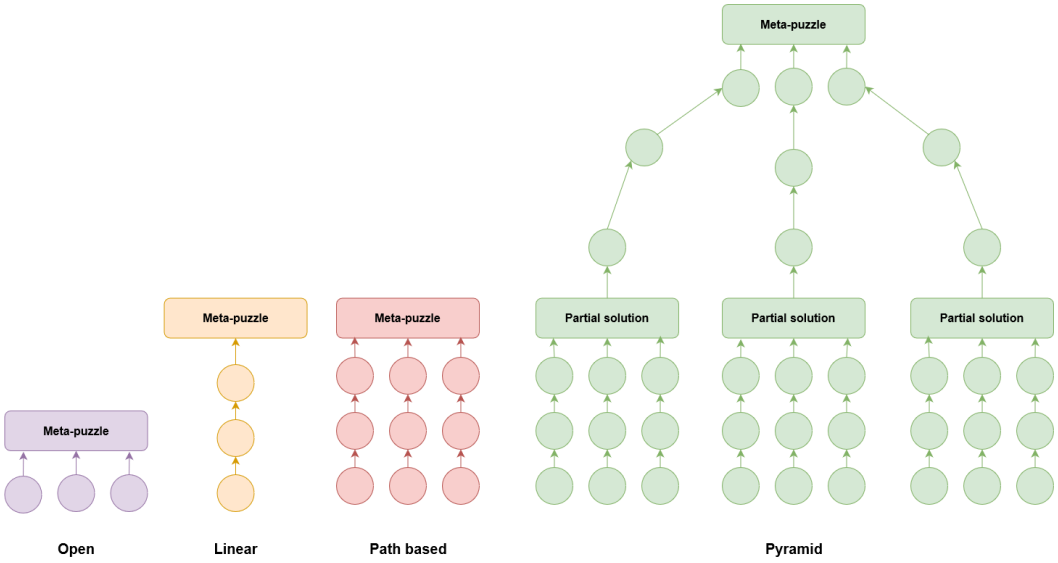


Figure 1. Flow chart of puzzle structures [5]

2.1.2 Conclusion

The aim of this subchapter was to find an answer to sub question 2.1: *What are the key concepts of an escape room?* First of all, it was found that an escape room can be defined as a small-scale interactive format in which a group of players execute tasks and solve puzzles to escape out of a room, or to find the answer of an end riddle, within a limited amount of time.

In addition to this, puzzle types as presented by Nicholson [6] were categorized into puzzle categories as presented by Fotaris [5]. A total of 31 puzzles were identified and these were sorted into 17 categories. It was also discovered that there are four puzzle structures which can be present in an escape room: open, linear, path based and the pyramid structure. It was concluded that linear-based structure was used the most because it forces users to solve one puzzle at the time. Lastly, Fotaris [5] mentioned that a linear structure can be used best in an educational setting because it ensures that every player can participate in every puzzle.

2.2 Educational escape rooms

Even though an escape room might be commonly seen as an activity solely for leisure, its usage is becoming more and more popular in educational settings. The utilization of escape rooms in the educational field might answer the call to action as formulated by Serdyokov: *'The need for educational innovations has become acute*' [8, p5]. This acute need for educational innovations is caused by the evolving way of information processing as portrayed by the younger generations. According to Aguaded [8] the current youth is the first generation in human history to not be reliant on the older generation regarding learning and knowledge. It is preferred by this generation to acquire knowledge via the internet instead of from older generations. Because of this, the younger generation can be called independent and self-taught.

In addition to the shown evolution of information processing presented by the younger generation, Aguaded [8] identified a rising demand for higher quality of education. According to Serdyokov [7] the social and economic well being of a country is dependent on the level and quality of education received by citizens. The concept of the 'knowledge society' is introduced by Serdyokov [7] meaning that a call for higher levels of knowledge and skills are required. The current educational material is not satisfactory for modern demands. The lack of effective and efficient learning possibilities is also identified by Barata et al.[9] stating that the traditional methods of transmitting knowledge like lectures, books and exercises are not always successful at providing students with contextual and on demand knowledge. This lack of effective knowledge transmission in addition to the earlier identified change in knowledge retention in youth leads to the conclusion that new and more engaging educational opportunities have to be created.

2.2.1 Game based learning and gamification

Learning is more than retaining knowledge. According to Pivec et al. [10] learning can be conceptualized as *'A Multidimensional construct of learning skills, cognitive learning outcomes, such as procedural, declarative and strategic knowledge and attitudes.'* [11, p217]. The Game based learning (GBL) theory is closely associated with educational escape rooms and embodies the multidimensional construct of learning as stated by Pivec et al. [10]. The model of GBL provides an interactive and fun learning experience for the learners [11]. Due to its interactive and engaging nature, the GBL theory can be considered highly effective in transmitting skills and knowledge.

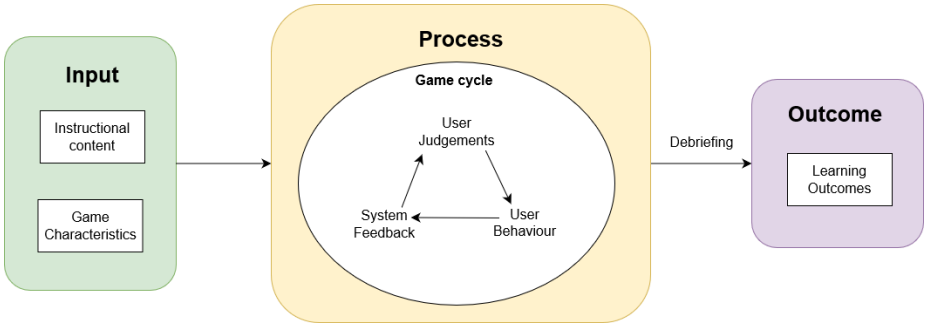


Figure 2. Game based learning model by Garris et al. [12]

In Figure 2 the process of Game Based Learning can be seen. The input stage of GBL is described as the combining of instructional content with game characteristics. Literature research conducted by Garris et al. [12] identified the lack of consensus in literature regarding which characteristics are critical within Game Based Learning. The described game characteristics include interactivity, interaction, goals, challenges, fantasy, complexity, control, strategy, competition, cooperation, change and lastly the fact that game made actions have no real world consequences [12]. Even though no consensus is found in literature about which game characteristic is the most critical for GBL, it can be concluded that the combination of the instructional content with the game characteristics is the main property of an educational game [10].

When analyzing the Process part of the game based learning model presented in Figure 2, a game cycle can be seen. This cycle is started by ‘User Judgement’ or the user making subjective judgments about their interest in the game and whether or not the game might be fun or interesting. After the initial judgment the user proceeds to behave in a certain way based on its earlier formed judgements. When the game is perceived as fun or engaging, displayed behavior might be longer persistence or a higher devotion to the game which leads to a higher engagement [12]. Engaging teaching methods are identified as a key factor in effective knowledge distribution strategy [2]. To ensure the effectiveness of GBL, it is important that the user perceives the game as fun and engaging.

The cycle is concluded with ‘System Feedback’ in which the user receives feedback during the game. Garris et al. [12] state that feedback can be seen as a necessary part of the Game cycle since feedback to goals regulate one's behavior and judgment. The effectiveness of feedback is supported by Hattie and Timperley [13] who state that feedback enables learning by closing the gap between what is understood by the student and what is expected to be understood by the student. Even though feedback can be seen as a crucial part of the learning

process, some caution is needed during the design of a game and its feedback. If it is indicated by feedback that the performance of the user always satisfies the goal, the game can be seen as too easy, leading to declined motivation. On the other hand, if the feedback only provides feedback about missed goals, the users are also at risk for losing interest [12].

Lastly, the model given in Figure 2 closes with the outcome stage. When closely looking at Figure 2 a debriefing stage can be identified. During this stage a connection between the game and the real world is provided. In addition to this, the link between the game and the learning objectives is made [10]. During this stage the difference between regular games and educational games becomes apparent since reflection would not be fundamental for a non educational game.

The Game Based Learning model can be applied to educational escape rooms because educational escape rooms combine the educational aspects with games and puzzles. In addition to this educational escape rooms are being utilized to create (quasi) realistic scenarios which enable the players to learn by applying knowledge and skills and team work [14]. Lastly the game cycle is embodied by the story line and puzzles of the escape room.

When exploring the effectiveness of GBL, a literature review conducted by Qian and Clark [15] identifies the lack of consensus. Some of the mentioned possible effects of game based learning are the development of so-called ‘21st century skills’. These skills exceed the basic skills like writing, reading and synthesis and focus on soft skills such as problem solving, leadership, creativity and communication [16]. The 21st century skills are described by Taraldsen et al.[14] as skills which are necessary for innovation, career evolution and a continuation of learning throughout life. A learning ground is provided in educational escape rooms for these earlier mentioned soft skills due to the gamified and collaborative nature of EERs.

2.2.2 Collaborative learning and social constructivism

Another learning theory closely related to educational escape rooms is Collaborative learning. It is recognized by researchers that collaborative learning (CL) can be seen as an important factor in learning. CL can be identified as an umbrella term where individual contributions are highlighted in group work. In addition, a responsibility is shared between the members of a group instead of a competition between the group members [17]. Collaborative learning enables students to create ideas and to find answers to problems together [10]. The benefits of collaborative learning are categorized into four categories by Laal and Ghodsi [18] : Social benefits, Psychological benefits, academic benefits and assessment benefits.

A theory within the umbrella of collaborative learning is constructivism or the fusion of various theories into one idea [19]. When applying the concept of constructivism to escape rooms a collaborative aspect is added. The addition of collaboration leads to the theory of social constructivism.

> *'Social constructivism is a theory of knowledge in sociology and communication theory that examines the knowledge and understandings of the world that are developed jointly by individuals. This theory assumes that understanding, significance, and meaning are developed in coordination with other human beings.' [16, p13]*

In practice, the aspects of social constructivism manifest themselves in the construction of knowledge based on the tangible experiences of escape room players while completing several puzzles. Players are presented with complex problems and puzzles which require interaction with others to find the solutions [20]. In addition to this, collaboration is fostered because of social constructivism. This encouraged collaboration can be identified as one of the main positive aspects of educational escape rooms since students are facilitated to give a meaningful contribution to the puzzle solving. In addition to this an active learning environment is created through the combining of different skill levels, formation of confidence and the communication of tasks [2]. Because all of these mentioned positive attributes it is important that a lot of consideration is given to the design of an educational escape room.

2.2.3 Conclusion

The subchapter of educational escape rooms was used to formulate an answer to subquestion 2.2: '*How are educational escape rooms effective in transmitting knowledge?'* First the need for educational change was identified. This need is caused by the evolution of the way knowledge is acquired by the younger generation in combination with the lack of currently available engaging and hands-on educational material.

It was found that the Game Based Learning (GBL), one of the learning theories closely linked to educational escape rooms, provides students with an engaging and fun learning experience. This is done by applying gaming characteristics such as goals, interaction, strategy and corporation to educational material. It was concluded that GBL is especially effective in the transmission of so-called '21st century skills'.

When analyzing the theories of collaborative learning and social constructivism, which are both closely related to educational escape rooms, it can be concluded that the collaborative nature of educational escape rooms also supports the learning experience.

2.3 Experience design

One of the aims of this thesis is to design a memorable and fun experience when players interact with the to be designed educational escape room piece. To gain knowledge about how to design a memorable, fun and engaging educational experience, the foundations of experience design will be discussed.By doing this, subquestion 3.2: *'How can an educational experience be designed?'* and subquestion 2.3: '*How can an escape room be utilized to encourage behavioral change?* Will be answered.

'The goal of experience design is to orchestrate experiences that are not only functional and purposeful, but also engaging, compelling, memorable, and enjoyable.' [21, p. 59]

2.3.1 Types of experiences

When designing an experience it is important to determine what kind of experience needs to be designed. A framework is provided by Pine and Gilmore [22] which can be used by experience-designers to find the best way to engage the user. It is stated by Pine and Gilmore [22] that guests, or users, can be engaged in several dimensions. The dimensions are depicted in Figure 3. Because the aim of this Graduation project is to design an educational experience, the educational realm and its corresponding axis: Absorption and Active Participation will be evaluated further.

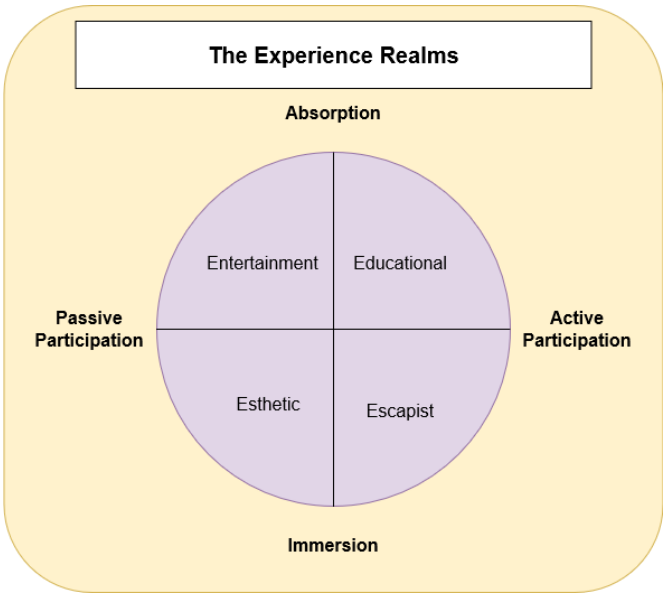


Figure 3. The Experience Realms by Pine and Gillmore [22]

On the active participation axis lay the users who actively participate in an experience. This means that the personal actions of these users influence the experience, or that these users actively engage in the creation of their own experiences [22]. The other axis linked to an educational experience is Absorption or the occupation of the user's attention by drawing the experience to the mind of the users. Pine and Gillmore [22] give the example of watching TV as an absorbing experience since the experience 'goes into' the user.

When analyzing the quadrant of educational experiences, correlations can be found with the GBL and the theory of collaborative learning. Active participation is expected within collaborative learning to foster creativity and teamwork [20],[2]. The aspects of game based learning also resonate with the active participation as depicted in Figure 3 since the user's engagement with the game shapes the experience [11].

For the creation of the educational escape room piece it is important to keep the experience realms as proposed by Pine and Gillmore [22] in mind. Despite the fact that the educational quadrant is bordered by the axes of active participation and absorption, the other aspects should not be ignored since the richest experiences consist of all the four quadrants [22].

2.3.2 Engagement, Immersion and Flow in an educational experience

Engagement, flow and immersion are important concepts when designing an experience. A study conducted by Hamari et al. [23] showed that a higher level of engagement (described as concentration, interest or enjoyment), had a positive impact on the learning outcomes of the students. When looking at immersion, described by Pine and Gilmore [22] as becoming part of the experience, no effect on the learning outcomes were found [23]. This can also be identified in the realms of experience as portrayed in Figure 3 where it was stated that not immersion but absorption was necessary for the creation of an effective learning experience.

Special attention should also be given to the concept of 'flow'. Csikszentmihalyi [24] describes the concept of flow as the state in which a person is freely invested in the material due to the absence of borders. During the state of flow, all the internal systems such as thoughts , intentions and feelings are concentrated on one end goal. The time seems to pass by fast and individuals in a state of flow do not show signs of high levels of spatial awareness [25]. Flow is usually found when students combine a high level of knowledge together with a high level task. In addition to this, flow leads to a higher level of concentration and can be identified as a positive contributor to learning [23].

2.3.3 Persuasive Design

One of the goals of the to be designed escape room piece is to encourage a behavioral change: Making more climate positive choices in day-to-day-life. In order to understand how this behavioral change can be achieved a concise overview on persuasive design will be given.

First, an understanding of human behavior is necessary and this will be researched by evaluating the Fogg Behavioral Model (FBM) [26]. The FMB consists of three principle factors: motivation, ability and triggers. All of these factors need to be present simultaneously for a behavior to be present. In practice this means that the user needs to possess a sufficient amount of motivation and ability in addition to a suitable trigger before a target behavior is displayed by the user [26].

Figure 4. Three factors of the Fogg Behavioral Model [26]

A trigger can be presented in many different ways and can be identified by three characteristics [26]. The first being that the trigger should be noticed. Secondly, the trigger should be associated with the target behavior. Lastly, the trigger should arise when the user possesses a high level of motivation in addition to the ability to perform the target behavior. The perceived ability to perform a certain behavior can also be called self-efficacy. Research conducted by Thompson et al. [27] shows that knowledge is an important factor contributing to one's self-efficacy.

When reflecting upon the aim of the escape room it can be concluded that the escape room should function as the trigger to get the user to perform the target behavior of making climate positive changes in day-to-day life. It is important that the user is motivated to make

those changes. The motivation should be fostered by enthusiasm gathered in the escape room in combination with an educational workshop after the escape room.

2.3.4 Conclusion

In this subchapter of ‘Experience design’ the answers to sub question 3.2: *‘How can an educational experience be designed?’* and sub question 2.3: ‘*How can an escape room be utilized to encourage behavioral change?*’ were researched.

The experience realms provided by Pine and Gilmore [22] show that an educational experience should consist of the allowance of information absorption in addition to the requirement of active participation. A correlation can be found between the definition of an educational experience as given by Pine and Gillmore [22] and the GBL and collaborative learning theories. All three mention the importance of active participation for the creation of a fruitful educational experience and should be incorporated into the final design of the escape room puzzle.

In addition to this, the concepts of engagement, immersion and flow were discussed and related to educational experiences. It was found that a higher level of engagement and flow lead to a positive impact on the learning process. Higher levels of immersion were found not to be a contributing factor to the learning process, this can also be seen in the experience realms of Pine and Gilmore [22].

Lastly, it was analyzed how an educational escape room could be used to encourage behavioral change. In order to find an answer to this question, a small, however incomplete, overview of persuasive experience design was given. In this overview, it was found that the user needs to possess a sufficient amount of motivation and ability in addition to a suitable trigger before a target behavior is displayed by the user. It was also hypothesized that an educational escape room could function as the trigger for the behavior change.

2.4 Climate crisis

In order to determine answers *SQ 4.2 Which climate positive measures can be taken by the general public?* a general understanding of the climate crisis is needed. In order to gain this understanding, a concise description of the climate crisis will be given. After this, it will be explained what a carbon footprint is and the carbon spending of the German general public will be reviewed. Lastly, several personal contributions will be evaluated on their effectiveness, this will be done by reviewing several scientific papers. To find an answer to *SQ 4.1 How can the climate crisis be communicated effectively?* Several climate communication strategies will be evaluated.

2.4.1 Concise description climate crisis

According to the United Nations [28] climate change can be defined as: *'long-term shifts in temperatures and weather patterns'.* Even though these shifts can occur naturally, research done by IPCC and NASA [29], [30] concluded that human activities are the cause of this climate change.

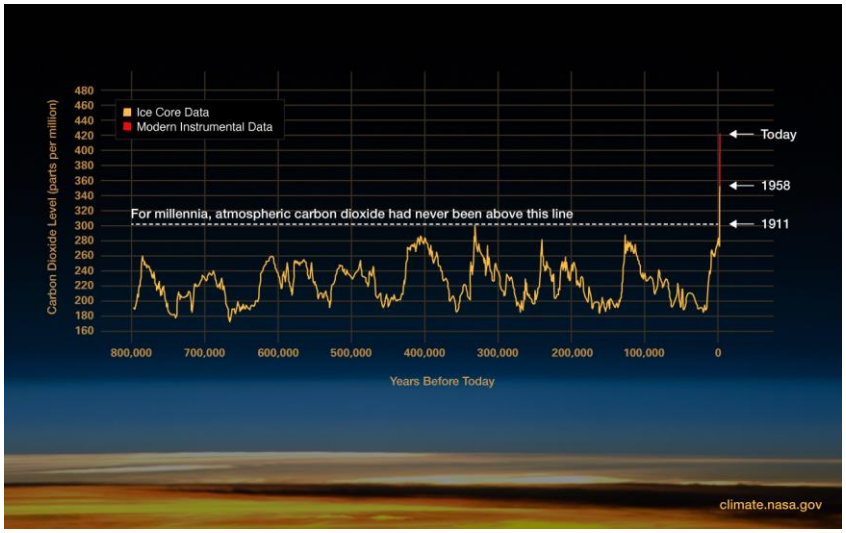


Figure 5. Atmospheric CO2 levels over the years [30]

When looking at Figure 5, a clear increase in atmospheric CO2 levels can be seen since the industrial revolution starting around the mid 1800s. These higher CO2 levels can be compared with a blanket wrapped around the planet earth, keeping the warmth of the sun in causing temperatures to peak. The European Commission of Energy, Climate Change and Environment [31] mentioned several consequences of climate change such as: drought, wildfires, floods,

decrease in biodiversity and erosion, all putting (vulnerable) communities and ecosystems at risk. All these consequences lead to the conclusion that climate change can be considered a climate crisis.

In an effort to bring the climate crisis to a halt, it was decided by the world governments to make an effort to limit the rising of the temperature to 2, most preferably, 1,5 degrees Celsius [32]. In order to achieve this pursuit, some serious carbon reductions are needed.

2.4.2 Carbon footprint

As earlier mentioned, some action is required to stop the climate crisis. Since the educational escape room will be created for the German general public, a small analysis of the German carbon footprint will be done.

According to the European Youth Portal [33] the carbon footprint can be described as: '*a concept used to quantify the impact of an activity, a person or a country on climate change.*' Research done by Chuvieco et al. [34] suggests that sixty to seventy percent of carbon spending can be contributed to personal lifestyles and personal decisions. Therefore, making personal changes

In the Climate Action Program 2030 [35] the German cabinet aims for a carbon emission reduction of fifty-five percent when compared to the level of 1990. Currently, Germany just fell short of reaching the intermittent goal of a CO2 reduction of forty percent by 2020 [35].

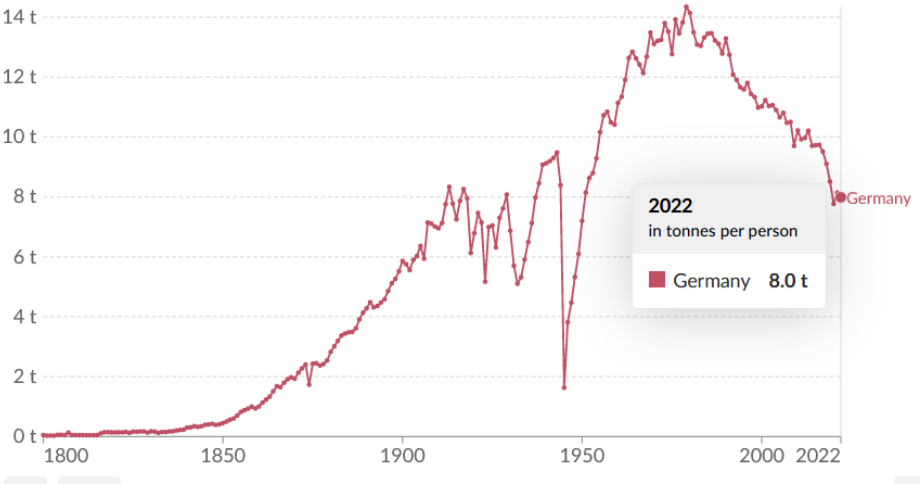


Figure 6.CO2 emission per capita Germany per capita over the years [36]

In order to reach the goal of a CO2 emissions reduction of fifty-five percent by 2030, the carbon spending has to decline even more. One of the means to achieve this goal is to reduce the carbon footprint per capita. In Figure 6, the CO2 emission per German capita can be seen. A

steady decrease can be seen since the 1970s however, per capita a CO2 emission of 8.0 ton per year is measured. This is far above the global average of 4.0 ton Carbon dioxide per capita [37].

According to the Paris Agreement of the United Nations of 2015 [38] the global emission of greenhouse gasses has to decline by 43% by 2030. The Intergovernmental Panel on Climate Change [29] introduces the goal of Net Zero: The reduction of CO2 emissions and the insurance that the remaining emissions are balanced by removals. This means that the remaining CO2 spending has to be absorbed by forests, the sea or other ecosystems. In order to minimize the rising temperatures to 1.5 or 2 degrees this Net Zero has to be achieved by 2050.

2.4.3 Perceived effectiveness of personal contribution possibilities

In the previous section, it was mentioned that a significant percentage of carbon emission can be contributed to personal lifestyle decisions. In a literature review conducted by Wynes and Nicholas [39], several personal measures to reduce the individual carbon footprint are described. By reviewing literature with a life cycle approach, Wynes and Nicholas [39] created a list with possible actions and the yearly CO2 reduction that adopting the measures could entail. In addition to this, a text book analysis was done by Wynes and Nicholas[39]. In this text book analysis, ten chapters of Canadian textbooks directly addressing the climate crisis were analyzed on the amount that the suggested climate mitigation measures were mentioned. A discrepancy between the actual effectiveness of climate measures and the top recommendations made by the textbooks was found with measures such as Recycling and conserving energy being mentioned most.

Research conducted by Pickering et al. [40] identified a gap between the actual effectiveness of climate mitigation measures and the perceived effectiveness of those measures. For this study, 18 year old Canadian citizens were asked what they believed to be the most effective climate positive actions. In Table 2, the measures and their effectiveness can be compared to the percentage of respondents that mentioned the measures as highly effective to lessen the CO2 footprint. It was found that 44,3 percent of the respondents mentioned recycling as one of the most effective measures to lessen carbon emissions even though Wynes and Nicholas[39] concluded that recycling only has a moderate impact on the CO2 reduction with 210 kg CO2 per year per individual. Another interesting discrepancy can be seen when comparing the actual effect of a plant based diet to the amount of mentions as found by Pickering et al. [40]: only ten percent of the respondents indicated that they perceived a plant based diet as a highly effective climate positive action. Another interesting measure is

upgrading lightbulbs to more efficient ones: 24,9 percent of respondents mentioned this as one of the most effective methods to reduce the carbon footprint even though adopting the measure only reduced the carbon footprint with 0,2 kg CO2 per year.

The perceived impact of climate action is also researched by Wynes et al. [3]. In this study, some measures as found by Wynes and Nicholas[39] were tested on their perceived effectiveness. This perceived impact can be seen and compared to their actual effectiveness in *Table 2*. When comparing the found perceived impact by Wynes et al. [3] to the actual impact as proposed by Wynes and Nicholas[39] some discrepancies can be identified. First, it can be seen that the high impact measures of avoiding a transpacific flight and adhering to a plant based diet are not perceived as such. These two measures are even perceived as low impact even though they are the most effective measures. The perceived impact of a plant based diet was also found earlier in this subchapter. When analyzing the perceived impact of moderate/ low impact measures it can be seen that the perceived impact is relatively similar to the actual impact.

Measure [39]	Maximum yearly CO2 reduction in Kg [39]	Impact [39]	Frequency cited in % [40]	Perceived impact [3]
Having one fewer child	117 700	High	-	n.m.
Live car free	5300	High	23.8*	n.m.
Avoid one transpacific flight	2800	High	n.m.	Low
Buy green energy	2500	High	n.m.	n.m.
Plant based diet	1600	High	10,0	Low
Buy more efficient car	1190	Moderate	5,9	High
Conserve energy for example by hang drying clothes	210	Moderate	24,9	Moderate
Avoid food waste	370	Moderate	20,0	Low
Eat less meat	230	Moderate	10,0	n.m.
Use public transportation	n.m.	Moderate	15,7	n.m.
Recycle	210	Moderate	44,3	Moderate
Eat local	360	Moderate	2,4	Low
Reuse shopping bag	5	Moderate	10,0	Moderate

Measure [39]	Maximum yearly CO2 reduction in Kg [39]	Impact [39]	Frequency cited in % [40]	Perceived impact [3]
Conserve water for example by running a full dishwasher	n.m.	Low	14,6	n.m.
Minimize waste	n.m.	Low	20,0	n.m.
Plant a tree	60	Low	4,9	n.m.
Purchase carbon offset	n.m.	Low	n.m.	n.m.
Reduce lawn mowing	n.m.	Low	n.m.	n.m.
Buy ecolabel products	n.m.	Low	2,4	n.m.
Upgrade light bulbs	0,2	Low	24,9	n.m.

Table 2. Measure and their actual effectiveness compared to their perceived effectiveness.

In *Table 2,* twenty measures and their effectiveness can be found; however, a measure with counter effectiveness was also identified: Using a paper bag instead of plastic bags. Research conducted by Muthu et al. [41] shows that the production of a paper bag in China emits 24.8 kg CO2 compared to an emission of 12.8 kg CO2 for a plastic bag. WHen comparing this to the production of India it can also be concluded that the production of paper bags emits more Greenhouse gasses (3,41 kg CO2) when compared to plastic bags (1,74 kg CO2). It was also found that the usage of paper bags with options for disposal (landfill, reuse, recycle) still leads to a significantly bigger CO2 footprint as compared to the same usage of plastic bags. In another study conducted by Muthu et al. [42] supported this conclusion stating that the impact assessments done suggest that plastic bags should be preferred over paper bags. In addition to this, it was illustrated that even though trees, the raw material for paper, can be seen as a renewable source, some caution is required. To create paper, a lot of trees need to be cut down which can lead to deforestation and the harming of animals. In addition to this, heavy machinery running on fossil fuels is required to convert paper pulp into paper bags resulting in a vast consumption of fossil fuels and energy created by coal and the use of natural gasses.

2.4.4 Climate communication

The goal of this Bachelor Thesis is to create an education escape room piece which motivates its users to make behavioral changes. In order to stimulate the users to make changes, it is important to understand how the climate crisis can be communicated in an effective manner.

According to Ballantyne [43] a substantial increase in climate communication can be identified in the past decade. This increase in communication can be attributed to the significant role of individual and household greenhouse gas emission in addition to the influence which can be exerted on the politic to make changes. It was concluded by Ballantyne [43] that the climate crisis is often described as a wicked problem: a problem which is so immensely complex and does not seem to have one definitive answer or obvious solution. This 'wickedness' might lead to a lack of engagement and a lack of action due to the fact that the climate crisis is perceived as a distant problem instead of an actual crisis.

Research conducted by Burke et al. [44] also contributed the lack of climate action to the absence of engagement stating that people need to understand the problem (cognitive engagement) and need to care about the problem (affective engagement). This need for affective engagement is something which was already identified in section *2.3.3. Persuasive Design* of this report where it was concluded that according to the Fogg Behavioral Model (FBM) [26] a higher motivation combined to the ability to act leads and a trigger leads to behavioral change. The belief that one possesses the ability to do something (self-efficacy) is also mentioned by Ballantyne [43] as an important factor in climate action. In order to address these issues, it is stated by Ballantyne [43] that there is a need to shift climate communication from information deficits to more engaging learning and engagement as well as by using a more dialog-oriented approach.

In a literature review conducted by Brosch [45] it was found that affect and emotions toward the climate crisis can be seen as one of the most important predictors for climate related behaviors and judgements. The way in which emotions can be utilized to encourage climate positive behavior fosters a debate on whether negative or positive emotions are the most effective. In the literature review it was found that negative emotions increased intentions to adopt climate positive measures. In addition to this, it was found that communication emphasizing the major threat of the climate crisis leads to an increase in risk perception. This effectiveness of negative affect is also described by Salama and Aboukoura [46] stating that negative emotions motivate people to seek more information about the issue. In addition to this, it was stated that negative affect enables people to remodel apathy and indifference into discerned importance and behavioral action.

Even though the effectiveness of negative affect seems obvious, Salama and Aboukoura [46] also describe a counterproductive effect of negative emotions since too much negative communication can lead to avoidant behavior and denial.These emotions can be called obstacles, which decrease the engagement with the topic. The Broaden-and-Build Theory as

formulated by Fredrickson [47] is mentioned by Salama and Aboukoura [46]. This theory states that positive emotions often trigger a cycle of more positive emotions. These positive emotions can be used to show how one is connected to the earth and it can increase one's creative capacity to effectively address the problems of the climate crisis.

The effectiveness of positive messages is also identified by Brosch [45]. Despite the fact that Brosch identified negative emotions to be effective in conveying a message, the same objections with regards to negative communication were found as mentioned above. Therefore, Bosch suggests a hope-based communication strategy. It is stated that communication which is focussed on self efficacy and solutions show an increase in climate-related political engagement fostered by hope. The term 'Constructive Hope' is described by Brosch [45] as the *' Hope that climate change can be mitigated by collective action was positively related to self-reported pro-environmental behavior, policy support, and political engagement'* [45, p. 17].

Another effective way climate communication is mentioned by Burke et al. [44]: visual communication. It was found that visual imagery can serve as an effective tool to achieve emotional engagement. Because of the fact that imagery is processed differently than language and statistics, using a visual communication approach can be beneficial. Burke et al. [44] do warn against using cliché images such as the earth getting tired or a polar bear on a tiny iceberg since this is no longer interesting for people.

2.4.5 Conclusion

In subchapter *2.4 Climate crisis* the answers to subquestion *4.1 How can the climate crisis be communicated effectively?* and *4.2 Which climate positive measures can be taken by the general public?* were evaluated. When looking at which climate positive measure which can be taken, a difference in actual and perceived effectiveness can be seen: measures like recycling and energy conservation were perceived as highly impactful meanwhile true highly effective measures such as flying less and changing to a vegan diet were often perceived as not effective. When designing the escape room puzzle, negative emotions can be provoked to ensure engagement, which was found to positively impact the willingness to make climate positive changes. Caution is required as not to make the message too negative since this can dis-engage the user. Positive emotions can be used to foster hope, which is also beneficial for engagement. Lastly, visual imagery should be used to enlarge the emotional engagement.

2.5 State of the art

2.5.1 Scientific studied educational escape rooms

First, four scientific studies of educational escape rooms will be analyzed on their effectiveness in the educational field. In addition to this, the different positive attributes of the escape rooms will be evaluated to learn more about what makes an educational escape room fun, engaging and effective.

Radiology

A radiology themed escape room was created by Jambhekar et al. [48] as a unique exercise for radiology residents. Their aims were as follows: to *'teach interesting content about radiology as a medical specialty, cultivate grit, and share the resource with any program in the country that was interested in replicating the activity for their residents'* [48]. The escape room was designed around the technical skills of radiology residents as well as the interesting challenges within this profession.

Figure 6. Escape room radiology [48]

Four divisions of puzzles were created. In addition to this two types of puzzles were used. The first being metal puzzles for which knowledge and critical thinking are required in order to solve these puzzles. The second type of puzzles used are physical puzzles for which the manipulation of artifacts is required. The physical puzzles were used to test the technical skills of the residents. The puzzles could be solved without a set order, however all the puzzles had to be completed in order to solve the meta puzzle. Therefore the escape room followed an open puzzle structure as described in *2.1.1 Escape room puzzles and game flow, Figure 1.*

After the game ended prompt feedback was given via a debriefing session. This was done by the game master and it enabled the players to learn from each other and it helped the residents to relate this teaching experience to the real world.

Jambhekar et al [48] found that the educational value came from the fact that an educational escape room stimulates a highly reflective process. The radiologists who played the

escape room were able to make the connection between the escape room and their (future) careers by analyzing, describing and communicating their experience. This escape room enabled the residents to practice their practical skills by solving the physical puzzles as well as their knowledge within the field of radiology. In addition to this the radiology residents were able to practice their soft skills such as communication, teamwork, critical thinking and multitasking. Lastly, the escape room enabled the players to judge their individual strengths and weaknesses.

Healthcare

An educational escape room for the nurse residency program or NRP was created by Adams et al. [49]. The aim of the escape room was to integrate skills such as critical thinking, communication and teamwork into a learning environment which fosters active learning. Ten educational principles were covered by this escape room which covered knowledge, the practice of skills such as the calculation of medication dosages and the identification of patients.

The escape room simulated a room with a patient in it. The players were divided into groups in which a variety of specialties were present and the groups were given a patient scenario with the rules and hidden clues. The goal of the escape room was to break out of the room. The used puzzle structure was not mentioned in the report.

This study done by Adams et al. shows that the educational escape room provided a successful learning environment for the nurses. The players were able to prove that they understood the learning objectives in an interactive way and they demonstrated their critical thinking skills. In addition to this the escape room enabled nurses to use their professional skill to figure out the correct answers.

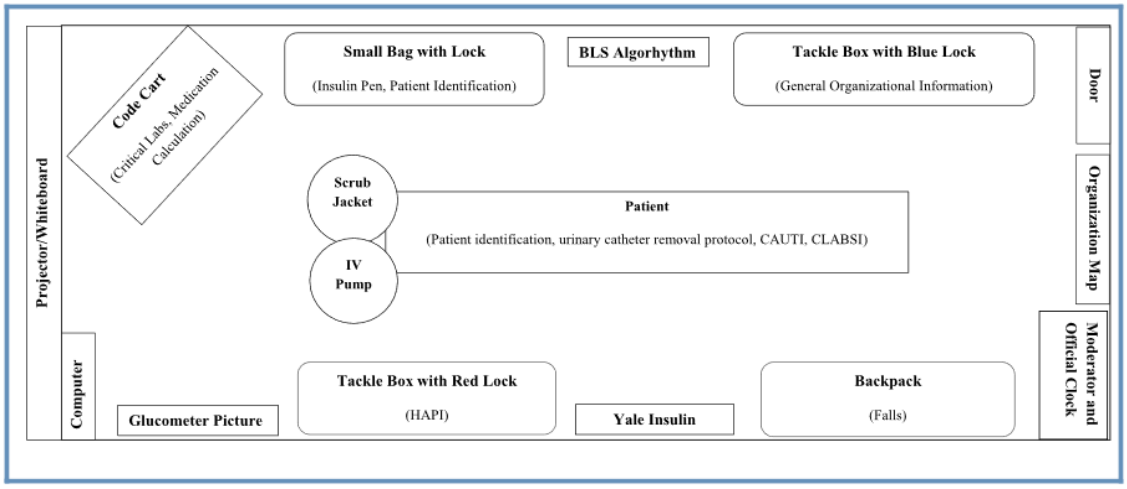


Figure 7. Layout of the educational escape room for the NRP [49]

Chemistry

In order to enable and support high school students in their conceptual understanding of chemistry, Avargil et al. [50] designed a chemical educational escape room. In addition to this meaningful learning is supported through the use of collaborative tasks linked to important day-to-day-life topics.

The puzzles in the escape room were designed around a curriculum which is appropriate for the target users (in this case 11th and 12th grade). A path based puzzle structure can be found in this escape room since the students will be presented with a variety of different puzzle paths in which the solution of one puzzle leads to another puzzle. The fact that the contents of the puzzles was closely connected to the curriculum allows the children to develop critical thinking skills while collaborating with each other.

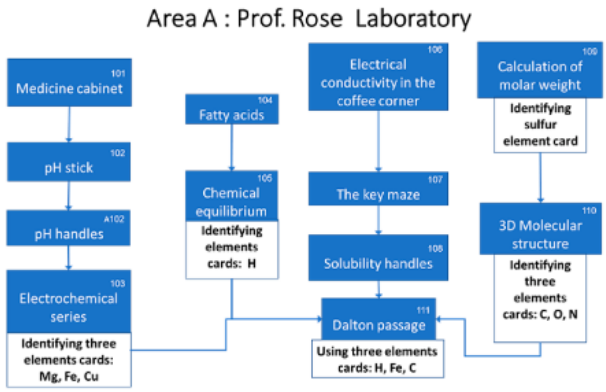


Figure 8. Part of the puzzle structure [50]

This study has been conducted with the help of teachers since it is still in the prototype stage. The teachers had the opportunity to review the educational escape room and the reactions were positive. Several advantages of the use of an educational escape room were found, the first being the promotion of teamwork. In addition to this the teachers stated that it might lead to a higher level of enjoyment during the learning process and they mentioned that the escape room could add to a deeper conceptual understanding of the topics of Chemistry.

In Figure 9 the mentioned skills which are needed to solve the puzzles as mentioned by teachers are mapped and visualized.

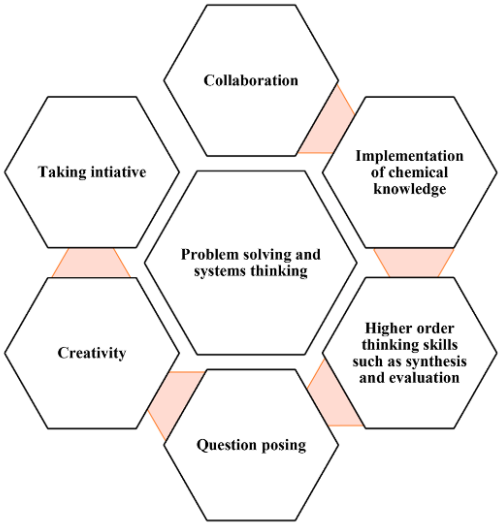


Figure 9. Mapped skills needed to solve the chemist [50]

2.5.2 Commercial escape rooms

In addition to the scientific studies of educational escape rooms, some commercial escape rooms will also be analyzed. By analyzing the website of the escape room as well as the reviews it will be investigated which element the players might see as important since this will be often mentioned in the reviews. In order to find the escape rooms with a lot of reviews the online platform ‘Escapetalk’ [51] will be used. This is a platform on which, at the date of research, 18240 users have reviewed over 2000 escape rooms in the BeNeLux (Belgium, Netherlands, Luxembourg). For the review the top 3 highest rated escape rooms on Escapetalk will be analyzed. In order to ensure a sound review of the rooms only reviews of reviewees with over 150 rooms played will be used. A total of 3 reviews per room will be analyzed, giving a total of 9 reviews. All reviewed escape rooms are located in the Netherlands.

Down the Hatch - Molly

Molly [52] is the highest ranking escape room on the Escapetalk platform with a 9.9 out of 10 as an overall score, which was based upon 749 reviews at the time of research (Autumn 2023). In addition to this, this room has been crowned ‘Crowd favorite’ in the years of 2018 until 2023. The storyline of the escape room is about Dr. Dan Kowalski who opened his doctor's office in 1971. Just before Dr Kowalski wants to sit in his chair he hears a voice which entangles him in a demanding game.

Figure 10. Atmosphere impression Molly [53]

The reviews about Molly (Appendix 2) are highly positive. The first thing which is mentioned in all three reviews is the welcome area of the escape room. It is a highly immersive experience which engages you directly into the story line. The attention to detail regarding the

music, use of lights and the decor is mentioned by all three reviewers which made the experience highly engaging and immersive. The puzzles were described as logical, physical, creative, beautifully decorated and the reviewees described them as a great addition to the story line. In addition to this, so called ‘wtf-moments’ or unexpected moments/ plot twists were mentioned and these moments were perceived as fitting and ‘just right’. The use of technology was also mentioned as fitting since it added to the story. The fact that the escape room can be perceived as immersive is also supported by the fact that two out of three selected reviewers stated to have gotten goosebumps due to the denouement of the room. In addition to this two out of three reviewers have shed some tears due to the story. Furthermore, the service within the escape room was also described as ‘phenomenal’. A last mentioned positive attribute of the escape room was the size, it was perceived as very extensive or gigantic.

Even though the reviews were highly positive it was stated that the story line was a bit hard to follow and sometimes a bit too extensive. This did not withhold the reviewers of giving the room a 10.

Reflection

After the evaluation of the Molly escape room some recommendations can be made for the to be designed escape room piece. First of all, it is important that the used technology is fitting and will not be seen as abundant. In addition to this, details can be considered as an important factor and are appreciated by the user.

Darkpark - Stay in the dark

The ‘Stay in the dark’ [54] escape room is a room stretched over an area of 4000 sqm. This escape room which is located in an old building and has a duration of 2.5 hours. The story revolves around the fact that you entered the old building without realizing that you are not alone in the abandoned factory. One noticeable artifact of this escape room is the fact that a human actor is also in the factory hall.

Figure 11. Banner Stay in the Dark Escape room darkark [54]

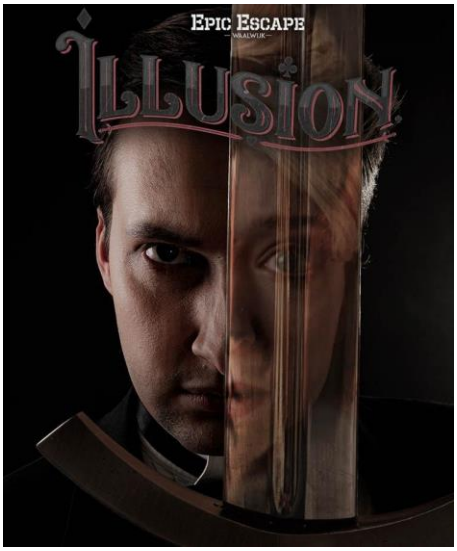
When evaluating the reviews on the platform Escapetalk [55] it can be concluded that the escape room can be labeled as scary or thriller-like. The players stated that the story line is clear and not overly complicated. In addition to this it was stated by one of the reviewers that the goal was immediately clear upon arrival due to the uncomplicated storyline. The location is mentioned as a supporting factor in the story and the reviewers mentioned that the building really adds to the atmosphere. Even though the escape room might be perceived as scary, one of the reviewers stated that there is no over the top stress or tension created by the escape room artists. A layered structure of tension, action, light and dark, audio, atmosphere, small details and the vastness of the location enabled the players to experience the story.

In addition to the earlier mentioned aspects of this escape room the service was perceived as very positive and supportive of the narrative. An actor was also involved in the escape room and one of the reviewers stated that the actor was really beneficial for the buildup of tension while taking into account the boundaries of individual players.

Reflection

After the evaluation of the Stay in the Dark Escape room it can be concluded that the storyline of the to-be-designed puzzle should not be too complicated. In addition to this, it is important to ensure that the puzzle complements the environment and therefore fits in the theme. Lastly, the reviews showed the positive effect of the actor as he/she helped to build up the tension.

Epic Escape Waalwijk - Illusion



The Illusion escape room [56] takes you back almost 50 years to the time of the mysterious illusionist Marcus Furore. This magician disappeared abruptly during his last performance after a terrible accident with one of the spectators. When an angry mass found his hiding place and tried to kill the illusionist, Marucs Furore saved himself once again. The playing duration is 90 minutes.

Figure 12. Banner Illusion escape room [56]

The first thing which is mentioned in the three reviews [57] is the introduction movie. Two of the reviewers indicate that the introductions experience was really great despite the fact that they most of the time are not too keen on introduction films. They indicated that the introduction movie was of great quality and truly added to the storyline due to its logical introduction. In addition to this it was stated by one of the reviewers that the players have the option to go through an online archive in order to prepare for the escape room. This is not necessary for the escape room but it truly added to the experience and it fostered a great anticipation of what was to come.

One of the main features which was often mentioned in the reviews was the quality of the soundtracks and sound system within the escape room. The reviewers stated that the audio and music was perfectly in sync with the atmosphere, creating long lasting memories. In addition to the sound quality the overall quality of the escape room was perceived as high. The reviewers stated that there was a great balance between the details, decoration, sounds, story and puzzles. The puzzles were perceived as varied with an alternation between teamwork, working simultaneously on different puzzles and solo puzzles. One of the reviewers wrote about how the hint system also added to the story.

Lastly, the owner was described as a passionate man who was not shy to tell everything about his escape room. With two players staying until 01:30 at night to talk about the room and the experience it can be concluded that the hospitality and passion of Maurice, the owner, can also be described as one of the main selling points of this room.

Reflection

The evaluation of this escape room provided a lot of recommendations for the escape room piece which will be designed. First of all, the importance of the atmosphere can be seen as really important. A believable and immersive atmosphere can be created by combining sounds, details, decorations and a story element to the puzzle. In addition to this, it is important that the escape room will supply a variety of puzzles and it is therefore important to know which other puzzles will be in the escape room. Lastly, it was shown that a well engineered introduction as well as a well thought out possibility to already explore the online archive are great factors for the build up of anticipation.

Chapter 3 - Methods and Techniques

During this graduation project the Creative Technology Design Cycle by Mader and Eggink [58] will be followed to design and create the educational escape room piece.

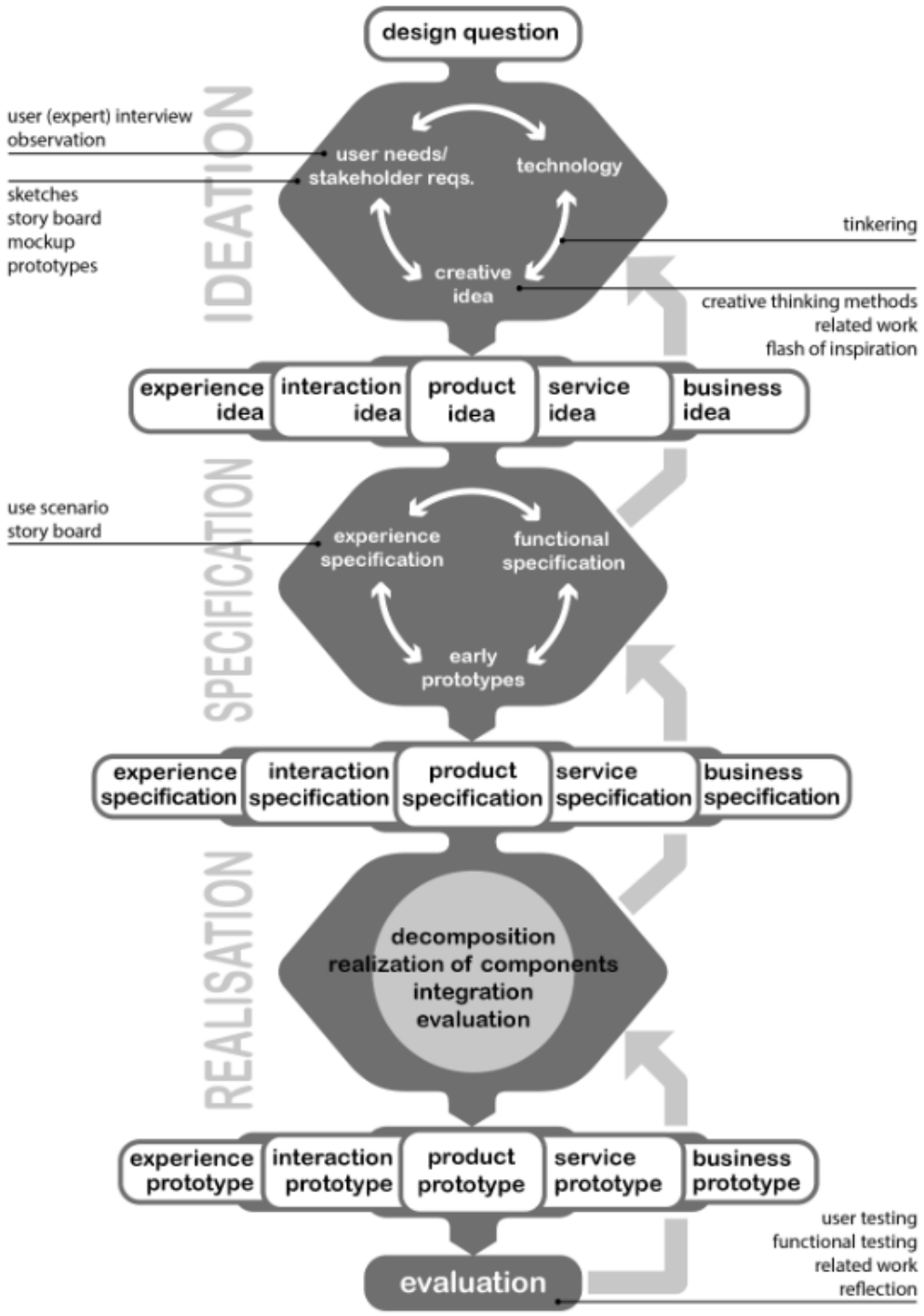


Figure 13. Creative Technology Design Cycle

The Creative Technology Cycle consists of four phases: Ideation, Specification, Realization and Evaluation. Below all four of these phases will be described and linked to the graduation project.

3.1 Ideation

During the Ideation phase a creative idea will be generated. First a problem is identified, in this case: "*How can an educational escape room piece, which encourages its users to make climate positive changes in day-to-day-life be designed?*". Secondly, a background research is conducted. In addition to this, the stakeholders of the project are defined and preliminary requirements will be created. Using the information acquired in the brainstorming session, as well as the preliminary requirements, around 50 ideas will be created during a brainstorm session. Lastly, a final idea will be chosen.

3.2 Specification

During the specification phase functional and nonfunctional requirements will be formulated. This will be done by analyzing interviews which are conducted with the client, the development team, members of the target group and an expert.

3.3 Realization

After the specification of the final puzzle idea the escape room piece will be realized. This will be done by conducting paper prototype tests to find out if the users are able to solve the conceptualized puzzle. After the creation of a paper prototype, the final puzzle will be created. The goal is to create a high fidelity prototype of the puzzle. During the week of the 8th of January, the puzzle will be installed into the Airstream caravan.

3.4 Evaluation

Lastly, the puzzle will be evaluated. To find out if the puzzle meets the non functional requirements, play tests preferably in the Airstream caravan will be conducted. In addition to this, the functional requirements will be tested and evaluated.

Chapter 4 - Ideation

In this chapter the ideation phase of the Graduation Project will be described. First stakeholders and their interests will be identified. In addition to this, preliminary requirements will be created for the prototypes. At the end of this phase, the brainstorming phase followed with the explanation of the top three ideas will be elaborated upon.

4.1 Stakeholder analysis

In order to develop a fitting and functional prototype, stakeholders need to be analyzed on their interests in the project. The following stakeholders were identified: The client, the members of the development team, users of the escape room, companies, educational institutes and lastly, the climate. In Table 3 the stakeholders and their interests in the project are described.

Stakeholder	**Description**	**Interest**
The Client	The client is Stefan Heinrich, he is co-funder of the project and is also part of the development team.	The client wants to create a fun and immersive experience which teaches the German general public about climate positive changes.
Members of the development team	The development team consists of over thirty enthusiastic German volunteers who are contributing to the project with a range of different specialties and skill sets.	Members of the development team want to create a fun and immersive experience which teaches the German general public about climate positive changes.
Users	The users are the main target group of this project and are members of the German general public. They are aged sixteen and above and interested in playing an educational escape room concerning the climate crisis.	Users want to have a fun and engaging experience during their game in the escape room. They also want to learn more about the climate crisis and different ways one can personally contribute to the solution.
Companies	Companies want to learn how to act in a climate positive way	Companies want to transform their behavior to a more eco-friendly way. The Escape room is used to learn in a playful manner.

The climate	The climate is an indirect stakeholder since the project aims to improve the climate crisis.	It is in the climates' interest if the escape room is effective and users adapt climate positive changes in day-to-day life.
Educational institutes	An educational institute can provide climate education by using the mobile escape room. The students are 16 and above to ensure that children are not exposed to shocking messages.	Educational institutes want to teach their students about climate positive actions in a fun and engaging manner

Table 3. Identified stakeholders and their interests.

4.2 Preliminary requirements

In order to conduct a fruitful brainstorm some preliminary requirements were created which have to be met. These requirements were stated by the client during frequent meetings. In Chapter 5 the final functional and nonfunctional requirements will be defined using the background research and interviews with the stakeholders and experts.

The first concepts must conform to the following preliminary requirements, as found through background research and during client contact :

- The puzzle should be linked to the climate crisis.
- The puzzle should foster collaboration.
- The puzzle should have an educational component.
- The puzzle should fit into the solarpunk theme.
- The puzzle should contain technology.

These preliminary requirements will be used during the brainstorming process.

4.3 Ideation Process

Brainstorm process

In the beginning of the brainstorming phase I created an overview of the usable properties of the Airstream caravan and the climate themes which I could think of.

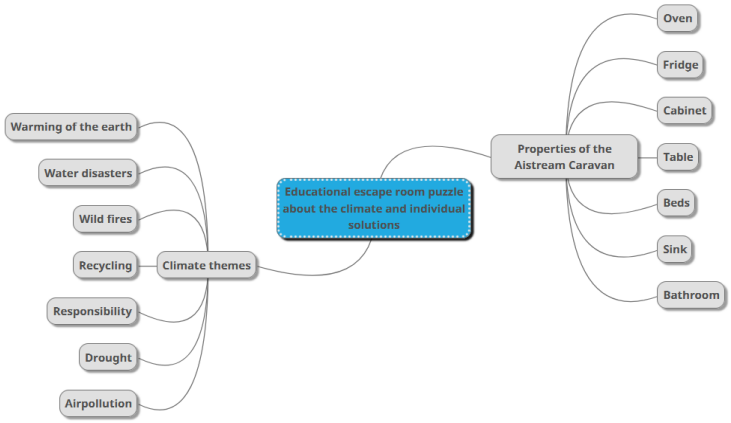


Figure 14. Overview of locations in Airstream caravan and Climate themes

After the identification of the properties and climate themes as described in Figure 14, a grid was created using the Heuristics Ideation Technique [59], with puzzle ideas matching in location and the climate theme.

Figure 15. grid

In order to find puzzles which consisted of multiple parts, two ideas were combined to create nine new ideas.

Figure 16. Combined ideas

The ideas as depicted in Figure 16 were evaluated on the earlier stated preliminary requirements. In addition to this, an indication was added to ideas that felt especially inspiring. This evaluation can be found in Table 4.

Idea	Link to climate crisis	Collaboration	Educational	Solar-Punk	Technology	Inspired?
Burning earth in an oven which has to be cooled by selecting the correct measures.	Yes	Possible	Yes	Possible	Yes	Yes
Correct time for a clock needs to be found.	Yes	Possible	Yes	Possible	Yes	No
Remove plastic from the ocean created in the sink and place the plastic in a recycling facility.	Yes	Possible	Yes	Possible	Possible	No
Find hidden temperatures to open the freezer door.	Yes	No	Possible	No	Yes	Yes
Find a secret vine which can save dying plants.	Yes	Possible	Possible	Yes	Yes	Yes
Find hidden numbers using the heat of a hand on thermochromic paint.	Yes	Yes	Yes	Possible	Yes	Yes
Find polarized glasses to de-smog the oven and to find a hidden message.	Yes	Possible	Possible	Possible	Yes	No
Find a recipe to reduce air pollution in a cookbook.	Yes	Possible	Possible	Possible	Yes	No
Flush bad environmental habits down the toilet.	Yes	No	Yes	Possible	Possible	No

Table 4. Evaluation of satisfaction of preliminary requirements created ideas

After careful evaluation of Table 4 it was decided to ideate further on the following ideas:

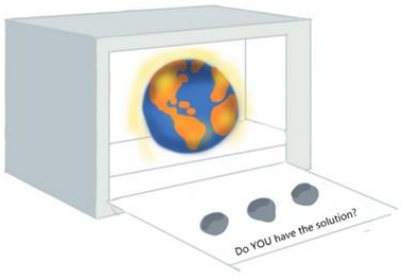
- Cool down the burning earth inside of the oven by taking out climate positive measurements, which have been ‘auf Eis gelegt’, out of the fridge and placing them inside of the oven. *(Idea 1)*
- Find a vine in the tap. Connect it to scorched plants in the oven to revive them. *(Idea 5)*
- Find handprints with thermo-chromatic paint. Use heat of hand to reveal temperatures. Enter temperatures to open the cabinet. *(Idea 6)*

Even though the idea of finding hidden temperatures which can be used to open the freezer door (*Idea 4*) really inspired me, it did not allow for collaboration and it did not really fit the solarpunk theme.

The three ideas as identified above will be further elaborated upon.

4.4 Top 3 ideas

4.4.1 Save the burning earth

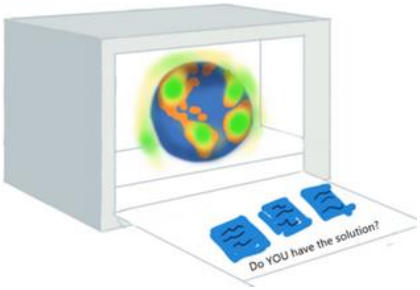


The first idea revolves around the burning earth. The users will find a burning earth inside of the oven. On the oven door, solutions can be placed.

Figure 17. Burning earth inside of oven

The solutions can be found inside of the fridge since they have been ‘auf Eis gelegt’.

Figure 18. Fridge with solutions



If the users place the correct solutions on the oven, the earth will flourish again and a code or object will be released, depending on the preferred puzzle flow of the client.

Figure 19. Flourishing earth after correct solutions

4.4.2 Personal contribution

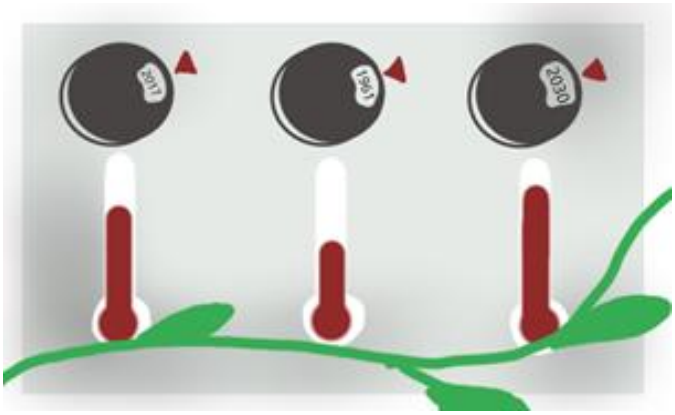
The players find a lot of painted handprints in the caravan. These handprints are painted with temperature chromatic paint. The players have to place their hands on the handprints, because through the warmth of the hand, the color changes and reveals a year and a number:

1. 2017, **2.** 1961, **3.** 2030

In addition to this also a temperature is given: (average temperature during the corresponding year, the temperatures below are not correct, they just serve as an example)

1. 16.6 degrees, **2.** 12.81 degrees, **3**. 20.81 degrees

Figure 20. Hand changing color revealing needed data



The found temperatures and year can be entered into a display. Once the correct combination of years and temperatures is given a code or object will be released depending on the preferred puzzle structure of the client.

Figure 21. Display

4.4.3 Revival

The players find an oven with dirt, everything is scorched because of the heat and on the door they find the message: Give us water. The players have to find a water source.

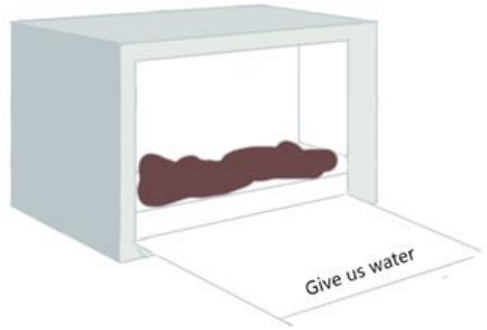


Figure 22. Oven with scorched plants

Figure 23. Vine growing out of tap

The players can find a vine growing out of the tap. This vine can be connected to the oven and after this is done flowers will start to grow. The color pattern of the flowers can be entered into a display, if the correct combination is entered a code or object will be unlocked depending on the preference of the client.

Figure 24. Connected flowers

4.5 Final idea

After consultation with the client, it was decided that the final idea would be Idea 1 - Saving the burning earth. The client liked the idea the most due to the educational nature of the puzzle and the burning earth inside of the oven, which gives a real sense of urgency. In Chapter 5 *Specification* the idea will be worked out more after the creation of the (non) functional requirements.

Chapter 5 - Specification

In order to further develop the final idea, functional and non-functional requirements will be created. This will be done by evaluating the background research, interviews with the target group, interviews with the design team in addition to the evaluation of an expert interview.

5.1 Interviews

To create requirements for the graduation project, interviews with the client, an expert and the target group were held. These interviews were conducted in collaboration with Mark Ziegelhöfer and Arthur van der Torre.

5.1.1 Client interviews

A total of five interviews with the client and members of the development team were conducted by Arthur van der Torre. The aim of these interviews was to define the wants and needs of the client in regards to user experience and product requirements. The interviews were conducted online and the anonymized transcription can be found in Appendix 2 A-E.

After the analysis of the interviews it became apparent that the client values the users having fun. For 2 interviewees, having fun was the first thing that was mentioned: ‘Well, it has to be fun, I think’ (Appendix 2A, r71) and ‘So, fun and entertainment would be the first’ (Appendix 2D r84). Another thing which was mentioned often by the client and the development team was durability. All five interviewees mentioned that durability should be an important aspect of the prototype with the expected durability ranging from three months (Appendix 2E, r101) up to three to five years (Appendix 2D, r94). The repairability of the puzzle is also highly valued by the development team and mentioned by all five of the interviewees. Lastly, the interviewees requested a plan B in case the puzzle fails.

When asked about the theme and logistics of the puzzles, all five interviewees mentioned that the escape room is created with the Solar puck aesthetic in mind and that this is something which also should be incorporated into the puzzle. One of the interviewees indicated that it would be ‘cool’ if the kitchen were to be used for a puzzle: ‘*For example, I find all these things that the kitchen is still there. No, I think that's totally great and I have to find it in the games. So it would be nice if they were integrated, this kitchen, this fridge, this oven*’ (Appendix 2A, r41).

5.1.2 Expert interview

In addition to the client interviews, an expert who played over 120 commercial escape rooms, studies Game design for educational escape games and who works for an escape room designing company , was interviewed. The aim of this interview was to gather more information on how to design an (educational) escape room. This interview was conducted online by me, the researcher, the anonymized transcription can be found in Appendix 5.

First the expert was asked about the goal of an escape room. It was mentioned by the expert that the main goal is for the users to have fun while playing the game. It was mentioned that having fun is often overlooked when designing an educational game. The expert explained that fun and achievement are important in educational games: *'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 whatever the topic of the story is but they should feel good!' (*Appendix 5, r17-19*).*

When asked about which elements can be seen as necessary for a good user experience the expert mentioned that emotions are important. The expert suggested thinking about what emotions should be felt by the player at certain moments of the game (Appendix 5, r68-70). In addition to this, it was mentioned that the emotion of frustration should not be avoided, however, should be minimized. The usage of red herrings (fake hints) is also discouraged by the expert since players often create their own red herrings (Appendix 5, r 76).

Lastly, the importance of paper prototyping was mentioned since it allows for easy testing and validating puzzles (Appendix 5, r47-50).

5.1.3 Target group interviews

Two types of target group interviews were conducted:

1. Target group members who have been to an escape room. A total of seven people were interviewed, the interview was audio taped and later transcribed and anonymized (Appendix 3 A-E). All of these participants went to a different escape room.
2. Target group members who just finished an escape room in Münster. A total of sixteen people divided over two groups interviewed. The groups played the escape room together and the interviews were also conducted together with the entire group. These interviews were also audio taped and later transcribed (Appendix 4 A,B). These interviews were conducted by Mark Ziegelhöfer.

When analyzing the interviews, several recommendations can be made. First of all it is important to create a clear story line to ensure that the players know what they are doing and how the puzzles are linked to the story. In addition to this, some participants also indicated that they did not enjoy their escape room fully because they did not understand some puzzles. When asked what puzzle participants liked the most, participants mentioned puzzles which require physical interaction: *' I also liked the puzzles where you actually had to do something physical, something tangible that you had to do something with'* (Appendix 3E, r79). Lastly, some of the interviewees mentioned that they really liked plot twists (when something unexpected happens). One of the participants gave an example of a door of a washing machine opening as a way to another room (Appendix 3A, r 11-14). Another interviewee also mentioned to appreciate the plot twist which was incorporated into the escape '*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.'* (Appendix 3D, r 63-65).

5.2 Requirements

The interviews with the client, members of the development team, an expert and members of the target group in addition to the background research and client meetings will be used to define requirements.

5.2.1 Functional requirements

Functional requirements are measurable functions and features which the design of the puzzle should satisfy for it to work the intended way. Because there will be a substantial amount of functional requirements, they will be prioritized using the MoSCoW method.

Must have

Must-have requirements are fundamental for the functioning of the puzzle. Without satisfying these requirements, the puzzle might not be safe or reach its intended goal.

Requirement	**Explanation**	**Source**
1. The puzzle must contain technology	Without the integration of Technology, the puzzle would not be suitable for an Graduation Project for the Bachelor 'Creative	Interview Client/ development team

	Technology'.	Interview Expert
2. The puzzle must be safe	It is highly important to ensure the user's safety when interacting with the puzzle.	Interview Client/ development team
3. The puzzle must be solvable in 10 minutes	The puzzle must be solvable in a relatively small amount of time because it is part of an escape room with a time limit.	Interview Client/ development team
4. The puzzle must be durable	Because the puzzle will be used continuously for 3-5 years, the durability of the puzzle is highly important.	Interview Client/ development team Interview Expert
5. The puzzle must address the climate crisis	The aim of the escape room is to teach about climate positive changes in day-to-day life therefore the climate crisis has to be addressed.	Interview Client/ development team
6. The puzzle should work reliably without the need for human intervention	It is important that the escape room puzzle is reliable since it is a technical piece, it should not need human intervention for it to function properly.	Client meeting Interview Client/ development team

Table 5. Must have functional requirements

Should have

The should-have requirements are requirements which are beneficial for the product but not necessary for its functioning.

Requirements	Explanation	Source
6. The puzzle must be in the theme of SolarPunk	The entire escape room is created with the theme of SolarPunk in mind. It would be really beneficial for the user experience if the puzzle also fits the theme.	Interview Client/ development team
7. The puzzle should fit in the existing infrastructure of the Airstream	A lot of the original decorations and infrastructure of the Airstream are preserved. In order to make sure that the puzzle fits within the surroundings, the puzzle should fit into the existing infrastructure.	Interview Client/ development team Interview Expert
8. The puzzle should be repairable by members of the development team	After the Graduation Project is finished, the development team should be able to repair the puzzle by themselves without the help of the puzzle creator.	Interview Client/ development team
9. The puzzle should take up a relatively small amount of space	A limited amount of space is available within the Airstream caravan. Because of this, the puzzle should not take up too much space.	Interview Client/ development team Interview Expert
10. The puzzle should have a plan B if the power goes out or connection is lost	The puzzle will be created using technology. In order to ensure the continuation of the escape room during technical difficulties, the puzzle should offer an alternative way of solving it.	Interview Client/ development team

Table 6. Should have functional requirements

Could have

The Could-have requirements are nice to incorporate into the project however, do not impact the working of the product.

Requirements	Explanation	Source
11. The puzzle could be made out of recycled materials	In order to embody the theme of climate positive solutions it could be really nice if the puzzle was made out of recycled materials only.	Interview Client/ development team Personal wish

Table 7. Could have requirements

Won't have

The won't have requirements are things which were explicitly mentioned by the client not to do.

Requirements	Explanation	Source
12. The puzzle cannot be placed in the power distribution box	The only place in the Airstream caravan which is not available for the placements of puzzles is the power distribution box (situated in the closet in the back of the caravan).	Interview Client/ development team

Table 8. Could have requirements

5.2.2 Non functional requirements

Non functional requirements describe how the puzzle should teach climate positive measurements to its users. In addition to this, non functional requirements define characteristics of the product which are necessary to meet the goal. All the non functional requirements were marked as should have requirements since all of them are highly beneficial for the puzzle but are not necessary for its operation.

Requirement	Source
1. The puzzle should foster collaboration	-Background research -Interview Client/ development team -Interview Expert
2. The puzzle should be fun to play	-Background research -Interview Client/ development team

	-Interview Expert -Interview Target group
3. The puzzle should foster the feeling of excitement	-Interview Client/ development team -Interview Expert
4. The puzzle has to teach its users how to make climate positive choices	- Background research - Interview Client/ development team
5. The puzzle should be understandable	- Interview Client/ development team -Interviews Target group

Table 9. Non-Functional Requirements

5.3 Context

After the definitive decision for the ‘burning earth inside of the oven’ puzzle and the creation of the requirements, a meeting with the client was held. During this meeting it was decided in which phase of the escape room, the earth inside of the oven puzzle would take place. This allows for the answering of *sub question 1.1 What is the context of the to be designed escape room piece?*

The escape room inside of the Airstream consists of three phases:

1. Kopf/Verstand (Head/ Understanding)
2. Hand/ Mut (Hand/ courage)
3. Herz / Liebe (Heart/Life)

It was decided, together with the client, that the ‘burning earth inside of the oven’ puzzle would be most suitable for the first part of the escape room since it focuses on learning about climate positive measures and requires some thinking. The puzzles of the co-researchers, Arthur van der Torre and Mark Ziegelhöfer were placed in Herz/Liebe and Hand/ Mut respectively.

The placement within the first part of the airstream caravan meant that the ‘Burning earth inside of the oven’ puzzle is encountered as one of the first puzzles. The timeline regarding the to be created puzzle is as follows:

1. Players get a torch
2. Players have to unlock the Airstream caravan by finding a code

3. Players have to use the torch to find the hidden light switch
4. Players find the ‘Burning earth inside of the oven’ puzzle
5. Players solve the ‘Burning earth inside of the oven’ puzzle
6. A video is started after the game master sees that the ‘Burning earth inside of the oven’ puzzle is solved
7. Escape room continues

5.4 Specification Final Idea

After a meeting with the client, in which the top three ideas were discussed it was decided by me and the client that the burning-earth idea was the best fit for the escape room. The specification of the final idea will be done via a walkthrough of the puzzle.

5.3.1 Walkthrough

1. ***The players enter the Airstream caravan and hear the sound of screaming and despair.***

2. ***The players open the oven and find a burning and screaming earth.***

In this step the goal is to evoke some negative emotions such as distress, fear or anger. The goal is to enlarge the risk perception of the climate crisis as described in section *2.4.4. Climate communication* by showing the severity of the situation.

3. ***The participants need to search for the correct solutions which are asked for by a platform inside of the oven door.***

The aim of this is to encourage teamwork and collaboration. The players need to find the solutions which are inside of the fridge.

4. ***The players find the solutions and try to find the correct solution***

The players need to find the best climate mitigation solutions. This can be done by looking at a table on the milk carton. Each milk carton is linked to a category of actions (as can be seen in Table 10.). On each milk carton there are one or two actions and the amount of saved CO2 per year.

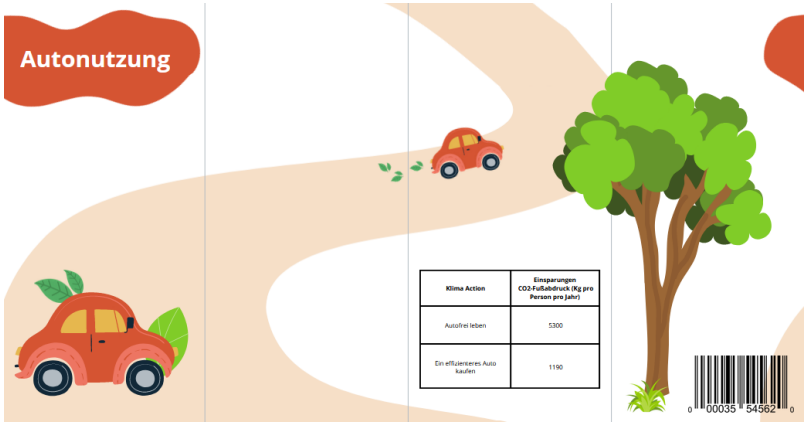


Figure 25. Concept milk carton

The categories and climate mitigation actions will be chosen based on the gained information of section *2.4.3. Perceived effectiveness of personal contribution possibilities.* In this section it was concluded that for some measures a discrepancy can be found between the actual, and the perceived effectiveness. To educate the players about the actual effectiveness of measures these findings will be taken into consideration during the selection of the measures used in the puzzle. In Table 10. The different milk cartons can be found in addition to the displayed measures and their effectiveness. The milk cartons can be classified into three categories as found in section *2.4.3. Perceived effectiveness of personal contribution possibilities* : high effectiveness, moderate/low effectiveness and counter effective.

Milk carton	Measure 1	CO2 reduction in kg/year/ person	Measure 2	CO2 reduction in kg/year/ person	Effectiveness
Car usage	Living car free	5300	Buying a more efficient car	1190	High
Airtravel	Not taking one transatlantic flight	2800	Not taking one continental flight	700	High
Diet	Eating less meat	230	Eating Vegan	1600	High
Water saving	Filling the entire dishwasher before starting it	<0,2	Shorter shower	43	Moderate/Low
Laundry washing	Hanging clothes to dry	210	-	-	Moderate/Low
Recycling	Recycling	210	-	-	Moderate/Low
Energy saving	Installing new LED lights	0,2	Buying green energy	200	Moderate/Low
Bags	Using a reusable bag	5	Using a plastic bag instead of a paper one	-12	Counter effective

Table 10. Milk cartons and their measures

An earlier idea was to not use milk cartons to display the measures but to use objects linked to categories e.g. a car for the category of car usage and a hamburger for diet. However, to create unity and a place for the table it was decided to use the milk cartons.

5. **The players place the measures on the oven**

Every time a user places one of the measures onto the oven door the system will react according to the measure. The following system interactions are possible:

a. The players place a high impact measure onto the oven door. When this happens, the system will react by lowering the volume of the screaming earth. In addition to this, the earth will begin to heal and will turn from bright red to a shade of orange or yellow depending on how many good measures there are.
b. The players place a moderate/ low impact measure onto the oven. In this case, the system will not react since the user does not make a big influence on the climate crisis with this action.
c. The players place the counter productive measure onto the oven. When this occurs, the earth will start to burn brighter and scream louder.

To ensure that the system gives the correct feedback, a point system will be used. The system will start with a score of 0. When a highly effective measure is placed onto the oven door, a point is added to the score. Subsequently, when a negative measure is added, one point will be subtracted from the score.

Score	-1	0	1	2	3
Color earth					

Table 11. Colors according to different scores

When all three correct measures are placed onto the oven, the earth will be blue and nature sounds will be played.

During the background research it was found that self efficacy is an important factor to ensure a behavioral change. This self efficacy, or the perceived ability to perform climate positive actions, can be fostered by a gained knowledge of the subject (Section *2.3.3 Persuasive Design*). By letting the players figure out which measures are effective by interacting with the systems as well as looking at the measures the players might enlarge their self-efficacy.

6. The players placed all three correct measures onto the oven door

Once the players have correctly identified all three correct solutions the earth will be blue again to embody a healed and healthy planet. In addition to this, sounds of nature and calmness will be heard by the players. The aim of this is to give the players a sense of hope since this emotion can be linked to more engagement (section *2.4.4. Climate communication*). It was found that engagement leads to climate action and that it can be attributed to better learning outcomes.

In addition to the client's approval, the ‘Save the burning earth’ idea also fits the insight of the background research the best. In section *2.3.1 Types of Experiences* and section 2.3.2 *Engagement, Immersion and Flow in an educational experience* it was found that active participation and absorption are important aspects for enabling an educational experience as well as the importance of engagement. In addition to this, it was found that motivation and ability are important factors to increase the likelihood of a certain behavior (Fogg Behavioral Model [26]).

5.3.2 Materials

One of the Must have requirements is that the puzzle has to be durable. The puzzle will be used in an escape room and the client wishes to use it for a minimum of 3 months - two years. This means that the puzzle has to be made of durable materials or that there should be an option for replacements. To ensure durability the milk cartons will be made out of wood with a lacquer finish to ensure that the wood is protected well from the elements. In addition to this, a lot of the parts will be 3D-printed and strengthened with glue. This ensures a durable artifact for the puzzle which is also easily replaceable since the escape room team has access to a 3D printer.

Because the escape room teaches about climate positive behavior, it is a personal wish to create the puzzle mostly out of materials which are already available at home. This way, no extra (e-)waste is generated.

Chapter 6 - Realization

In this chapter, the realization phase of the Bachelor thesis will be described. This will be done by clearly explaining the process of how the final prototype was created. In addition to this, all the prototype iterations will be assessed on whether the version meets the functional requirements as described in Chapter 5. Only the Must Have requirements will be assessed in this chapter, a full evaluation will be done in Chapter 7: *Evaluation*.

6.1 Prototype proof of concept

To create a prototype which could be used to explain my final idea, a proof of concept was created by me, the researcher. This proof of concept was created by 3D printing a small milk carton and embedding an RFID tag in the bottom of the milk carton. In addition to this, a small earth was printed and into this earth, a led-ring was added. A RFID reader was attached on the bottom of a black painted box and the earth was inserted into the box. The proof of concept showed the core functionality of the system: When the milk carton was not in the oven the earth was red and when the milk carton was present the earth turned green.

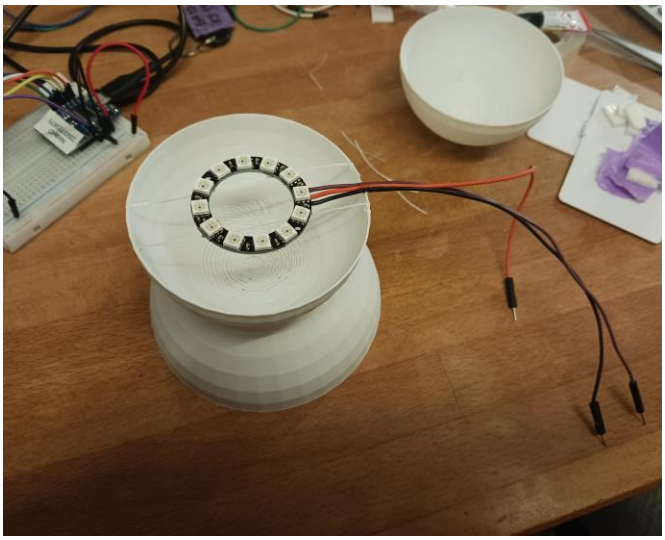


Figure 26. LED inside of earth

Figure 27. Small 3D printed globe

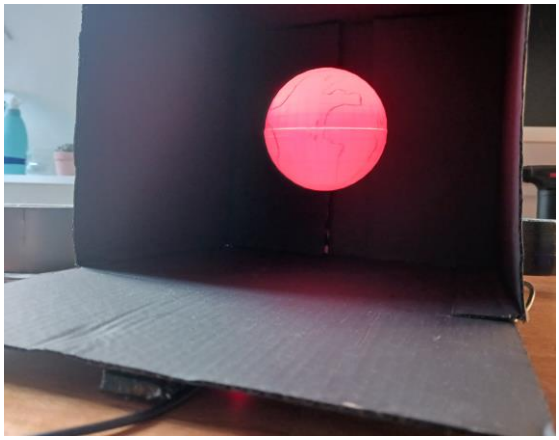


Figure 28. Burning earth without measure

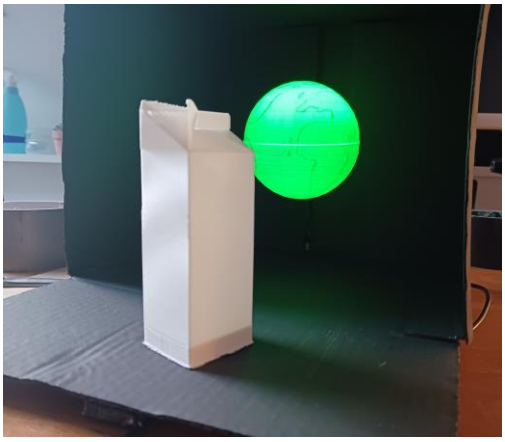


Figure 29. Happy earth with measure

In order to find out if the puzzle is intuitive in its nature a small test was conducted with some housemates. The burning earth was placed inside of the oven and the measure was placed in the fridge. This proof-of-concept was tested by housemates, who were asked to find the solution.

The reactions on this small and informal test were positive. The participating housemates found the milk carton and thought that it was really nice and intuitive that the earth changed color when the milk carton was placed onto the installation.

6.2 Prototype first generation

After the proof of concept the first generation of the prototype was created.

6.2.1 physicalization prototype first generation

For the creation of prototype v1. the system of the proof of concept was expanded with 2 extra RFID sensors as well as an MP3-TF-16P audio player. The MP3-TF-16P was chosen by me due to its intuitive user interaction. Using this media player allows for great flexibility for the client because the sounds can be loaded onto an SD card and are therefore easily adaptable. A set of loudspeakers which were not used anymore by me were added as audio output.

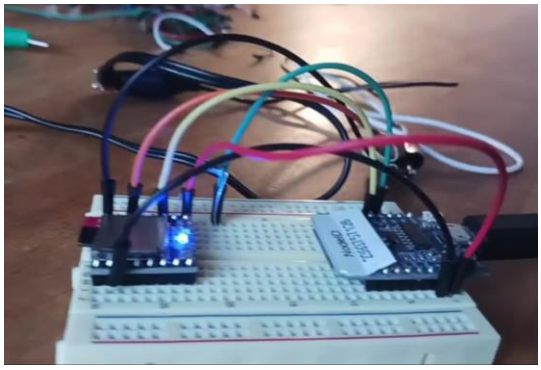


Figure 30. MP3-TF-16P connected to D1 mini microcontroller

6.2.2 technical validation prototype first generation

In order to ensure that the system satisfies the functional requirements some tests were conducted. The main focus of the tests was to ensure the reliability of the system since the system has to function without human interference.

During the tests a major issue regarding reliability became apparent. Around 80% of the time the system functioned as it should, however around 20% of the time one (or more) the RFID readers failed to initialize. This could sometimes be solved by restarting the system however, when implementing an automated restart the issue was not solved. Multiple online forums were consulted to solve the issue. It became apparent that this issue occurs relatively frequently. This issue might be caused due to an unstable connection between the RFID-readers and the Arduino Nano which was used as a microcontroller. Another cause for this issue might be that the RFID sensor communicates in a way which only permits one sensor at a time even though it communicates via common serial bus (SPI). This is potentially caused due to cheaper chips on the RFID module.

The following efforts were made to find a solution to this problem:

- Ensuring a stable physical connection by soldering the RFID readers directly onto the microcontroller.
- Ensure that the cables used to connect the RFID readers to the microcontroller are of the same length to rule out data delivery errors.
- Programming delays to ensure that the RFID readers had enough time to initiate.

Unfortunately, the system failed to satisfy the demand for a stable and reliable system and therefore a prototype v2. was created.

Must-Have Requirement	**Achieved**	**Explanation**
1. The puzzle must contain technology	Yes	The puzzle contains technology such as an Arduino Nano, RFID sensors and a LED ring.
2. The puzzle must be safe	Yes	With normal usage, the puzzle can be deemed safe. No high voltage is used in the puzzle and the puzzle will not hurt the user with normal usage.

3. The puzzle must be solvable in 10 minutes	Not tested	Not tested, this will be tested during the user tests.
4. The puzzle must to be durable	Not tested	Not tested, this will be tested during the user tests.
5. The puzzle must address the climate crisis	Yes	The topic of the puzzle revolves around finding effective climate mitigation actions.
6. The puzzle should work reliably without the need for human intervention	No	The puzzle is not reliable enough. The RFID sensors fail to initiate for 100% of the tries. This means that for some of the runs, human intervention is needed to start the system.

Table 12. Achieved Must have functional requirements prototype v1.

6.3 Prototype second generation

6.3.1 physicalization prototype second generation

In order to ensure reliability, the RFID readers were removed from the system and replaced with Hall-effect sensors. The main functionality of a hall-effect sensor is to detect a change in the magnetic field. In order to detect which measure is presented to the system a combination of magnets will be used underneath the milk cartons. When a milk carton is placed on top of the system the hall sensors detect how many magnets are present.

The magnets will be configured in such a way that there are nine unique IDs. This will be done by checking if there is an inner magnet present and counting how many outer magnets are present.

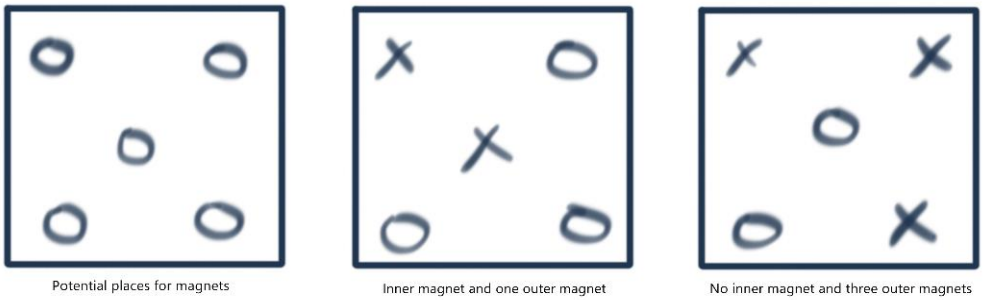


Figure 31. Magnet configuration

This configuration allows for identification without the need for a specific orientation since it is a numerical approach. In *Figure 32* the nine different IDs are shown.

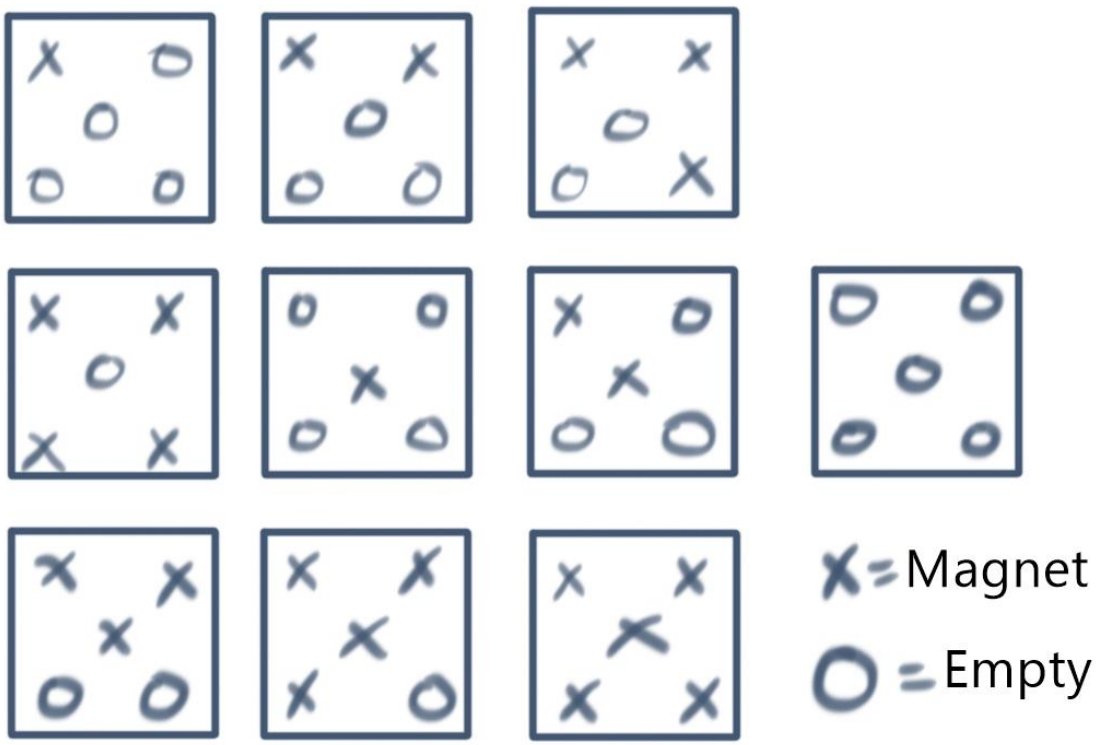


Figure 32. Possible IDs.

In *Figure 32* ten different IDs can be seen, however the isolated ID most right in the middle consists of all empty spaces meaning that no magnets are present. This is the state which is used to indicate that there is no milk carton present.

The ID configurations were taped to a piece of carton, and magnet detectors were made in a similar way. In addition to this, a bigger earth was printed to test how the 3D printed globe could be painted.

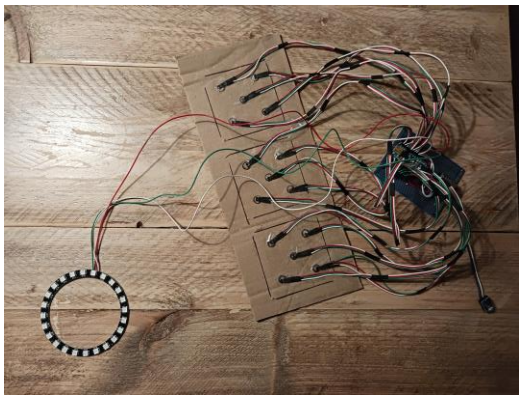


Figure 33. Configuration hall effect sensors

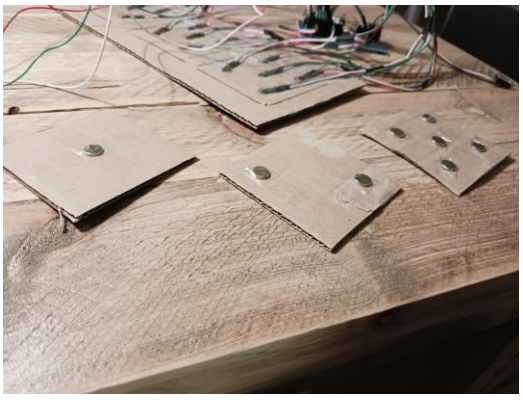
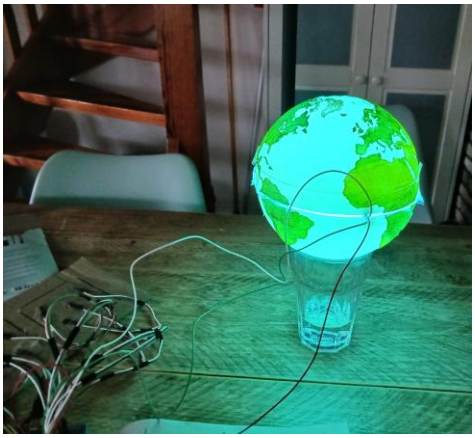


Figure 34. Cardboard IDs



To ensure that the colors of the paint would appear vibrant and appealing with the blue background light which will be displayed if the puzzle is solved several colors were tested.

Figure 35. Painted earth

6.3.2 technical validation prototype second generation

To verify whether or not the second generation of the prototype was satisfying the Must have requirements some tests were conducted. The system was tested by testing all different inputs. During these tests some minor problems arose, most of which were resolved with some minor modifications in the code.

One problem was a bit harder to resolve since a tilted input of the ID patch could generate a false ID recognition because some Hall effect sensors recognized magnets earlier than others. This will be resolved in the last generation of prototypes by adding a negative space to place the milk carton in. By adding the negative space the movement of the milk carton is restricted ensuring a perpendicular insertion.

Must-Have Requirement	**Achieved**	**Explanation**
1. The puzzle must contain technology	Yes	The puzzle contains technology such as an Arduino Nano, RFID sensors and a LED ring.
2. The puzzle must be safe	Yes	With normal usage, the puzzle can be deemed safe. No high voltage is used in the puzzle and the puzzle will not hurt the user with normal usage.
3. The puzzle must be solvable in 10 minutes	Not tested	Not tested, this will be tested during the user tests.

4. The puzzle must to be durable	Not tested	Not tested, this will be tested during the user tests.
5. The puzzle must address the climate crisis	Yes	The topic of the puzzle revolves around finding effective climate mitigation actions.
6. The puzzle should work reliably without the need for human intervention	Yes	The puzzle is not reliable enough. The RFID sensors fail to initiate for 100% of the tries. This means that for some of the runs, human intervention is needed to start the system.

Tabe 13. Achieved Must have functional requirements prototype v2.

6.4 Final prototype

After gaining valuable insight from the two previous prototypes, the final prototype was developed. Several parts of the previous prototypes were adapted to ensure durability and usability.

6.4.1 Earth

The first part of the prototype which was adapted by me, was the earth. To give the prototype more fidelity, a larger (175mm in diameter) and more detailed 3D model was used for the earth. To create the earth a model made by Daniel Wenger was used [60]. The model was printed in two parts, and locating pins were used to fit the halves correctly together. The landmass of the earth was painted using acrylic paints and a realistic color scheme. In the middle of the earth, a LED ring was again mounted. This LED ring was larger than in previous versions of the prototype, to make up for the increase in size of the earth and to increase the amount of emitted light. The LED ring was mounted inside of the earth using another 3D printed part (see picture 36). The wires needed for the LED ring exited the earth between Asia and the Americas. This position was chosen in collaboration with the client, as it resulted in the frontal placement of Europe and Africa. In order to mount the earth inside of the oven in the Airstream, a system consisting of a screw thread and two 3D printed foot was devised (see Figure 39). The earth was suspended on the screw thread using lock-nuts, which could also be used to tighten the feet against the oven walls. This system was inspired by extendable shower-curtain rods.

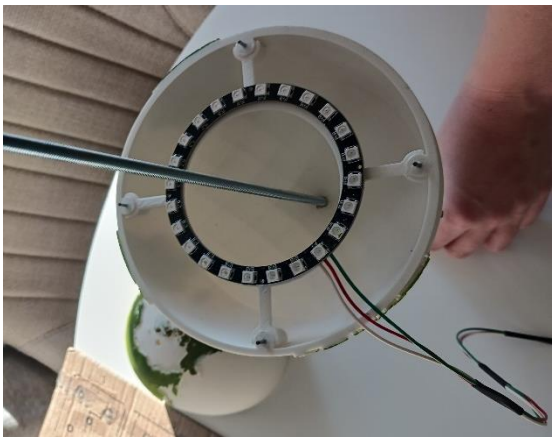


Figure 36. LED-ring mounted inside the earth

Figure 37. Painted earth

Figure 38. 3D printed half of earth

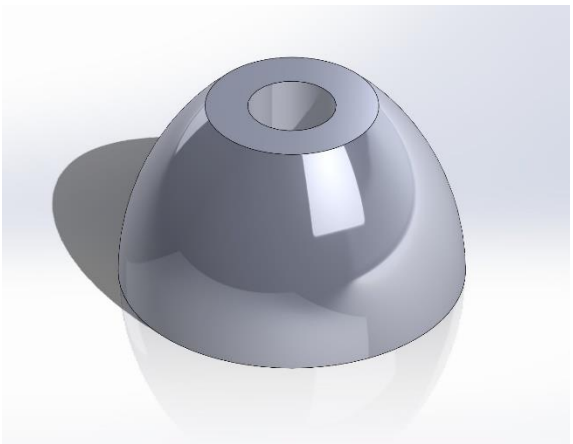


Figure 39. 3D printed footer for fastening of the earth

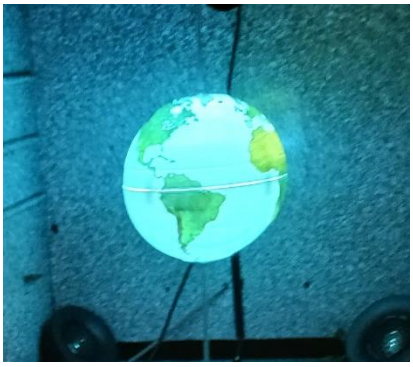


Figure 40. Blue earth

Figure 41. Yellow earth

Figure 421. Red earth

6.4.2 Milk cartons

In order to ensure a durable play object, the milk cartons were created out of wood. The final dimensions of the milk cartons were modeled to real milk cartons (70x70x280mm). First, a wooden beam was cut to length using a handsaw. Subsequently, the diagonal cuts at the top of the carton were made using a template to ensure consistency. The milk cartons were then decorated with a wooden dowel, which represented the cap. The entire carton was painted with white lacquer, which ensures protection from moisture and damage. After successful tests with the paper-prototype magnet IDs, 3D printed magnet holders were designed and printed. All holders were filled with the correct magnets as described earlier in subsection *6.3.1 physicalization prototype second generation* and labeled to enable easy identification during prototype testing. The holders were attached to the wooden milk cartons using four wood screws, which again ensure durability. Finally, labels for all measures were designed according

to the final milk carton sizing. The designs were made in an online editor named Canva[4] and printed at the university. The labels are attached to the milk cartons using double-sided tape.

Figure 43. Sawing of milk cartons

Figure 44. Lacquered milk cartons

Figure 45. Inserting magnets into ID

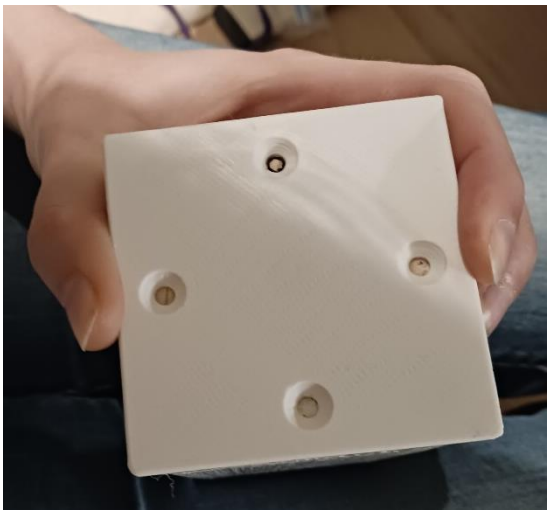


Figure 46. ID on bottom of milk carton

[4] https://www.canva.com/

Figure 47. Milk carton inside of fridge

Figure 48. Render of ID magnet holder

6.4.3 Measure detectors

For this final prototype, the same style of detector was made as in the paper prototype. To ensure no false positives would be detected as in the previous prototype, the magnet detectors were now 3D printed. A holder was created which placed each detector at the correct location of the ID grid. Additionally, the magnet detectors were put into a negative space, which ensured that the milk carton was inserted straight into the holder, however to not interfere with easy insertion, the top of the holder was chamfered. On the bottom of said holder, cable channels were added for the detector cables. This ensured that the holders took up as little space as possible and the baseplate could be kept low. In order to guarantee stability, the magnet detectors were additionally taped to the holder.

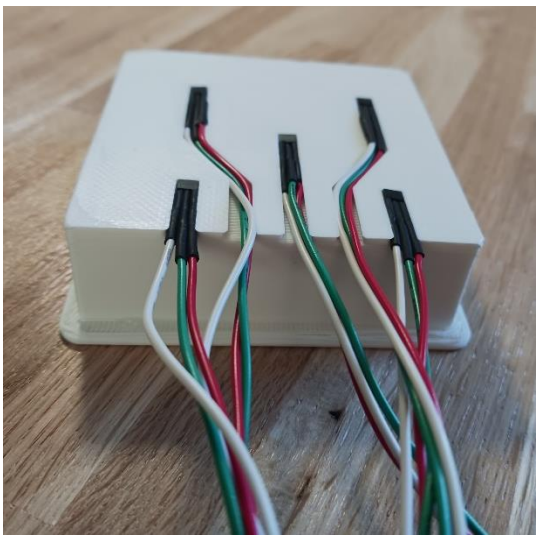


Figure 49. Magnet detector on back of milk carton holder

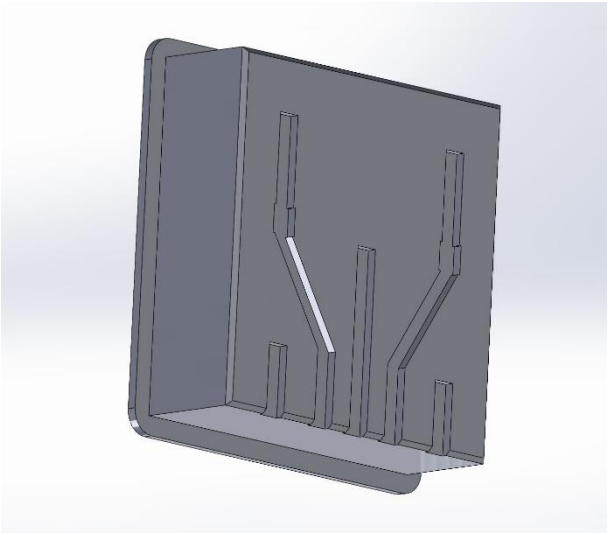


Figure 50. Render of milk carton holder

6.4.4 Baseplate

A baseplate to fit the electronics as well as the milk carton-detector holders was constructed from wood. The dimensions of the baseplate were adapted during installation into the Airstream, to precisely fit the oven door and still enable seamless opening and closing. The baseplate consisted of a top plate and a wooden frame. The top plate can be easily removed with four screws. The whole baseplate was painted black to fade into the oven and mounted using double sided tape. There were cutouts for the detector holder on the top, as well as a cutout at the back to enable wires from passing in and out of the enclosure. On the underside of the top plate, there were mounts for the electronics(see pictures in next section). A raised message was added to the baseplate, which prompted the players of the escape room to go look for the best solutions - “Suchts du die beste Lösung?”.

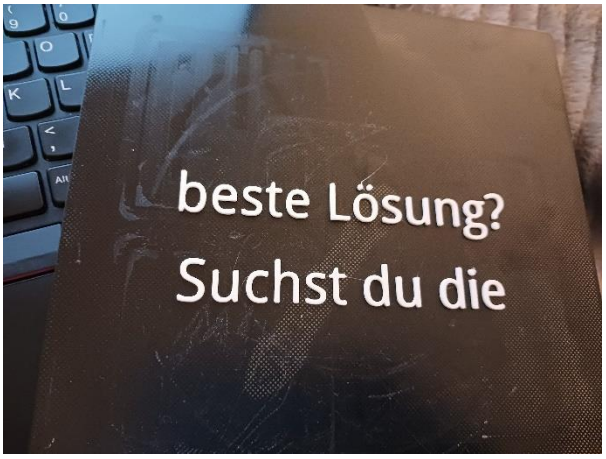


Figure 51. 3D printed raised letter

Figure 52. Top view baseplate

Figure 53. Overview installation

6.4.5 Electrical system

The electrical system remains largely unchanged from the previous prototype, however it was improved for added durability. The components (Table 14) were soldered onto a protoboard and cables for the magnet detectors were soldered and crimped. All external components such as the speakers and magnet detectors were connected using pin headers, which ensures easy replacement when needed. The protoboard can be powered using a standard USB power supply or direct 5V power. The maximum power draw (measured) was around 1.2A, resulting in a power of 7W. The electronics were tidied using holders and cable ties connected to the underside of the baseplate. For reference, the electrical schematic can be seen below in Figure 56.

Component	**Description**
Microcontroller	Arduino Nano V3
MP3 player	DFrobot MP3-TF-16P Mini
Magnet detectors	Allegro A3144 hall effect sensor
Speakers	Thrifted Philips 3W 8 ohm speakers
Circuit board	See schematic below

Table 14. Components needed for system

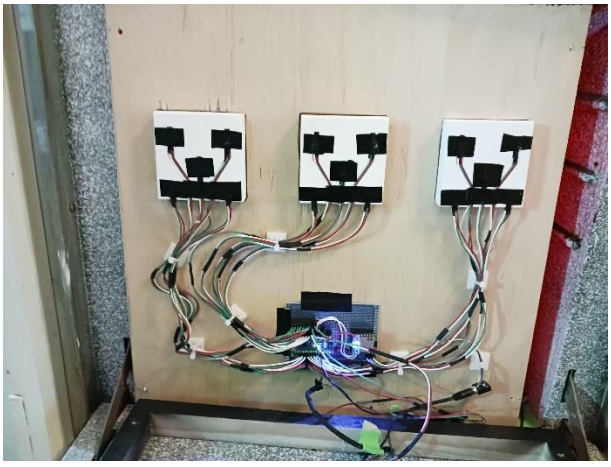


Figure 54. Underside base plate

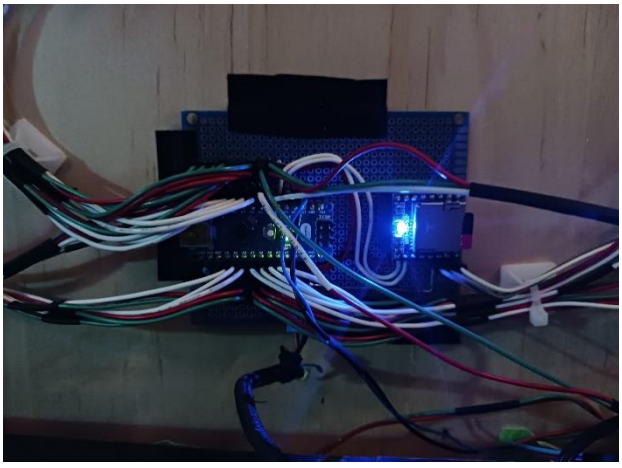


Figure 55. Close up soldered proto board

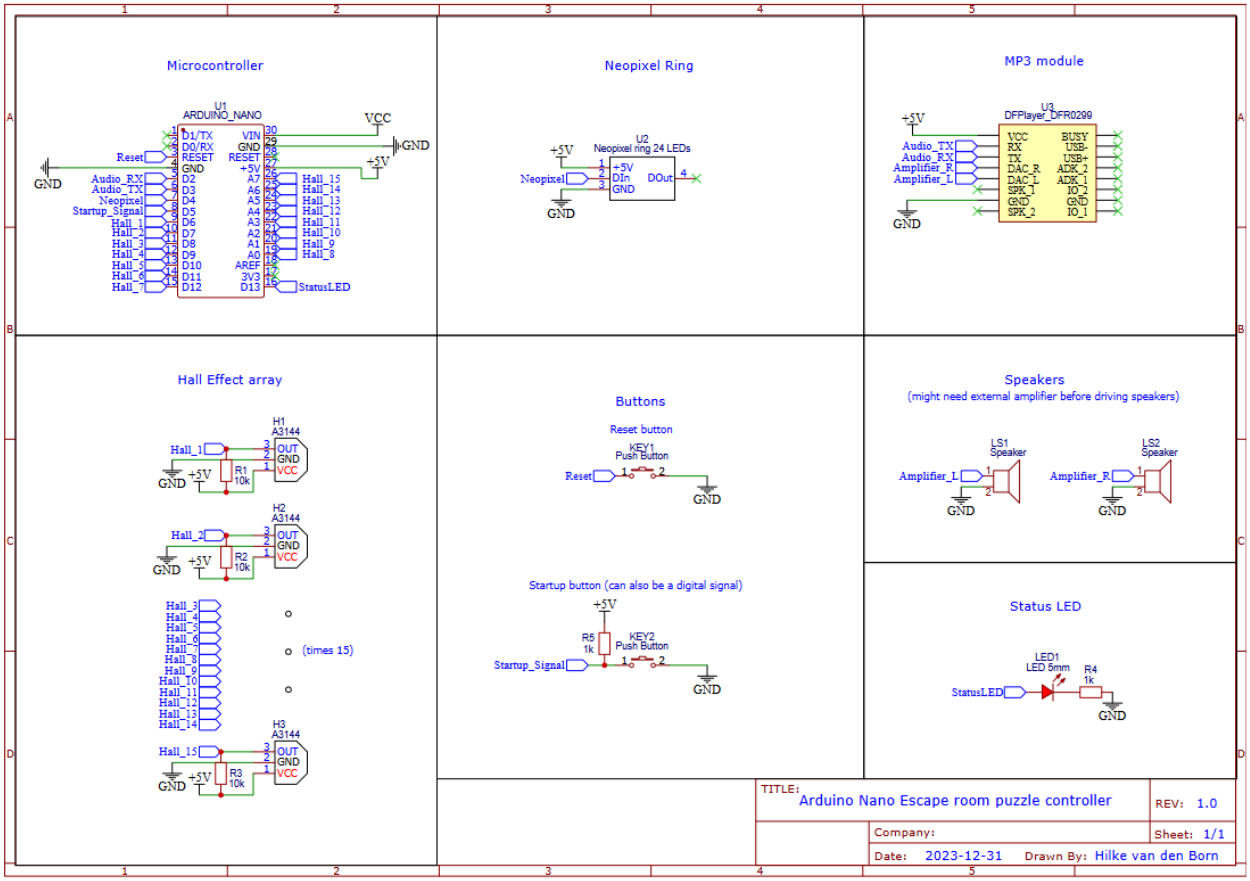


Figure 56. Schematic electrical system of puzzle

6.4.6 Coding

The microcontroller was programmed using the Arduino platform. The code initializes all connected components using their respective communication protocols (UART, SPI and Digital IO). The soundtrack and LEDs are started once the Startup button is pressed. The main program periodically checks all magnet detectors and decodes each ID once they are detected. The program updates the LED animation using the color scheme as described previously in subsection *5.3.1 Walkthrough*, as well as the volume of the sound playback once it detects a change in IDs. After the three correct measures are input, the program enters its end state, in which the LED animation shows a revived earth, and the winning soundtrack is played. After the soundtrack is finished, the microcontroller goes into idle mode and waits to be reset for the next playthrough.

6.4.7 Functional requirement review

The functional requirements were evaluated after the final prototype was constructed.

Requirement	MoSCoW	Achieved	Explanation
1. The puzzle must contain technology	Must have	Yes	The puzzle contains technology such as an Arduino Nano, RFID sensors and a LED ring.
2. The puzzle must be safe	Must have	Yes	With normal usage, the puzzle can be deemed safe. No high voltage is used in the puzzle and the puzzle will not hurt the user with normal usage.
3. The puzzle must be solvable in 10 minutes	Must have	Yes	All test groups solved the puzzle within 10 minutes.
4. The puzzle must to be durable	Must have	Yes, however more testing is required	The puzzle is created with durability in mind. However, one day of user tests might not be sufficient to conclude the durability of the puzzle.
5. The puzzle must address the climate crisis	Must have	Yes	The topic of the puzzle revolves around finding effective climate mitigation actions.
6. The puzzle should work reliably without the need for human intervention	Must have	Yes	The puzzle is not reliable enough. The RFID sensors fail to initiate for 100% of the tries. This means that for some of the runs, human intervention is needed to start the system.
7. The puzzle must be in the theme of SolarPunk	Should have	Yes	Some nature related parts, as well as technology were incorporated into the design of the puzzle.
8. The puzzle should fit in the existing infrastructure of the Airstream	Should have	Yes	The puzzle fits into the existing infrastructure of the airstream. The oven is used to contain the burning earth and the base plate. The fridge is used to store the measures.

9. The puzzle should be replaceable by members of the development team	Should have	Yes	The installation was made modular and spare parts were given to the climate escape room team. In addition to this, documentation is available.
10. The puzzle should take up a relatively small amount of space	Should have	Yes	The puzzle fits inside of the oven.
11. The puzzle should have a plan B if the power goes out or connection is lost	Should have	Yes	The game master is responsible for the next part of the escape room since a video is started by the game master as soon as the puzzle is finished. However, the puzzle can also be started if the puzzle is not completed.
12. The puzzle could be made out of recycled materials	Could have	Yes	Minimal new materials were bought for the creation of the puzzle.
13. The puzzle cannot be placed in the power distribution box	Should not have	Yes	The puzzle is not placed in the power distribution box.

Table 15. Review of functional requirements.

Chapter 7 - Evaluation

The fourth and last phase of the Creative Technology Design Cycle is called the evaluation phase. During this phase the created final prototype as well as the non-functional requirements will be tested.

The user tests were conducted in the Airstream caravan which was located on the O&O square of the University of Twente on the 11th of January, 2024. A total of 14 participants divided amongst five groups took part in the user test. The participants were recruited via the personal social circuits of the researchers. The main inclusion criteria was that the participants should have a sufficient understanding of the German language. However, due to some miscommunication between the researchers, not all participants possessed a sufficient understanding of the German language. As can be seen in *Table 16* the group size is not consistent, this is because the participants were grouped by their availability.

Group	**Number of members**	**Number of fluent German speakers**
1	1	1
2	3	3
3	2	2
4	3	1
5	3	0

Table 16. Group characteristics.

The groups were asked to solve the puzzle within ten minutes. If the puzzle was not solved after ten minutes, the test was paused and the participants would be asked to describe their problems and questions. After the completion of the puzzle, the participants were asked to fill in an evaluation form *(Appendix 6)*.

7.1 Setup

For the user test, the participants stayed inside of the caravan to solve the puzzle. As to not interfere with the participants, the researcher stood outside monitoring the participants via the window as indicated in *Figure 57.* In addition to this, the researcher had access to a livestream with audio which could also be used to create observational notes.

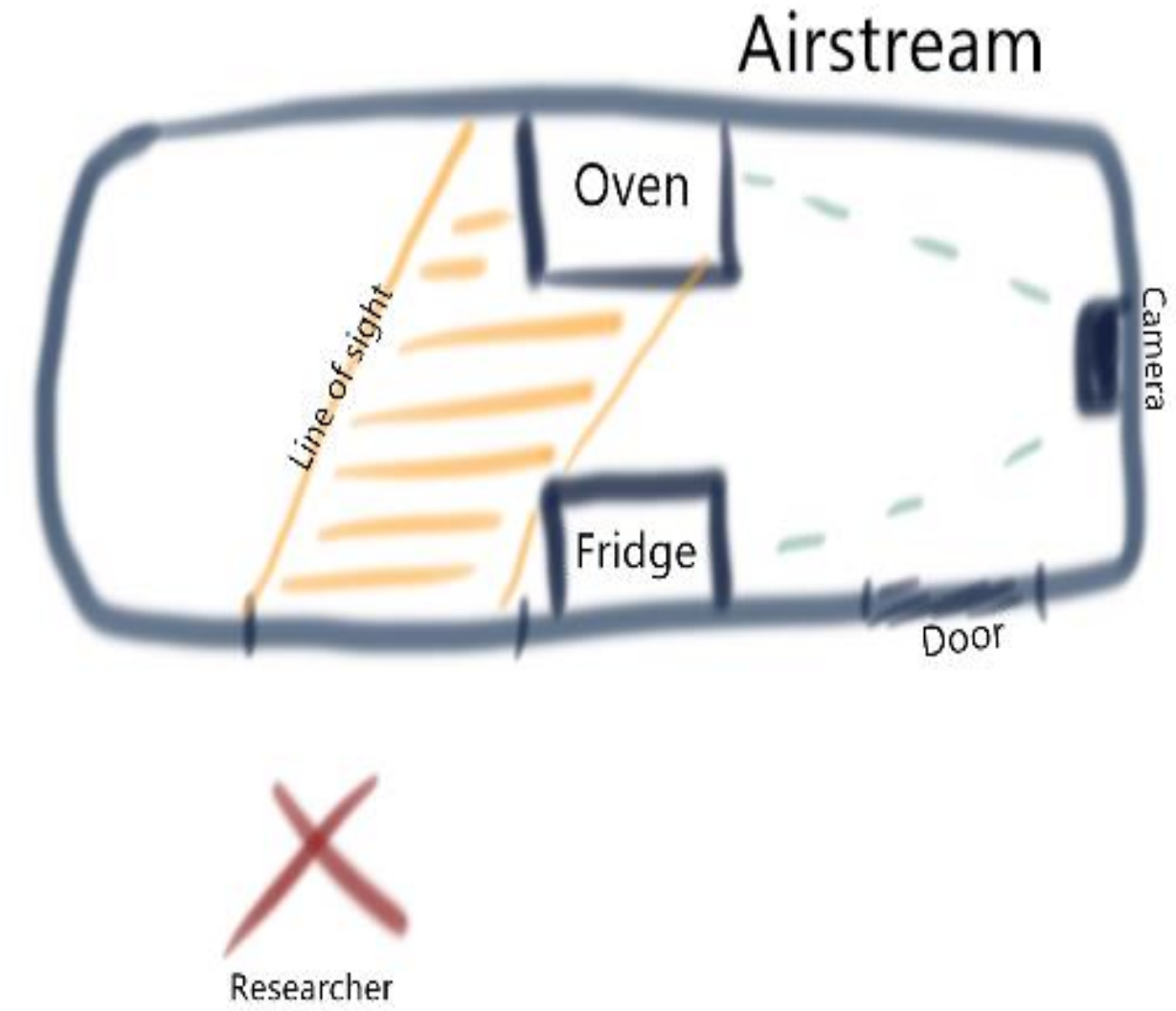


Figure 57. Setup user evaluation

7.2 Procedure

The participants were all asked to follow the same procedure:

1. The groups are invited into the caravan and briefed about the project. During this briefing information about the project, the participating students, the German development team and the user test will be given. In addition to this, a clear explanation is given about the way the gained information will be processed and the participants are notified about the possibility to withdraw from the study within seven days of the user test.
2. The participants are given an information brochure which they are asked to read.
3. The participants are asked if they have any questions about the project, the data collection or anything else.
4. If there are no questions, the participants are asked to sign a consent form in which they indicate that they agree with the data collection and acknowledge that they know that withdrawal is possible up until seven days after the user test.
5. The participants get a group number which will later be used to identify the different groups without the need for personal identifiable information.
6. The participants are asked to wait outside for a short period of time.
7. The puzzle is started without the participants seeing it.
8. The researcher goes outside and invites the participants into the caravan.
9. The participants receive the following hint: ‘Your puzzle is solved once you find a blue earth’. *
10. The participants have ten minutes to solve the puzzle.
11. If the participants did not manage to find the solutions after 4 minutes the following hint will be given: ‘Die Lösungen sind auf Eis gelegt’ - the solutions are put on ice.
12. As soon as the participants have solved the puzzle the researcher goes inside of the caravan to congratulate the participants.
13. The participants are asked to fill in a survey.
14. The participants are thanked for their time and participation.

*This hint was added after two groups were unsure if they finished the puzzle or not.

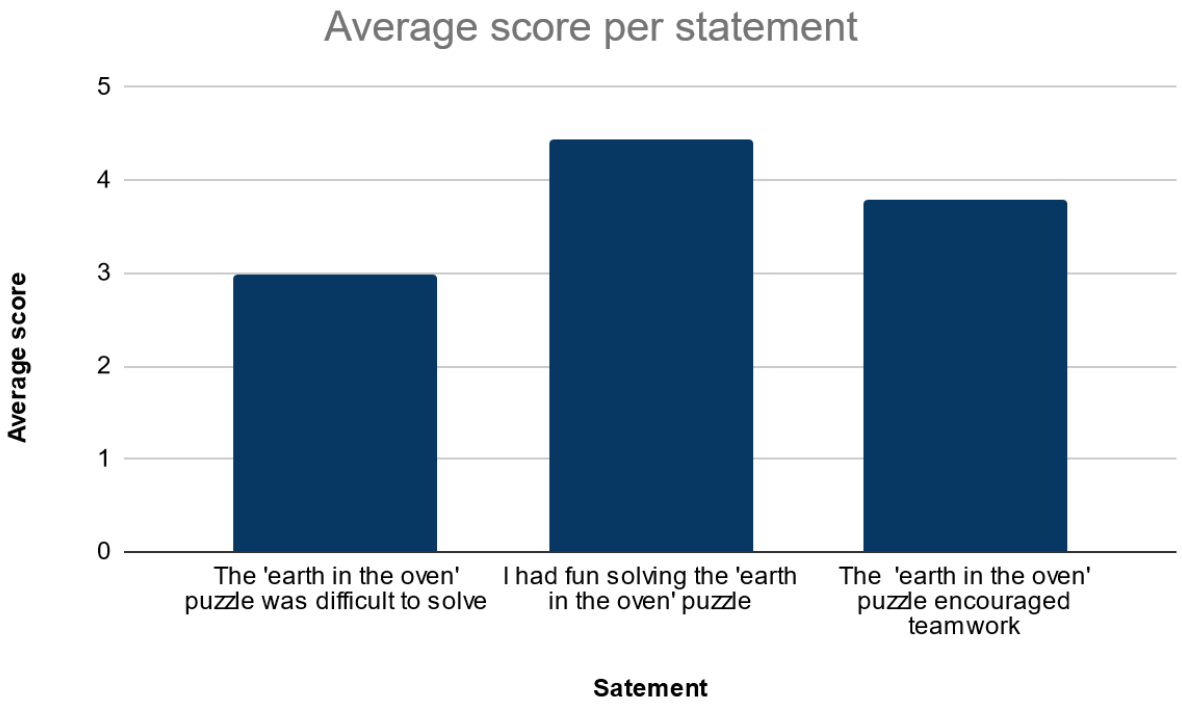
This study and procedure have been approved by the ethical committee of the EEMCS faculty with the provision that the results are published anonymously according to the GDPR regulations.

7.3 Survey Results

The participants were asked to fill in a questionnaire about their experience. All of the groups managed to solve the puzzle within the given ten minutes however, all groups needed the hint which was available after four minutes. This hint was given because four out of five groups began solving the wrong puzzle. This was likely caused due to the fact that two other puzzles were also being tested in the Airstream. In addition to this, a lot of unrelated objects were left in the Airstream caravan after building, which caused confusion. First the participants were asked to describe the general theme of the puzzle and the learning experience. Overall, most of the participants indicated that the puzzle revolved around the climate crisis. Several participants stated that the theme of the puzzle was related to solving the climate crisis with responses such as; ‘Approaches to solve the climate crisis’ and ‘Learning things about impacting climate change’.

When reviewing the answers to the question what the participant learned from the puzzle some mixed answers were given. Eight out of fourteen participants mentioned that they learned about the fact that some actions have more impact on the climate than other actions. Representative answers include: ‘Different actions have different consequences’, ‘I learned which of the given 'issues' related to climate change should be tackled with most urgency’ and ‘What aspects of sustainability are most important’. In addition to this two participants answered with the effectiveness of specific measures and two other participants mentioned the need for CO2 reduction. One participant indicated not to have learned anything due to a language barrier.

The participants were also asked to fill in three likert scale formatted questions from 1 (strongly disagree) to 5 (strongly agree).



Graph 1. Average score per statement granted in the user evaluation survey

When analyzing the results as depicted in Graph 1, it can be seen that all three statements obtained a satisfactory score. Noteworthy is that even though the statement about the difficulty level did not receive a high average score the obtained score can still be considered satisfactory since the puzzle should not be too hard.

7.3.1 Emotional responses

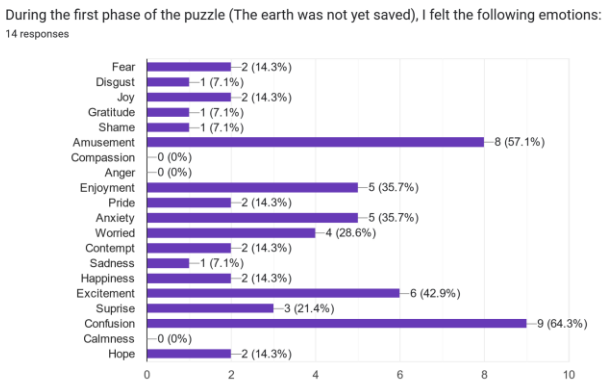
The puzzle was designed with certain emotions in mind: in the beginning of the puzzle the aim was to trigger more negative affect and emotions such as fear and shame. Once the puzzle was solved the intended emotions were associated with the positive affect such as hope.

To test the felt emotions, a list of emotions was created which the participants could use to indicate their felt emotions, this list was inspired by two studies about the review of emotions conducted by Pekrun et al. [61], [62].

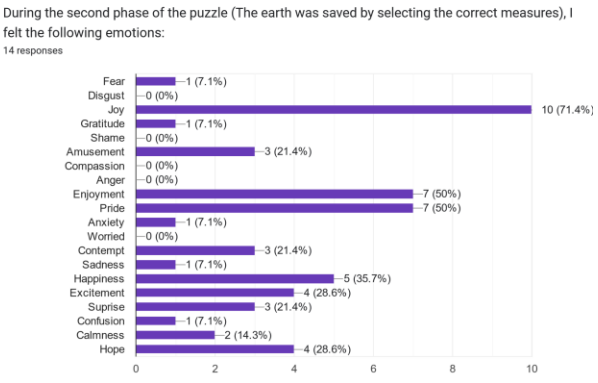
When reviewing the results it can be seen that the participants felt a range of emotions before the puzzle was solved. Amusement and Confusion were often selected. These emotions were expected since it is really exciting to solve an escape room and the solving of a puzzle goes hand in hand with some confusion. When looking at the negative emotions it can be seen

that five out of fourteen participants indicated to feel some anxiety. In addition to this, four participants expressed that they were worried.

Once the puzzle is solved, an increase in joy and pride can be seen. In addition to this, four participants indicated to feel hope after the completion of the puzzle. Other positive emotions such as calmness, happiness and enjoyments were also indicated slightly more. Anxiety and worry were mentioned significantly less after the completion of the puzzle and other negative emotions such as fear, disgust, shame also decreased.



Graph 2. Felt emotions before the puzzle was solved.



Graph 3. Felt emotions after the puzzle was solved.

7.3.2 Usability and problems

To find out if the puzzle is intuitive and solvable, the participants were asked to write about any problem they encountered during the user test. Please note that all the comments related to the language barrier which was experienced by some of the participants such as ‘change the language of the puzzle’ and ‘also create an English version’ will not be mentioned. This problem will be reflected upon in Chapter 9. *Discussion.*

The following problems were encountered by the participants:

- There were too many unrelated objects in the airstream caravan making it difficult to figure out which objects were relevant for the user test.
- It was somewhat hard to figure out when the puzzle was solved.
- The table on the milk carton label was not found by all participants.
- The table on the milk carton label was not intuitive.
- The fridge was hard to open.

7.3.3 Suggestions for improvement

Lastly, the participants were asked to list two strong assets of the puzzle, and two improvements.

The following improvements were mentioned by the participants, please note that all the comments related to the language barrier will not be mentioned since the product was developed with the German general public as target group. This problem will be reflected upon in Chapter 9. *Discussion.*

- It needs to be more clear if participants are looking for positive contributions or negative contributions.
- More feedback is needed when a milk carton is put into the box.

When analyzing the positive attributes of the puzzle it can be seen that the participants found the visuals pleasing. In addition to this, the interactivity of the system was mentioned several times as a positive attribute. Lastly, two participants mentioned that they appreciated the learning outcomes of the puzzle.

7.4 Observations

During the user tests, observational notes were taken. The following observations were made:

- Two groups did not notice the tables on the back of the milk cartons and solved the puzzle based on the visual feedback given by the system (Group 1 and 5). The table was not understood by Group 5, which consisted of only non-German speakers.
- Three groups placed the measures: Recycling, Water saving and Energy conservation in the system first (Group 1, 2, 4). When these measures were not the correct ones, some confusion arose. Two of these groups (Group 2 and 4) found the tables on the back of the milk cartons and were able to solve the puzzle as intended. The remaining group solved the puzzle by using the visual feedback of the system (Group 1).
- One Participant quote about the burning earth: ‘This sound is distressing’
- Participants reacted excited or surprised when the earth changed colors according to the correctness of the measure placed onto the system.
- Four or five groups had extensive deliberations while solving the puzzle, meanwhile one group (Group 4) had a lot less communication between the members. Group 4 consisted of three people, of which two were unable to understand the German language. It was observed that the participant with a sufficient level of German took over the process and did not include the other participants.

7.5 Feedback client

In addition to the feedback given by the participants of the user tests, the client also mentioned two feedback point:

- The sound of the installation should be a bit louder.
- There should be a clear victory indication.
- It was not clear why there were two measures on the back of the milk carton.

When analyzing the problems as mentioned by the participant in addition to the observational notes and the feedback of the client, the following improvements should be made in the next revision of the prototype:

- The table on the milk carton needs to be more clear
- Clear feedback when the puzzle is solved should be added

- Feedback should be given with every milk carton which is placed on the system. This feedback was also given by the participants. Observations show that participants who first placed a milk carton with moderate/low effectiveness experienced some confusion since the system did not react. To ensure that the user receives feedback, also when a Moderate/ Low effective measure is placed onto the system, an audible feedback signal might be given.

7.6 Evaluation of Non-functional requirements

After the analysis of the test results, the non-functional requirements can be evaluated.

Non functional requirement	**Achieved**	**Explanation**
1. The puzzle should foster collaboration	Yes	Four out of five groups had extensive deliberations while solving the puzzle.
2. The puzzle should be fun to play	Yes	The participants indicated to have fun while solving the puzzle. The average score for fun was 4.5/5.
3. The puzzle should foster the feeling of excitement	Yes	6 out of 14 participants indicated to feel excitement during the puzzle. However, other positive emotions such as amusement and enjoyment were also mentioned a lot.
4. The puzzle has to teach its users how make climate positive choices	Yes	12 out of 14 participants indicated to have learned something while solving the puzzle.
5. The puzzle should be understandable	Partially	Users indicated that the table on the milk cartons were not clear enough.

Table 17. Evaluation Non-functional requirements

7.7 Revision prototype

The user tests were conducted on Thursday the 11th of January however, the Airstream Caravan was situated on the campus of the University of Twente until Saturday January 13th. This allowed for a revision of the prototype, but due to time constraints, there was not enough time available to conduct another usertest to validate the revised prototype.

The following revision were made before January the 13th:

- The volume of the installation was amplified by altering the code of the escape room puzzle.
- A clear victory sound was added to indicate that the puzzle was solved.

Unfortunately, there was not enough time available to also alter the table on the back of the milk carton. This alteration was done later. To ensure that the table at the back of the milk cartons are understandable, only one measure will be mentioned. The choice was made to keep the most impactful measures to teach the users about the most impactful measures.

Milk carton	Measure 1	CO2 reduction in kg/year/person	Effectiveness category
Car usage	Living car free	5300	High
Airtravel	Not taking one transatlantic flight	2800	High
Diet	Eating Vegan	1600	High
Water saving	Showers shorter	43	Moderate/Low
Laundry washing	Hanging clothes to dry	210	Moderate/Low
Recycling	Recycling	210	Moderate/Low
Energy saving	Buying green energy	200	Moderate/Low
Bags	Using a plastic bag instead of a paper one	-12	Counter effective

Table 18. Milk cartons and their revised measures

Chapter 8 - Discussion and recommendations

After completion of the final prototype and after the testing procedure, some valuable insights were gained. These insights will be discussed in the following chapter. After the discussion, some recommendations for future work will be made.

8.1 Background research

During the background research, several climate positive measures were evaluated on their actual impact and their perceived impact. This gained knowledge was later used to create the labels for the milk cartons. A critical note should be made since the available and found research was not related to the perceived effectiveness by the German public but by Canadian participants. This means that some of the found information might not be directly translatable to the German general public.

In addition to this, a concise overview of three climate communication strategies (using communication revolving around negative and positive emotions and using visual communication) was given. However, these strategies represent a fraction of all possible climate communication approaches. Because of this, possible other effective communication methods might have been overlooked.

8.2 Prototyping

The prototyping stage of this thesis allowed for some precious insights.

8.2.1 Paper prototyping

Paper prototyping is part of the first phase of the Creative Technology Design Cycle, in addition to this, it was highly recommended by the expert who was interviewed. During this project, the process of paper prototyping proved to be helpful. Not only did it help me, the researcher, to create a proof of concept, it also allowed for system validation. This system validation proved to be critical in the process since it allows finding problems with the system early on and without financial consequences. This enabled me to make required changes to the system.

8.2.2 RFID

The main problem which was identified during the paper prototyping was the unreliability of using a system consisting of multiple RFID readers. The main problem with using multiple RFID

readers is the fact that not all RFID readers initialize reliably. This means that the system does not recognize the RFID readers and therefore no ID can be scanned. Several possible causes were identified. The first being the fact that the RFID readers which were available to me, the researchers, were cheap components, which possibly caused a problem with communication via the common serial bus (SPI). In addition to this, possible connections issues might be the cause for the failed reliability. An effort was made to resolve possible bad connections by soldering the RFID readers directly to the microcontroller; however, this proved to be unsuccessful.

8.2.3 3D printing

During the prototyping phase, as well as the realization phase several parts of the system were 3D printed. This 3D printing during the prototyping phase allowed me, the researcher, to create detailed elements without a lot of material and time constraints. In addition to this, the 3D printed system parts of the final prototype such as the earth, the milk carton detection baskets as well as the raised letters for the message, allowed for detailed and customizable parts. To ensure rigid and stable 3D printed parts, the parts were reinforced with glue. The 3D printing of the parts also allows for easy and cheap replacement in case of breakage.

8.3 testing methods

The evaluation of a designed escape room puzzle gives valuable insights into player interaction, perception, experience and more. From the evaluation results, the puzzle was generally well received, however some points of attention for the testing methods can be made.

First of all, some participants did not speak any German. This led to the participants not fully understanding the puzzle and the content. Since the puzzle was designed for German speaking people, the inability to understand the puzzle might have led to inaccurate test results. Combined with the low number of participants (n = 14) in addition to the fact that all the participants were students and possibly more competent with technology, might lead to slightly unrepresentative results. The participants were recruited via the personal social networks of the researchers

Furthermore, the test method used to validate the designed escape room puzzle is not scientifically validated for the use of an evaluation of an escape room puzzle.

8.4 Recommendations

Some recommendations can be made based on the discussion of the creation and testing of the prototype.

With regards to the background research, it might be interesting to conduct a more extensive research on climate communication, in order to ensure a more extensive approach. Secondly, the background research was not always directly related to the German population. For future research it might be interesting to link the research fully to the German climate actions, however, in order to do this, it is necessary to be fluent in German since a lot of the literature is written in German.

When prototyping, the use of paper prototypes is highly recommended since it allows for easy and cheap system validation and alterations. In addition to this, the use of 3D printed parts can be truly beneficial for the prototyping process as well as the final product since it allows for cheap and easy adjustments and grants easy replacement if a part is broken.

Lastly, some recommendations for the testing and validation of the prototype can be made. A durability test can be conducted in future research to test how durable the prototype is. In addition to this, the prototype should be tested with a bigger, and representative test population consisting of varying age and knowledge of technology. In addition to this, a validated test method should be used to test the design.

Chapter 9 - Conclusion

The aim of this Bachelor Thesis was to find an answer to the following research question:

RQ: How can an educational escape room piece, which encourages its users to make climate positive changes in day to day life, be designed?

During the background research it was found that, according to learning theories such as Game Based Learning, Collaborative learning and Social Constructivism, an effective learning experience can be created. Educational escape rooms can achieve this through their engaging, immersive and fun nature..

Because of these properties, educational escape rooms can be used to encourage behavioral change. A correlation can be found between the mentioned properties of educational escape rooms and the definition of an educational experience as given by Pine and Gillmore [23], who mention the importance of active participation for the creation of a fruitful educational experience. In addition to this, the Fogg behavioral model [27] shows that the user of the escape room puzzle needs to possess a sufficient amount of motivation and ability in addition to a suitable trigger before a target behavior is displayed by the user. This perceived ability to perform a certain behavior can also be called self-efficacy. Research conducted by Thompson et al. [28] shows that knowledge, in this case gained by participating in the educational escape room, is an important contributing factor to one's self-efficacy.

However, when designing for behavioral change with regards to the climate crisis, some caution is required. The climate crisis is often perceived as a 'wicked problem', or a problem without a clear solution. This leads to disengagement. To boost engagement, which is necessary for a good learning experience and behavioral change, it was found that communication centered around negative emotions works well. However, if the message is perceived as too negative, the user becomes dis-engaged. By using climate communication centered around positive emotions such as hope, engagement can be enlarged. Lastly, it was found that visual imagery can help to achieve additional emotional engagement.

After several rounds of ideation and extensive client contact, the final idea was chosen. This idea revolved around a burning earth inside of an oven which could be saved by finding milk cartons with effective climate positive measures on them. After the creation of an insightful paper prototype, a system consisting of magnet detectors and magnets was used to identify the correct measures.

The gained knowledge from the background research was incorporated into the final prototype. To create engagement, the puzzle was designed with a clear educational purpose to enlarge the self-efficacy and thus to enlarge the engagement. In addition to this, the aim of the first part of the puzzle was designed to evoke negative emotions. This was done by showing the players a burning earth and playing distressing, screaming sounds from the earth. To evoke positive emotions the earth became blue and calm after all three correct measures were placed on top of the system.

A user valuation of the created puzzle, which consisted of solving the puzzle and filling in a questionnaire in addition to taking observational notes, indicates a positive and engaging experience. Due to unvalidated testing methods, in combination with a small testing population (n = 14), the results of this evaluation remain somewhat limited.

Despite the limited results of the evaluation, it is evident that the climate crisis needs to be addressed in an engaging manner. With the effort to create an engaging and fun way to teach about the climate crisis, I, the researcher, hope to make a small positive impact on this world.

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Appendix

1. Reviews escape rooms

1-A. Reviews Down the Hatch - Molly

Casturii (253 rooms)
2020 september 24

Een ellenlange review waarin ik dit monster probeer te beschrijven

Ineens was het overal. Molly's Game. Bij elke escape room waar ik heen ging was er wel iemand die hem gespeeld had en wel iemand wiens nieuwe favoriet het was geworden. Het zou alles moeten overtreffen, alle verwachtingen teniet doen, en de nieuwe beste kamer van Nederland, als niet de wereld zijn. Nou hecht ik zelf niet veel waarde aan dat soort opmerkingen, omdat escape rooms zo persoonlijk zijn, maar dat is een flinke en lastige status om te behouden. Aan de ene kant is dat een prachtig compliment, aan de andere kant kan dat de verwachtingen tot onrealistische hoogtes brengen en kan de ervaring eigenlijk alleen maar tegen gaan vallen. "Okee, beste nieuwe kamer van Nederland, laat maar zien wat je hebt" dacht ik. Toen ging de voordeur van het pand open...

Wauw. Wauw. Wauw! Die ontvangstruimte is al niet meer een ontvangstruimte te noemen. Volledig in thema en daarbij prachtig afgewerkt. Zo mooi dat je nauwelijks gelooft dat je er oprecht gewoon mag zitten. De deur naar Molly's Game loert naar je en de spanning loopt al hoog op. Laat ik dan ook zeggen dat de intro zo fucking vet en uniek is. Zoiets als dit heb ik nog nooit gezien bij een room en ik kreeg (niet als enige) kippenvel. Molly's Game is begonnen!
Wat een overweldigend goede aankleding! Kamer voor kamer is foutloos ingericht en prachtig verwerkt in thema. Alles is prachtig afgewerkt en de details kloppen allemaal. Je hebt dan wel 80 minuten, maar je krijgt nooit alles mee in één keer. Het liefst zou je nog meer tijd hebben om zelfs even te kunnen gaan zitten er voor. Alles is ook zo groot en indrukwekkend dat je bijna zou vergeten dat dit allemaal is gemaakt door maar 1 man.
De kamer is daarbij ook lekker spannend en dat klopt ook goed met het thema. Loran heeft zich op geen enkel front ingehouden en dat zie je zo terug. De sfeer is zo dik als maar kan en de prachtige custom soundtrack in de kamer tilt dat nog eens naar een nieuw niveau. Alles omvat een ambitieus, intens verhaal dat zich ontvouwt naarmate de ervaring verloopt. Alles klopt gewoon!

Die puzzels, die puzzels! Allemaal zijn ze fantastisch in thema en absurd goed bedacht. Ze zijn precies uitdagend genoeg, creatief, en uniek. De puzzels zijn ook erg groot en voelen samen met de kamer enorm aan. Ik heb zelden het gevoel dat een puzzel oplossen of zelfs het puzzelen zelf zo veel impact heeft als dit. Alles is ook heerlijk fysiek. Veel klimmen, heen en weer lopen, trekken, duwen enzovoort. Je doet ook heel veel zelf, de kamer doet nooit iets "voor jou". Dit is wat lastig uit te leggen hier, maar zeker een pluspunt. Dit alles geeft de puzzels zo veel gewicht en impact. Je waant je echt midden in de ervaring.
Daar komt bij dat er meerdere momenten zijn geweest dat we versteld hebben gestaan van een paar goede "wtf-momenten". Hoe verbazingwekkend ze ook zijn, ze dienen allemaal een doel. Alles gebeurt voor een reden en alles is verklaarbaar.
Daar komt ook nog eens bij dat er lekker veel te doen is in de kamer. De kamer duurt 80 minuten, is enorm, lang, en het is zo veel om op te nemen.
Daarop aansluitend wil ik ook nog zeggen dat het goed is dat Loran dit ook echt een escape room heeft gehouden. Het had zo makkelijk kunnen zijn om te flexen met techniek en zo een indrukwekkende kamer te bouwen, maar dat is niet gebeurd. De techniek in de kamer zelf is zeker indrukwekkend, maar het dient ook allemaal een doel. Sommige ideeën zijn zelfs best simpel, maar zijn uitgevoerd op een manier die heel goed werkt en de kamer naar een nieuw niveau tilt. Het is die gouden balans die Loran precies te pakken heeft met Molly's Game.
De eindpuzzel is ook prachtig! Hij is niet moeilijk, maar het is zo'n climactische afsluiter voor de kamer. Ik heb mij zelden zo heroïsch gevoeld bij een puzzel en ik werd er zelfs een beetje emotioneel van. Wat een manier om de kamer af te sluiten!

De service was perfect. Loran is een fantastische eigenaar die met passie en terechte trots praat over zijn "kindje". Hij kan werkelijk alles uitleggen en enig iets dat je niet mee hebt gekregen of niet begreep in de kamer kan hij zo toelichten. Alles is logisch en alles is verklaarbaar. We hebben werkelijk uren met hem zitten praten over van alles en het is duidelijk dat hij zijn principes door voert in de kamer. 21 maanden werk, maar dan heb je ook echt wat. Hij mag trots zijn!

Betekent dit een foutloze kamer? Niet helemaal. Als je wil mierenneuken kun je zeggen dat het verhaal enigszins ingewikkeld is. Als je 80 minuten lang overweldigd bent door die kamer is het moeilijk om het hele verhaal mee te krijgen. Je krijgt gelukkig wel een recap aan het einde. Verder kapt een soundtrack soms in het midden af omdat je een puzzel hebt opgelost en dit kan misschien beter gemaskeerd of

aangepast worden. De Engelse uitspraak is ook niet altijd op zijn best, maar zoals ik al zei ga je dan wel heel snel mierenneuken en waarom zou je dat doen? Dit zijn allemaal totaal niet punten waardoor de ervaring minder was en ik zou er verder niet bij stil staan.

Dit is een escape room die zo compleet is als maar kan. Alles klopt gewoon en het is onmogelijk voor mij om dit lager dan een 10 te geven. Dit is een van de beste escape rooms die ik ooit gedaan heb en ik wil Loran feliciteren met wat hij heeft neergezet. Top op elke manier!

Ter afsluiting, zoals bij de intro werd gezegd, die 80 minuten is om even weg te zijn van de buitenwereld en ik heb dat zelden zo sterk gehad als hier. Toen ik bij de uitgang van de kamer stond dacht ik: "Dit is het. Dit is de uitgang. Hierachter staat Loran en we zullen te horen krijgen dat de kamer over is. En dat wil ik niet. Dat wil ik echt niet." Toch moest die deur open...

Theekopje (154 rooms)
2020 october 28

Lieve Molly..

Het is inmiddels al een flink aantal weken geleden sinds de dag dat ik je heb mogen ontmoeten. Dat ik nu pas deze review over je schrijf, is niet zonder reden. Ik denk dat dit de moeilijkste review OOIT gaat worden.. Hoe ga ik jou beschrijven? HOE!?

21 september 2020, op een mooie maandagavond, reed ik samen met mijn lieve teamgenoten richting Voorburg. Voorafgaand aan jou speelde wij de klassieker flight 815. Maar hoe gaaf die vlucht ook was, diep van binnen keek ik al de hele avond uit naar dat moment. Het moment dat ik je na alle lovende verhalen EINDELIJK mocht ontmoeten.

Dat jouw ontvangst mooi zou zijn, was voor mij geen verassing. Maar dat die ontmoeting op zo'n manier begon? Dat was magisch.. Vanaf moment 1 zat niet alleen ik, maar ook de rest van mijn team volledig onder de kippenvel. En toen waren we nog niet eens binnen..

Stijf van de zenuwen stapte ik de praktijk van Dr. Kowalski binnen. starend naar jouw waanzinnige decor, genietend van jouw eerste puzzels, en luisterend naar de eerste tonen van jouw soundtrack, begon dit avontuur. Waar dit avontuur ons heen zou lijden? Ik had werkelijk geen flauw idee.

Deze vraag werd al snel wat duidelijker toen jij voor het eerst jouw lugubere kant liet zien. Met nóg meer spanning en nieuwsgierigheid dwaalde ik verder af in jouw verhaal, jouw emotionele verhaal. Lopend door jouw spel besefte ik me hoe mooi jij bent. De aankleding, de afwerking, de vormgeving, de indeling. Je zag er uit als een Disney/Efteling-attractie. Maar dan gewoon hier, in Nederland, helemaal voor mij alleen, zonder mensenmassa's, personeelsleden, of wachtrijen.

Dit alles werd ook nog eens ondersteund door heerlijke puzzels: prachtig vormgegeven, creatief, logisch, afgewerkt, en passend binnen jouw thema en verhaal. Hoe dieper ik afdwaalde in jouw verhaal, hoe meer ik erachter kwam wat je ons nou al die tijd wilde vertellen. De zo genaamde “wtf-momenten” vlogen ondertussen om m'n oren, maar altijd op het juiste moment. Het moment dat je het even niet zag aankomen.

Aan de soundtrack en effecten te merken begonnen we aan de ontknoping van jouw verhaal. Een ontknoping waar ik nogmaals stijf onder de kippenvel zat. Deze eindpuzzel/ontknoping voelde ZO ERG als een finale.. een slotstuk.. Dat gevoel heb ik nog nooit gehad in een escape room. Maar hoe fijn en episch dit moment ook was, ik wist dat ik binnen enkele minuten een deur zou openen, en gefeliciteerd zou worden met het behalen van de kamer. En dat was ergens niet iets wat ik wilde.. Maar het gebeurde toch.. Molly was klaar.

Maar Molly.. ben je dan echt perfect?! Nee. Niks is perfect.

Je kunt zeggen dat het verhaal enigszins aan de ingewikkelde kant is. Je kunt zeggen dat het geluid op bepaalde momenten even stil valt of slecht verstaanbaar is. En zo zijn er ALTIJD nog wel dingetjes. Maar nee, ik kan het niet over m'n hart krijgen om deze kamer een lager cijfer te geven dan een 10. Dat kan niet en dat hoort niet.

Lieve Molly, je was me der eentje <3

sjephanie (204 rooms)
2022 august 22

Molly's-terechte wereldwijde top 3-Game

Ik review helaas niet zo veel als wat ik zelf zou willen (iets met inconsequent zijn) maar ben vooral te laat begonnen, waardoor tussen het reviewen en spelen té lang tussen zit. Nu snap je natuurlijk waar dit naartoe gaat…Rede genoeg om een kamer zoals deze gewoon nog een keer te doen. Wat een straf!

Dit is zo'n kamer waarbij we meteen riepen, 'Deze MOETEN we nog een keer doen!' 1 jaar later mochten we deze bijzondere escape nog eens ervaren. En (spoiler) het blijft geweldig.

De entree is fenomenaal, wat een manier om binnen te komen en een kamer te starten. Tel daar een hartelijk ontvangst bij op, en de zin om te beginnen wordt alleen maar groter. Voor mij zit een grote kracht in deze room aan het feit dat je totaal niet weet wat je te wachten staat. Dat moet je ook niet willen weten, dat ga je stukje bij beetje ervaren. Na een spectaculaire introductie mag je op ontdekkingsreis, en ontvouwt het verhaal zich verder.

Het decor is prachtig. Alles voelt zó realistisch aan. De tweede keer speelde wij deze kamer met twee onervaren (lees: 1 en 0 kamers) spelers, en ook zij vielen van de ene verbazing in de andere. Ik vind dat echt tof. Als je je eerste kamer speelt gaat alles (naar mijn ervaring) als een soort roes voorbij en ben je niet persé altijd bezig met de kleine details binnen het decor. Maar als zo'n teamgenoot tijdens het spelen wijst naar een klein onderdeel en roept: 'Wauw, dat is gaaf gedaan!' Zegt dat voor mij genoeg. Van geur, tot licht, afwerking en ook het geluid en de muziek; ik snap niet hoe je het uit je handen krijgt. Ongelooflijk.

Puzzels zijn er genoeg te doen. Logisch op te lossen, maar ook logisch waarom je ze doet. Zij versterken het verhaal. Soms merk je in belevingskamers dat deze 'ook zijn toegevoegd -want escaperoom' maar hier zijn ze het middel. En dat is knap. Er zit variatie in, iedereen kon even uitblinken en de lijn tussen parallel en lineair is divers. Sommige momenten even samen nadenken, en dan weer allemaal iets om handen hebben. De feedback wanneer iets opgelost is, is duidelijk en vaak op een mooie manier uitgevoerd.

Dan het verhaal. God, wat hou ik hiervan. Al krijg je niet direct alles mee, alles ademt dat over elk klein detail is nagedacht, niets is zomaar. Het voelde als een rollercoaster van emoties en zelden heb ik zoveel verschillende dingen gevoeld in 80 minuten tijd! Het is origineel, soms spannend (zeg maar oprecht niet heel gezellig) maar nooit horror. En zelfs een klein beetje emotioneel. Wat ik eerder benoemde is het feit dat het verhaal zich zo perfect ontvouwt. Elke stap die je zet is er weer eentje dichter bij hoe het zit. Ik heb mezelf heerlijk overgegeven aan de beleving en dat zou ik ook iedereen aanraden. Al denk ik dat je daarin geen keuze hebt. Er zitten onderdelen in die niemand koud laat, dat geloof ik niet. Zo ja, dan ben jij de rede waarom ik steeds plaatjes van stoplichten aan moet klikken om te bevestigen dat ik 'echt' ben. Sorry.

Ik kan nog wel even doorgaan. Dit is niet voor niets mijn (en van vele anderen) een favoriet. Ik ben omver geblazen toen we 'm de eerste keer speelde, en stiekem de tweede keer gewoon weer. Heerlijk om achterover te leunen, om je heen te kijken en gewoon te genieten. En ook dat zegt iets over iemand met de gemiddelde spanningsboog van een visstick. Het is het zo waard!

Bedankt Loran, voor het bouwen van deze parel, voor je ontvangst en napraten. Voor alle extra toelichting die je vol passie met ons wil delen en het bedenken en uitvoeren van dit bijzondere verhaal.

Ik kan nog wel uren doorgaan. Maar ik denk dat het wel duidelijk moge zijn. Op naar Voorburg, en ga deze terechte topkamer meemaken! Of voor de 2e keer, of 3e keer of…..

1-B. Reviews Stay in the dark

De Milde Dictator (316 kamers gespeeld)
Geplaatst op: 08 juni 2021

The stay of a lifetime

Ik was, net als vele van jullie, niet erg hoopvol dat 2021 ons heel veel nieuwe zaken ging brengen.
De lopende projecten zullen zeker en vast afgerond worden en open gaan, maar erg hoopvol op nieuwe zaken was ik niet.
Dat was buiten Darkpark gerekend. Op 1/1/2021 werd uit het niks Stay in the Dark aangekondigd.
Een boodschap die mij toch weer wat hoop gaf voor het nieuwe jaar.
Helaas voor Gijs en zijn team ging de openingsdatum steeds weer verder naar achteren tot nu!
Wij hadden de eer om Stay in the Dark te mogen testen en wat we ervan vonden lezen jullie hier:
Onthaal:
Stay in the Dark bevindt zich in de oude fabriek van Unilever. Je krijgt duidelijke instructies waar je mag parkeren en waar je moet wachten en voor je start kan je nog even naar de wc.
Het ontvangst zelf gebeurd perfect in thema, mooi subtiel en narratief. Goed opletten dus vanaf het begin ;-)

Kamer:
Tja mag je nog kamer zeggen? 4000m2 fabrieksloods…
Het doel en het verhaal is te simpel voor woorden, althans dat lijkt zo. Ik vond het erg fijn dat het voor ons als spelers meteen duidelijk is wat ons doel is. Geen hopeloos moeilijk verhaal dat toch niet tot zijn recht komt.
De start is meteen erg sterk en Gijs en zijn team slagen erin om de sfeer net op het randje te houden.
Net genoeg licht, net genoeg spanning en nergens echte overkill. Het geeft ff dat ongemakkelijk gevoel, maar net een gevoel waar je ook een beetje aan went.
Naar mate we verder en verder geraakte, werd ook duidelijk dat het geen one-trick pony is. Er zit duidelijk een gelaagdheid in. Sfeer, spanning, actie, rust, grootsheid, maar ook kleine zaken die je ziet als je goed oplet waardoor het simpele verhaal plots wat meer duiding krijgt.
Je werkt met je team duidelijk naar een finale toe en die voelt ook echt zo aan. Het is echt een ontknoping en bij Darkpark weten ze heel goed wat dat moet inhouden.

Conclusie:
Ja veel aan mijn "kamerbespreking" hebben jullie niet en dat is met goede reden.
Eigenlijk wil je zo weinig mogelijk weten over deze experience, geloof me vrij.
De meest gestelde vraag blijft: Is het eng?
Dat is steeds heel persoonlijk en deze experience is idd niet voor iedereen.
Maar de meeste van jullie zullen heus wel weten waar Darkpark voor staat, ze doen niet aan kitsch. Net als in hun rooms hangt er een spannende, misschien wel onaangename sfeer in deze beleving en dat is echt prima.
Maar alles heeft een reden en niets is zomaar om het eng te maken.
Stay in the Dark haalt je met momenten echt uit je comfortzone, maar dat is net wat dit soort beleving zo leuk maakt. Het is geen halloween huis met scares. Het is echt een psychologische triller waar goed over nagedacht is.

Wij genoten echt van deze beleving en de 2.5 uur vlogen voorbij. Nergens heb je een gevoel van tijd, nergens hangt een scherm, nergens heb je een tablet of walkie talkie nodig. Het is gewoon een back to basics, verkennen, ontdekken en ontsnappen en misschien zelfs nog iets meer…
Door slim gebruik te maken van het bestaande pand krijg je een super authentieke sfeer die ze perfect behouden hebben en dat aangevuld met het verhaal maakt dat dit echt een topbeleving is. Het pand draagt echt bij aan het verhaal en versterkt de sfeer enorm.
Het is haast zonde dat het tijdelijk is en ik hoop van harte dat Gijs en zijn team de kans krijgen om dit nog geruime tijd open te houden.

Op puzzels geef ik een 10 en dat is misschien wat raar. Iemand die echt wil puzzelen, die boekt beter een andere room.
Maar die 10 dan?
Wel de beleving is de puzzel, je moet je niet gaan concentreren op afzonderlijke zaken, want dat is niet eerlijk tov de beleving.
Je boekt ook geen escape room, je boekt een 2.5 uur durende thriller waarin jij het hoofdpersonage bent.

Het enige wat ik jullie nog kan zeggen is, boek het gewoon. Overwin ff je angst, omring je met de juiste mensen en ga de uitdaging aan. Je gaat zoveel meer beleven als enkel die vraag "is het eng".

Het is tijdelijk en je wilt nooit achteraf willen zeggen, had ik maar……

Moess (282 kamers gespeeld)
Geplaatst op: 28 juni 2021

Must-play in the dark

Waar te beginnen.. Waar te beginnen.. Laat ik maar meteen met de deur in huis vallen, ik vind Stay in the Dark zo erg de moeite waard om te spelen! Het is elke euro, tijd en kilometer ernaartoe waard! Zelfs al ben je een beetje een angsthaasje (zoals ik), gewoon doen en zorg dat je met een groot genoeg team bent. Ik speelde de kamer met zes personen in totaal en dat vond ik een heerlijk aantal en zou iedereen adviseren om met een groep tussen de 4 en 6 personen te gaan. Ik denk dat het de beleving leuker maakt. Maar wat is die beleving dan? Ik ga er niet teveel over zeggen, zoals eigenlijk alle voorgangers hier op escapetalk, vooral omdat het zonde zou zijn.

Op het moment dat het spel start, raak je ondergedompeld, verlies je tijdsbesef en kan je echt even ontsnappen aan de werkelijkheid. Het is een beleving die zo ontzettend goed is neergezet, denk aan flow, sfeer, timing, spanning, audio, licht, overal is over nagedacht met oog voor detail. Darkpark heeft het talent om in het hoofd van een speler te kruipen en vanuit daar te bouwen en daar ontstaan fantastische dingen uit, waaronder Stay in the Dark.

Ik heb 's avonds in de auto, in mijn bedje en de volgende dag nog vaak teruggedacht om te verwerken wat er nou allemaal precies was

gebeurd, absoluut nagenieten. Ik hoop heel erg dat Stay in the Dark langer kan blijven bestaan en de tijdelijkheid langer opgerekt kan worden, zodat alle liefhebbers de mogelijkheid hebben om dit spektakel te beleven!

Miess (164 kamers gespeeld)
Geplaatst op: 28 juni 2021

Hello darkness, my old friend

Met natte handen aan het stuur, je horloge dat een ontspanningsherinnering geeft, omdat je ademhaling zo hoog zit... het zal ongetwijfeld weer tijd zijn voor een kamer van Darkpark.

En wat voor een kamer. Gijs en zijn team hebben echt een fantastische ervaring neer weten te zetten. Zo spectaculair, zo bijzonder en toch zo tot in de details uitgewerkt ondanks z'n grootsheid.

In deze experience speel je samen met je team de hoofdrol in je eigen actiefilm. Wat heel stoer klinkt alsof ik niet een groot deel van de tijd hand in hand heb gelopen met zes personen tegelijk (ik wist ook niet dat dat kon) en toch heb ik me oprecht ook heel stoer gevoeld in de kamer. De sfeer wordt perfect neergezet door de aankleding, de muziek en je eigen angst. Is het enger, doordat je jezelf compleet opfokt? 100% Weet Gijs perfect in de menselijke geest te kijken en hierop in te spelen? You bet your scared ass dat hij dat doet.

Ook de puzzels worden bij deze escape room naar een nieuw level getild. Net zoals een escape room de hobby 'puzzelen' een nieuwe betekenis heeft gegeven, wordt er in deze experience een beroep gedaan op jouw logica en inzicht om te kunnen ontsnappen zoals ik dat nog niet eerder heb meegemaakt. Ik heb er ontzettend van genoten en vond het geweldig hoe knap dit in de experience zit verweven. Het enige wat voor mij niet helemaal logisch was, was het einde, maar dat maakte er de ontsnapping niet minder spectaculair om.

De service was super en onze acteur heeft het echt heel erg goed gedaan. Hij wist de spanning op te bouwen tot het randje en hield daarbij toch rekening met de grenzen van de verschillende spelers. Super gedaan Skip, dank je wel!

Ik hoop voor iedereen dat deze kamer nog een lange tijd open kan blijven, zodat zoveel mogelijk mensen dit avontuur aan kunnen gaan. Ga ook vooral met een grotere groep, want waar ik normaal gesproken vier personen de max vind in een escape room, is vijf of zes mensen hier juist top.
Helaas is het open blijven van de kamer niet gegarandeerd, dus ik kan alleen maar aanbevelen om zo snel mogelijk te boeken, zodat je dit niet mist. Wat een ervaring!!!

1-C. Epic Escape Waalwijk - Illusion

Theekopje (154 kamers)
21 juni 2021

Een paar mooie visuals betekent niet automatisch een mooie kamer… toch?

Al vanaf het moment dat er twee prachtig vormgegeven visuals op de sociale media van epic-escape verschenen trok deze kamer enorm mijn aandacht. Maar hé, een paar mooie visuals betekent niet automatisch een mooie kamer, toch? Nadat de eerste reviews online verschenen werd onze nieuwsgierigheid des te meer getrokken en konden we het niet meer laten. Na een uitputtende werkdag kwamen we last-minute om 22:30 aan in Waalwijk. Het pand bevind zich op een toegankelijke locatie waar je de auto praktisch voor de deur kwijt kan. Hier werden we uiterst vriendelijk ontvangen door Maurice. Ongelofelijk fijn dat we op dit tijdstip nog terecht konden. De ontvangstruimte is dan wel niet de mooiste in zijn soort, toch is het van alle gemakken voorzien.

Ik waarschuw je alvast, deze review wordt lang. Er is zo veel te zeggen over deze kamer. Ik ga het zo overzichtelijk en duidelijk mogelijk proberen te beschrijven, beginnende met de intro van Illusion. Zonder dat je er erg in hebt begint deze ervaring. Op een theatrale, originele, onverwachte, en grappige manier word je als speler geïntroduceerd tot het verhaal. De makers hebben dit qua timing briljant uitgedacht. Nu weten de mensen die mij kennen dat ik een hekel heb aan filmpjes vooraf. Voor hen wil ik graag 1 uitzondering maken. Want hoe Illusion dit doet is PRECIES hoe je een introductie-filmpje moet gebruiken. Kwalitatief gigantisch sterk en op een logische manier gebracht binnen de context.

Na een iets wat stroeve start begonnen we aan een onvergetelijke ervaring. De aankleding van deze escape lijkt op het eerste oog bescheiden. Maar zoals de pay-off al verklapt, niets is wat het lijkt. Naarmate we verder kwamen in het verhaal van Marcus Furore ontvouwde zich een Efteling-waardig decor. De aankleding van deze escape is “out of this world..” Elk detail, elk hoekje, elk stukje aankleding klopt. Alles is ook nog

eens prachtig uitgelicht. Ik heb een aantal momenten gehad dat ik echt even stil stond en gewoon om me heen begon te kijken. En dan te bedenken dat er binnen die talloze objecten en details puzzels zitten verstopt.

De puzzels in illusion zijn uitdagend, origineel, en stuk voor stuk fantastisch verwerkt in het thema. Dat laatste is een van de dingen wat Illusion zo ongelofelijk goed maakt. Ik had als speler soms niet het idee dat ik bezig was met het oplossen van puzzels, maar eerder rond aan het neuzen was tussen de spulletjes van een illusionist. Een gevoel dat ik slechts 1 keer eerder heb gehad bij een kamer: de conciërge in Volkel. En dat is nog eens een compliment.

Dan ben ik nu aangekomen bij hetgeen wat deze ervaring zo onvergetelijk maakt: het verhaal. Vooraf aan deze escape word je als speler al verwent met een shitload aan stukjes verhaal. Eenmaal in de kamer zelf begaf ik me voor m'n gevoel niet in een escape room, maar in een verhaal. Een verhaal dat zich langzamerhand ontvouwde. En ondanks dat het verhaal nog aardig complex is en vol zit met details, is Illusion de eerste kamer ooit waarbij ik het volledige verhaal kon volgen en achteraf begreep. De manier waarop je als speler mee wordt genomen in dit dramatische sprookje is buitengewoon. Je aandacht word echt even weg gehaald van de puzzels en andere zaken waardoor je maar 1 ding kan doen, het volgen van een verhaal. Technisch mooi verwerkt, goed verstaanbaar, en bovenal ondersteund door een prachtige soundtrack.

Muziek is een van de dingen waar ik vrijwel altijd direct op let. Nu is dit vaak ook hetgeen wat eigenaren vergeten of onderschatten. Illusion is een perfect voorbeeld van hoe belangrijk een goede soundtrack is en wat voor bijdrage dit aan de ervaring geeft. Ik zou pagina's lang kunnen schrijven over hoe goed de muziek in Illusion is, maar dat bespaar ik je, geloof me maar gewoon, hij is grandioos. Wat ik in deze review wel gezegd wil hebben, is hoe belangrijk de kwaliteit van het geluid is. Hoe goed een soundtrack ook kan zijn, als ik merk dat het uit een speakertje komt die boven me hangt is de ervaring al zo veel male minder. Bij Illusion was dit niet het geval. De muziek kwam niet uit een speaker, de muziek was IN de kamer. Je voelde de muziek letterlijk door je lichaam stromen. Investeer als eigenaar in een goede soundtrack en wat goede speakers met een subwoofer. Het maakt de ervaring zo veel intenser en geloofwaardiger.

Tot slot wil ik Maurice bedanken voor de service. Deze man heeft tot half 2 's nachts met volle overtuiging en passie verteld over de kamer. Hierbij moet ik Roy natuurlijk niet vergeten. Samen hebben zij een nieuw pareltje neergezet die in de top van Nederland hoort.

Ik denk dat ik nu wel genoeg heb gezegd, al blijf ik constant twijfelen of ik niks vergeten ben. Mocht je het tot hier hebben gelezen dan hoop ik dat ik 1 ding heb duidelijk gemaakt: ga deze kamer spelen, ga deze kamer beleven en laat je meeslepen in het ongelofelijk mooie, sprookjesachtige verhaal van Marcus Furore.

De Milde Dictator (316 kamers)
05 juni 2021

Maak je dagje Efteling nog net iets magischer...

Ik keek er hard uit naar deze kamer, door het thema, maar ook omdat ik wist dat Roy en Maurice de lat echt hoog hadden gelegd.
Hoogtijd om dus te gaan checken wat er juist gebouwd was in Waalwijk.

Onthaal:
Epic escape bevind zich op een industrieterrein en dat heeft als voordeel steeds dat je voor de deur kan parkeren.
Het was een blij weerziens met de heren, zeker na alle beperkingen ontrent corona.
We kregen een woordje uitleg over de hoe de kamer (zonder spoilers) tot stand was gekomen en natuurlijk in het kort de regels.

Kamer:
Tja hier draait het natuurlijk allemaal om hé. De inleiding vond ik enorm leuk en uniek in zijn soort. Niets is wat het lijkt kwam bij me op en daar betrapte ik me meermaals op.
En dan begint het! Het verhaal begint bijna theatraal, de wereld van Marcus Furore ontvouwt zich voor je, pakvol met details, sfeervol, maar nooit eng.
Je wordt ondergedompeld in zijn wereld, in zijn geheimen en dat doen ze enorm goed, met een groot oog voor detail, sfeer en beleving.
En dan denk je, tja belevingskamer, dag puzzels. Gelukkig niet. Meer nog, de puzzels zijn lekker pittig en gevarieerd.
Ook een goede variatie qua samenwerken, parallel werken en afwisseling, dat gecombineerd met een waanzinnig hintsysteem en sterke link met het thema maakt dit tot een compleet pakket.
Naar mate de kamer naar een einde gaat, wordt ook meer en meer duidelijk wat er juist is gebeurd, maar dat mag je zelf gaan ontdekken.

Conclusie:
Wel de kracht van deze kamer zit zich in het geheel. Je hebt niet 1 uitschieter, maar alles zit op 1 lijn. Sfeer, techniek, muziek, puzzels, verhaal, alles versterkt elkaar wanneer dat nodig is.

En dat is moeilijker dan het lijkt. Er zit namelijk zoveel detail in deze kamer, dat op het eerste zicht onbelangrijk lijkt, maar toch onbewust op je zintuigen inspeelt en dat werkt zo verhaalversterkend, zo onderdompelend dat alles vele malen geloofwaardiger overkomt.
Zie het als een Efteling attractie als escape room en dan kom je het dichtste in de buurt wat ze hier gebouwd hebben.

Onze grootste tip zou vooral zijn, net zoals bij Molly en andere totaalkamers, speel wat kamers voor je deze gaat spelen. Het geeft je de rust om meer te genieten/waarderen wat er hier gebouwd is.

En onthoudt:
Niets is wat het lijkt……

bilipe (153 kamers)
22 juni 2021

Bilipe is tevreden :)

Dit is hem dan; mijn allereerste review ooit.
Na ongeveer 35 kamers krijgt Illusion het plekje. Ik ga dit nooit vergeten. Wat een dondersgoede kamer, jemig.

Zelden heb ik zo'n meeslepend, diep, spannend, en prachtig verhaal meegemaakt in een Escaperoom. Er is zó goed over nagedacht, alles is duidelijk en wordt op een creatieve manier verteld. Het houdt je op de puntjes van je tenen. Mij heeft het in ieder geval écht geraakt.

De experience begon al voordat we er waren. Zelf vind ik het vaak naar als er van tevoren al te veel informatie weg wordt gegeven, of als je 80 documenten door moet lezen. Epic Escape daarentegen, doet dit ontzettend creatief. Van tevoren mochten wij het 'archief' online bekijken. Niet verplicht, maar wel leuk. Ik heb nog nooit zo veel dingen vrijwillig door zitten kijken en lezen. Er is zó veel aandacht in gestopt, en dat zie je overal in terug. Video's, krantenartikelen, foto's, posters, interviews, noem het maar op. Alles zelf ontworpen, en het ziet er oprecht verbazingwekkend prachtig uit! Ik had zo'n plezier in het doorkijken van al het gearchiveerde materiaal. Het design is prachtig, het acteer- en filmwerk spectaculair. Ik ben niet vaak van tevoren al zó erg onder de indruk.
Het trok me volledig mee. Het was allemaal niet verplicht, maar ik wilde mij zo graag verdiepen in het verhaal, ik wilde het mysterie van Marcus Furore ontrafelen. Ik werd er helemaal enthousiast van. En dit was nog maar het tipje van de ijsberg.

Na de afwachtende autorit kwamen we eindelijk aan bij Epic Escape, en de ervaring werd alleen maar beter. Onironisch waren mijn eerste woorden: "Jongens, het ruikt hier écht heel lekker". Ik zal je vertellen, als Escapetalk een statistiek had voor 'geur van de ontvangstruimte', zou ik een dikke tien geven, echt waar.
Maar goed, we gaan door naar de echte zaken.
Onze host, Maurice, creeërde voor mij gelijk een fijn gevoel van comfort en betrokkenheid. Ik zeg met zekerheid dat dit oprecht één van de gezelligste hosts is die ik heb gehad. Zijn enthousiasme en passie spat er van af, en daarmee brachr hij mij een onvergetelijke ervaring. Duizend maal dank! Ik zou graag nogmaals napraten tot half 2 's nachts.

Nou is het tijd voor de kamer zelf. Een uitzonderlijk creatieve intro, waarbij je je afvraagt of je nou stiekem al bent begonnen met de kamer. Niet is wat het lijkt. Ik had er oprecht gewoon zo veel plezier in, en vond het toch wel een beetje spannend. En ja hoor, een geslaagde introfilm. Ik zeg het niet vaak (nooit eigenlijk), maar deze introfilm was zo goed in thema, en sloot perfect aan op het verhaal en de kamer.

De overgangen en openbaringen waren zó episch, ik heb meerdere malen met kippenvel gestaan. Het decor is prachtig uitgewerkt, elk detail klopt. Je zou uren kunnen staren naar al het decor, ik overdrijf niet.
De muziek jongens. De muziek, de muziek, de muziek. Ik kan het niet genoeg benadrukken. Werkelijk prachtige soundtrack. Er wordt met geluid en muziek perfect ingespeeld op de sfeer, en dit creeërt zulke memorabele momenten. Ik wou dat je dit op een CD mee kon nemen, zo erg heeft het mij geraakt.
En natuurlijk de puzzels. Zulke leuke en creatieve puzzels. Uiteraard ook in thema (net als het hintsysteem trouwens). Iedereen heeft een rol, en er is een lekkere flow en balans in het puzzelen en ervaren van de kamer.

Al met al is deze kamer een samenbundeling van perfectie. Verhaal, puzzels, muziek, techniek, setting, service. Alles samen vormt een onvergetelijke ervaring. We hebben ons doodgelachen, met mond open gestaan, bijna in tranen gezeten, en dat alles door deze ervaring. Geweldige avond gehad!
Tien, tien tien, en nog eens een tien voor Illusion van Epic Escape Waalwijk!

Als je deze kamer niet linea recta gaat boeken, kom ik je persoonlijk een bezoekje brengen.

2. Client Interviews

2-A. Respondent 1

I: What is your function in the project?

So I'm a bit responsible for the interior design. So I make sure that it's a bit pretty and that it's furnished a bit in the spirit of Solar Punk and I try to contribute a bit and otherwise I support X when it comes to the organization, so when we meet, that these meetings are organized, otherwise... In general, I always try to contribute ideas.

I: What design phase are you in with your project? (Explain with room2educ8)

So I would say. Hm. That we are, well, no longer at the beginning, but at what stage? Well, we've now collected a lot of ideas and they're slowly getting on track, so a common thread is slowly crystallizing, which we're then also pursuing, so so far it's really been a lot of collecting ideas and sorting them out a bit, then new ideas came up again. It was a bit diffuse and now it's slowly becoming more concrete.

I: What difficulties have you overcome so far in building the facility?

With the interior, well, it's a very old thing, the Airstream. You've already seen it and yes, sometimes when you touch something it crumbles, so on the one hand you want to preserve the old or preserve as much of the old as possible, but some things just don't work, so the wood I used is often broken and then you have to remove it. So yes, just this combination of preserving a little bit, but still making it look reasonably nice, that's sometimes a bit difficult, because then, for example, if you paint over it, moisture still comes through and you'd have to go to a huge effort to make it invisible, but then you have to ask yourself whether the ratio is still right, i.e. whether this effort is worth it, because in the end it might be completely dark in this escape and you can't see anyway. So that's exactly what's sometimes a bit difficult.

I: How have you experienced the design process so far?

Sometimes you think of a really great, big end goal and imagine it so beautifully and then the individual steps are more laborious and take much longer. Of course, you always get support from time to time and then you get a corner really good or cool or totally fun, but yes, then you look around and think, "Oh, somehow 95% isn't done yet, so you have to do it again somehow and then it also plays a role that the puzzles aren't ready yet, which means you don't really know, do you perhaps need a projection surface or do you need a corner or a box or a drawer that somehow has to be used for it? And maybe it's better not to start with this corner yet. Then no, I have the feeling that I'm going to make a few corners of something, but I have no idea whether it really makes sense in the end.

I: What user experience are you designing for? (What should the visitor feel and when?)

Well, I want the atmosphere to be kind of cool, so that the ne. We agreed on this solar punk at the beginning and of course that's really difficult to implement in such an old caravan. But you can still create a bit of a mood and that would be a goal, so that they feel a bit like they're in the future and still hang on to the past, so that they get this, yes, this feeling.

I: How have end users reacted to the bus prototype so far?

Most of them actually thought it was pretty cool. So this stream in general and then they went in and watched it inside. Yes, they were simply surprised because you don't see something like that every day, I think that's such an important expression that you think, oh wow, it's really cool if it can become something and... Yes, definitely positive.

I: How much experience do you personally have with technology?

Well. So pretty much yes, so nothing at all about that. No, I'm a primary school teacher, no, and I use what I need in my professional environment and otherwise I don't have that much with technology, I use it and I have to work and if it doesn't work, then that annoys me.

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I: How do you envision the final escape room?

So. I imagine it to be pretty cool and therefore very appealing from the outside, that it really attracts people, just by the fact that it's there and then inside it's a bit mysterious, maybe even a bit creepy and therefore simply with a high level of appeal. And. Yes. Exactly, you kind of really want to play it. If only because you want to experience it in the first few rows.

I: What would be things that you would find cool?

For example, I find all these things that the kitchen is still there. No, I think that's totally great and I have to find it in the games. So it would be nice if they were integrated, this kitchen, this fridge, this oven. Something like that too. We now have the table in the front, I think that's really important, so that you can sit down, so that you can somehow put the individual solutions in order or look at them again. You can sit under this table. Yes, then these plants, some of which are really this ivy that Ossi always drags along and then also this, which crochets itself there, so it gives the feeling that it's grown in and overgrown and has been standing around somewhere for a very long time and the plants are already conquering this air stream.

I: What spatial requirements do you have for each individual escape room puzzle?

Yes, that is of course limited, simply because it is not as big as an apartment now where you also play escape rooms, then in the rooms of one or 2 rooms are included, but I still think there is such a division in the Airstream, so in the back the bathroom that used to be, we now have the garden in there, so you can, for example, play a, I think there can probably even be 2 or 3 puzzles. So I'm thinking of the fridge, the oven and maybe this sliding thing upstairs. And where those beds or benches are. Yes, there's actually a two-thirds space there and then maybe just to the right, where this water tank is still at the bottom. So, yes, just whatever the space allows.

I: You mean the one under the table?

Mhm Mhm, maybe something else there, because it's cool when these old things are integrated, I think, and then in combination with something new, like the Marriott Garden, for example. So that both play a role, the old, the way it used to be. And this future-oriented aspect.

I: What are the visual or design requirements for each puzzle? (How must it (not) look)

Of course, it would be cool if you could also bring in something really modern, right? I still think so. Quite nice, but that's natural. So it's also kind of difficult in terms of craftsmanship if you bring in something really modern. If I don't bring in plastic and white or something like that. Yes.

I: In your opinion, how high should the production complexity of each puzzle be? (How much technology can you handle)

So it can't be too difficult or too complex, I think, because otherwise you lose interest or your nerve relatively quickly. So it has to be somehow... I think at the beginning maybe we talked about it yesterday and that's what I always thought. So it's easier at the beginning, isn't it, and then you can become a bit more complex or perhaps experience something more haptically or with your senses at the beginning. So with these cards you can open up a lot with the smell and then later it becomes more technological, so that everyone is challenged a bit, but it shouldn't be too difficult, so that you don't feel like playing it anymore. And sometimes, I like to play escape rooms myself. It's really the case that it's a coincidence that you come up with a solution, because somehow they've created it, they've just thought of it that way at that moment, but as a normal person you can't figure it out at all, it's always a coincidence, so it's random thinking that you find it out and I think that's good if you can avoid that a bit, so if it really just makes logical sense. You have to find this solution, so to speak.

I: Are there any characteristics by which one can recognize that a puzzle is too difficult?

Hm. I think I only realize when I'm playing myself, but simply when there are perhaps too many possibilities. You have to somehow be put on a track that leads you into the right solution channel, let's say, no, it can't be completely diffuse now. I don't know, that... Yes, somehow there has to be a line in the solution path. I don't have an example now, somehow I don't have an example ready, but maybe you understand what I mean.

I: What other requirements could you name?

Well, it has to be fun, I think. It has to be a bit, yes, somehow also so that you can laugh. I also think it's really important that you can grasp something, understand something, touch something and then put it together, don't you? And that with your hands. I think that's important too. Yes, and I mean, of course, it's always about learning something, so is it educational or just for fun? I think you can combine that somehow, no, so that you learn something and still have fun, right? Yes, you can somehow get into a certain mood. So it can also be a bit scary, but that you've just really experienced it. Simple. Diverse, I think diverse is a good word for how they should be. Exactly, because I think that the people who do it are totally different, no, and that's exactly why they complement each other, Stefan and I, it's always very exciting, it always gets really heated, because he thinks very differently to me and so yes, the people who do it are simply diverse, that's why they should be diverse.

I: Would you say that teamwork fits into a puzzle?

Yes, yes, yes, yes, absolutely absolutely. It's very important, yes, so it looks like my personal, when we play the hold as a family, when the children are there or something, then we do something like that and that's totally important, because the characters really crystallize once again and in any case it's very important.

I: How durable (long-lasting) and robust (solid) should the puzzle be (how often should it be used)?

So I mean, the ideal is of course if it's totally durable and very robust, because it should be played often. Well, ideally, it's played very often and then it's bad if you have to constantly maintain it somehow, well, if you constantly have to make sure that it's all running, that it's always in order, that's very time-consuming. So I think the more robust and durable it is, the better.

I: What is the atmosphere you want to create for the experience?

Mysterious, I would say. Well, off the top of my head, mysterious comes to mind, a bit, yes, you don't know what's coming, and it's very exciting and somehow also beautiful and strange. I think mysterious is the best way to describe it.

I: What is the "common thread" (connecting features) of the puzzles within the installation?

So I do think that you can use such a ne. Climate. Message. There's a common thread running through all the puzzles. And I mean, I still have this story in my head, no, that somehow this caravan lands somewhere from the past and that someone reports what it will probably be like in the future if we don't change our behavior. Well, whether it's this Doctor Dorothy Hartmann or something else, some other being, a soul or whatever. But someone already knows more than we do and gives us the information so that we can do something with it. Exactly. It would be like that. My thread through it.

I: Okay, it's the story that connects them all.

Exactly, the story and the puzzles themselves, so the content of the puzzles now in that they somehow always have something to do with climate, whereby it doesn't always have to be this raised index finger, no, so if we don't do this and that, then this and that will happen, but somehow always, it can also be something funny or fascinating or somehow surprising in between, no? Something where you say, oh, gosh, really, that's how it is. Yes, that's difficult. That's exactly the requirement, no, but... Mhm. So I think things are always fun when you have to act, when you have to do something and then something happens. So I don't know, you press the button and then something comes out. So the form can be fun and the content can be something you learn or experience. Yes, that's something new, I've actually never heard of it or I didn't even know about it.

I: Is there anything else you would like to add to what has been said?

Can't I think of anything right now? No, but what else would I like to say? Well, I hope that. Yes, that somehow... We've actually already met so many people who think it's somehow good or who enjoy it or who see potential that they actually believe that it will somehow be an exciting, not just an exciting journey, but that the destination will also be exciting and that we will somehow reach a destination, what exactly it is for everything or what it will look like, you can tell. Maybe we can't say exactly yet, but there will be one, one goal and I'm looking forward to it. There are always setbacks or things that are a bit unsettled or something, there always are, as in every project, but overall the mood is positive, so it's always fun when we have these creative weekends, a nice atmosphere and yes, I have to say that you guys from Twente are of course adding to the momentum and that's fun and I would have loved to have been there for the last weekend.

I: Thank you very much for your time.

2-B. Respondent 2

I: What is your function in the project?

I am a climate educator.

I: What design phase are you in with your project?

Which of these? Yes, of course you can do it that way, but we don't necessarily do it that way, so there are also other forms of models, we see it more as something where other steps come back, these phases are never really completely finished. So, if we were to draw this graphic, we would have more emphasis on the return request, so that some steps can be revisited, because a step is never really finished. A phase is never really completely finished,

questions are always revisited. In the rough course of the project, however, you can see roughly on the Miro Board where our phases are and where we are in the process.

I: What difficulties have you overcome so far in building the facility?

Already overcome? Not yet. We have now identified all the difficulties and then it happens that they are no longer there with such gravity. Difficulties mean tension, difficulties mean uncertainty. At least we have one difficulty, which is to avoid the target group, so we knew we didn't want children, but rather young adults. Later we may be able to include several groups, but now age is the most important thing. Well, at least we have already identified that it will remain a very intensive process in order not to lose the identity of the project during the process. How to include several ideas in the project, so that everyone can name their own idea and that the project still remains correct. Not that I come up with one idea, for example, and the others say "Yes, that's nice, but let's not do it now" and then I say "Oh, ok, I'll go".

I: What design process are you following? (For X) / How have you experienced the design process so far?

Rapid prototyping, we already have a lot of this design scene with us so that everyone can think quickly and create something. We always have it with us. But there are also other preconceived design steps, the modus operandi, where we look more at the visual or haptic aspects, i.e. we evaluate ourselves how the things are received. It's important to keep in mind in these steps what exactly the focal point is, i.e. should it be about structure, about technology, should it be funny? Like this.

I: What user experience are you designing for? (What should the visitor feel and when?)

The aim is to create the possibility that what has already been experienced is somehow integrated into the system, i.e. that one's own experience and understanding is brought into the escape room. You should be able to bring your own experiences and insights into the game and use them to recognize yourself in the puzzles or to generate information.

I: How have end users reacted to the bus prototype so far?

First and foremost, of course, there is the cover, so the artifact is naturally an eye-catcher. It has already inspired people and triggered questions, such as "Oh!" and "Ah!" and "May I come in? So, the exterior looks very tempting for immigrants. So the first reaction was in fact absolutely positive. Everyone says: "This is an incredibly great, inspiring space with a high level of authenticity."

I: How much experience do you personally have with technology?

Vacuum cleaners, hair dryers and razors. So we're more in the consumer sector. So, I can make a drone fly, but I can't program it. I can still program an Arduino, but that's not difficult, any student can do it. It's consumer level, but I can already evaluate the technology a bit, so I know where it would be useful and where not, and how it could be combined. But I wouldn't enjoy programming a robot or something like that, for example. If a light went on in Alex's (robot) room, I wouldn't be so enthusiastic.

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I: How do you envision the final escape room?

Definitely two levels, one group will be outside and one inside. We will then try to provide and animate other animations. We also want to offer the possibility to look from the inside to the outside and from the outside to the inside. In the modi operandi, we haven't quite decided what exactly will happen, i.e. what the final form will look like. The idea is that the topic of climate change and the climate crisis should be experienced in a playful way, and there should be the opportunity to discuss it again afterwards. So that's how it should be in broad terms. And the best thing, of course, would be if they could take this into their everyday lives. If we had several groups, then we could also have one group inside while the others go in and they could observe each other, that would also be nice.

I: What spatial requirements do you have for each individual escape room puzzle?

These requirements result from the design of the interior, so we still have many original parts from the original furnishings that could be built on, for example the oven, the refrigerator, the bed, the shower, so the bed already nestles into the surroundings and this is how the laboratory is ultimately formed.

I: What are the visual or design requirements for each puzzle? (How must it (not) look)

It will be very diverse because, for example, from light to dark or from different colors such as green to red, there should somehow be an association, so that you can clearly see that these things have something to do with each other. And it should slightly stimulate the atmosphere when you enter.

I: In your opinion, how high should the production complexity of each puzzle be?

So, of course, there's the danger that if a puzzle is too complicated, a group will get stuck and freeze, well, frozen somehow, and then leave. In a game like this, you always need interaction, so a reward has to come out all the time, otherwise the players freeze. You can solve this by making the game master active and giving them hints, or you can give them a joker, so that they can ask once exactly how to solve a puzzle. If players are stuck on a puzzle for a long time and keep repeating the same iteration, this is a good sign that they are stuck. But even then, they may suddenly accidentally aah! and understand it. But well, it's still important to step in on time, otherwise, they knock on the door and say we come out.

I: What other requirements could you name?

It should have its own identity, but at the same time it should not be forgotten that it is part of something bigger, so the question is of course to what extent a puzzle can stand alone and how far it should fit, because the information from one puzzle is transferred to the next. To a certain extent, a puzzle should also be able to fit in with its neighbors. The question is also what the place will be in the story, so does it have to be solved or is it just for stimulation? It could be something like that.

I: How durable (long-lasting) and robust (solid) should the puzzle be (how often should it be used)?

It should indeed be a hands-on experience, i.e. it will be touched several times and should be able to withstand this. It should also be reproducible, i.e. not so complex that the individual parts cannot be reversed. The specification is also such that as soon as you introduce technology, it is a source of error, so if the power is now gone, whether the puzzle still works, or if the program fails, it would be good if there was a way to bridge this, so that the whole game does not become unplayable.

I: To what extent should the materials in the puzzle be interchangeable?

Already answered.

I: To what extent should the puzzle be repairable?

In terms of materiality, there should be as few irreplaceable parts as possible, i.e. nothing that would make the puzzle completely unusable if it were to break.

I: What is the atmosphere you want to create for the experience?

There are two themes that intermingle in the installation, on the one hand The end of Time, on the other The bringer of Hope, The bringer of Love, so the mood is a little serious, but at the same time hopeful, because the players connect the world with their own, it's not meant to be an inevitable dystopia, but that the world can be made better.

I: What is the "common thread" (connecting features) of the puzzles within the installation?

Networking always makes sense, but it shouldn't be mandatory. Our basic orientation is solar punk, which is supposed to be more of a revolution. Humans are nature, and that should somehow be reflected in the puzzles, this underlying message. But I don't know if something like that would fit into the macro structure.

I: Is there anything else you would like to add to what has been said?

Every protagonist who gets involved becomes part of this group, no matter how long or how much he or she puts into it. And everyone then plays a part in this installation, which makes it a very special project for me. And the fact that I've met and worked with so many great people is also amazing.

I: Thank you very much for your time.

2-C. Respondent 3

I: What is your function in the project?

So the good question: I'm one of the contributors today, but now without a special task----------. And I am. So I'm still relatively new, even in this area of Escape Romski. I've played, but not yet developed one. So that means I'm not even involved as one of the contributors.

I: What design phase are you in with your project?

Oh, that's a good question. Well, the first workshops have already taken place. I was only importantly involved in one of them, otherwise just online. We've come up with various games, for example, and we're still working on them. Also to develop the story. But to what extent it's already a done deal or whether it's still relatively new, I can't say myself, I'm also looking forward to November when we have the second workshop, where I'll be involved. If we then get some input in the direction of the Climate Weeks and I now think that from my feeling, that's also the case, that we can still, so also with the.

We actually presented the thing once in Nuremberg: How do people react to individual elements that were already there? That you think about it a bit, how can you actually bring all these themes behind it so that it becomes a game and people want to play it. And I think that's, that's very important, that's the other point where I say that we're still relatively at the beginning, that's what I would be very interested in, whether you can still manage to put the whole thing in a larger framework, for example with the computer part, which doesn't necessarily have to have anything to do with the escape room. But somehow it does. So the two could form a common unit, so to speak. Both to extend the range and the long-term nature, the problem with escape rooms, even with workshops and so on, is that afterwards you've done something for an hour and then you're left alone again. And on the other hand, due to the size of the room, a maximum of 4 people can actually play. That means you might have 16 people a day. How you can play in this room. That's why we're also thinking about building something outside, i.e. making games that then have to be used inside so that whole school classes can pass by.

And at the moment I don't know exactly where we are with that. And I think I'm still very much thinking about what could be done. But that's somewhat hindered by the fact that I have less experience with escape rooms. And that's why I can't say, "Hey, yes, I'm always like that, so that works a bit. Get the input. How does it even work? You can do that and then put ideas back in, like an iterative process really.

I: What difficulties have you overcome so far in building the facility?

Well, the others for sure. They've already practically got the whole thing... Uh, let's call it a playable state. Which wasn't the case from the start. Well, that's fine, my impression at least was that it was musty in there and the whole thing always smelled pretty bad. I only got to know it in that state when it was already better, so to speak. But I'm already taking away some of the difficulties, so it's already TÜV-compliant. So that means we've already been able to trailer it. Twice. Now he's already got it. Have you already had it done? And. Yes, I think so. What's not quite clear to me yet, in terms of difficulties, it's just the state it's in now, where they've already built really great things with these mosses and so on, for example. But to what extent this is actually the final state and whether these were difficulties or not, to what extent they are not, let's say from the games, I don't think there is so much that is really in a finished state. So we can say.

That's where the difficulties actually arose, because with the prototypes it's usually relatively easy to say OK, this is how it's going to look, put the cardboard cover on it in black or... We haven't had any difficulties in actual production yet. And the thing that will still come, of course, which we were only able to do in Nuremberg in a rudimentary way because nothing was there yet, is actually the long-term playability. For example, can we then use this keyboard from a hackerspace, where there are already transparent keys and you can work with light symbols somehow. I don't know whether this will actually be played, but it's at least being considered and then of course you have to think about what happens if it's really played by 16 people every day. How long does it last, how many backing systems do you need, is a good idea in general, that will certainly make up a certain part of it. From November to . Yes, then, when it should actually be running, I guess.

I: How have you experienced the design process so far?

Yes, that's quite interesting. Above all, you're the first person to ask that directly. I come from a degree course that did semester projects. And it was actually always like this, with the schedule. At least in the projects, of which 3 of my 4 projects won the internal award, i.e. were awarded by the IHK, it was the case that we took a relatively long time to come up with ideas and only then started to produce something. And now it's completely different here and I have a bit of a problem with it because sometimes I think, OK, you've already produced something that could perhaps have been produced better if you'd given it a bit more time to think about it. On the other hand, they say, OK, that's just how we do it, so the people who have experience with these escape rooms don't really enjoy doing it, so it's an interesting experience for me right now. Because sometimes I think to myself: OK, the way it looks now, it's quite nice, but it's not actually productive at all. If you discuss it more, couldn't something better have come out of it? The one where I think a bit... We think, OK, let's see what comes out and what he does and so these voting processes sometimes run, so I say democratic, it doesn't have to be, but it has to be a bit transparent as to why certain decisions are made. That means OK, that's what we've decided now, then some people don't even know who decided it and why and whether it means anything. You can still change it at any time, but it's not that simple, so. Well, that's a bit of a negative, but I think it's very positive when you look at this, this community that was there at the first workshop and since I know it from the online things, I think it's a positive thing in itself and, yes, it's definitely effective.

Where people pull together to say: Yes, this topic is close to our hearts. But as I said, I would like to see a bit more presence in the implementation.

I: What user experience are you designing for? (What should the visitor feel and when?)

Uh, well, of course that's not entirely clear to me either. They would have, because I still have so little experience with escape rooms, the couple that I have played. We then had the opportunity to play one in Nuremberg and then guide it again myself, which is also completely different. Um. I'm not quite sure yet how much these target groups differ. But the games we had now were not like the ones you had with you. It was a box with the escape room on the subject of Humboldt, where I say OK, it was developed by pupils and can be played by adults as well as pupils who are probably not very young, but in any case also by pupils, where I say it's not quite clear to me yet whether we actually have to do something different for the groups and what's not quite clear to me yet is that I came up with this target judge. Or a funnel like that, actually just where, where what that means would only come in the workshop. And they classified it as not relevant to the topic, even though I said it could or should be a very important aspect for you, but I said I don't know if you can even charge these games with such a pedagogical background?

And how to go about it. So my idea was practically that you do something and think, OK, aha, there are different locations and if I get the right one, then something will happen and I would then include the transfer in the workshop without you knowing it at the beginning. But I have no idea, because I'm also an educator, whether that's the right concept or not, but that was just, that was the consideration. And that's exactly the difficult part. I, OK, I came up with it especially for this, I said. Yes, it could be something like that, but I just don't know. And then somehow you have to let ideas die and then I said: I have no problem with that, I really have a lot of ideas, but I would have liked to know why it died and why. Because they said that it was a kind of subordinate idea, which I found somehow incomprehensible. For example, and but, but that's the kind of thing where I say I'm just looking around myself, but I'm happy to be instructed if they say yes. For the target group that we have, I don't think we actually know exactly, but I guess I, I always think 15-16 year olds, so a bit of a game element is still important, so to speak. But they don't really want to work scientifically, but they still have an understanding. That's what I keep in the back of my mind. Whether this is the right method at all, whether it's suitable and what needs to be developed for them. As I said, I also have to rely on the expertise of the teachers.

I: How have end users reacted to the bus prototype so far?

So that was very exciting for me, because there were also some guys there. We were at the station forecourt in Nuremberg. And the audience walking past there is now. Possibly not quite the target group. In other words, I assume that we. With schools then above all, since times Realschule stops serving. So in Germany, the middle level of education up to grammar school. And not necessarily the completely different level, although that certainly works. And then we had things like people somehow finding out what we're doing and then saying yes, but the AFD has already proven that it can save everything, because that was one thing, and then that was another. Um, there were people there where I thought to myself, OK. He looked a bit, let's say, like people who just hang around at the station. So we didn't really look after him very well and I brought him in anyway. But I'm definitely sticking with it and not learning on my own. And he's totally freaked out. And the "Wow, the drop of youth there and I think it's just great!" and I then realized that he was so enthusiastic about the device itself, but of course he wasn't interested in the other equipment, but actually in the original condition of the device.

And then there were lots of people next to it, especially younger, middle-aged women, who found it really exciting, especially in the back with the plant smells, just like that. Something like that in the main table is not olfactory, so it was simply an experience. Unconditional killer, you like it quite a lot and for me it's just that I say OK, I'm now completely claustrophobic or a bit taller, it's not really that much fun to walk around standing in that thing. OK, well, I'd much rather be squatting somewhere doing something, so I say OK, yes, it depends what job you have. But the people who were there were really enthusiastic just about the indoor set-up.

I: How much experience do you personally have with technology?

All right, what does technology mean? Well, I was born in '66 and I was actually interested in microprocessors and similar things as a child and it wasn't that easy to get information back then and I actually wanted to study environmental protection in a technical course, so I didn't become an environmental engineer because I wasn't so good with chemistry, but I became a physics engineer. I programmed my. I programmed my diploma thesis on Matari, which now has a professor who developed music programs for Atari, and that's where I did some of my diploma theses. Then I worked in construction physics and for 20 years in a technology company as a quality manager. And then partly because the auditors kept noticing that our database was full of shit. And they had great database people, but they were always involved in the projects and of course nobody did anything. And that's what I then started to do, really a database, our HP system optimizations with, so that 20 years and now in our studies we had again, so of course I'm always Indian differences in, but I myself say what some politicians say now as the technology will save us, was perhaps the idea of me a few 30 years ago when I finished my studies over 20 years but I say no we need other solutions, the technology alone will not save us. But if, then, if we happen to find something that can support it, technology can already be a part that helps us. But actually, I have to give the awareness change to the effect that I simply need a different approach to resources, i.e. the one that X, the co-founder of Stein Future here in Germany, has always brought beautiful images. We have an economic system that is like a conveyor belt. Where the underground trains come on at the front, then it is rebuilt and at the end of the whole thing it is simply tipped onto the garbage heap at the very top. And this idea is technological, if you like. I come from the city, where there are a lot of conveyor belts, which were often used for gravel pits, which is sometimes quite long, but at some point it just ends up on top of the heap and what we have to do is practically close this cycle. That's why it can't be done purely with technology, but R technology experience with me also has a lot to do with how technology is always brought

across to other people because I also did some of it in the company. OK, it was technology-heavy anyway, but still certain things with the staff lady or something like that where you just said OK, I don't know how E System works or how it works. But it was essentially theoretical, let's say.

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I: How do you envision the final escape room?

Yes, from the outside, I think it's actually quite good if it's not so different from what a caravan looks like, maybe even try to upload it again, polish it a bit instead of flashing it so that it looks new, but I don't necessarily have to be. Because you have this story that it somehow comes from the future, so of course it can be a bit damaged.

And inside, the visitor has this idea, we can then ultimately come to this solar punk or steampunk considerations, that you realize that the device is more than just a caravan, but that the whole thing is also an AI or whatever, so perhaps even with the possibilities of the biotechnology presented. Once when I was researching, I found it exciting that they said that data could also be stored in the DNA. So, there are considerations.

Where they even say that it can then be stored for as long as honey or even over 1000 years without it breaking down. So you said 5000 years. Where they simply say that it contains technology from the future. We're just going to take it out now, plant it again and at some point in the course of the thing, the whole thing will be a unit, a something that lives, something that fuses technology, as well as cyborg but not so scary. So I think cyborg, if you say something like built-in camera, I think that's rather creepy, but if the plant that somehow corresponds with the thing or can help the energy. Um, then I would actually find that quite exciting and it wouldn't look so different from what we have.

And the other aspect is that you can also incorporate as part of the game that you realize that the thing is no longer complete, that something has broken during the transfer through time. Practically used look and also this, which is there at some point and that can also be reinstalled in the games, something to repair, somehow 3 clamps or the vulture knows or some part has to be replaced to get it going again. Something like that. Of course, these considerations should always be playable and it should also be playable in the long term. Of course, it should also have a certain robustness if you don't have to instruct people for 3 hours and then be able to move around in the thing at all. So there has to be a certain degree of robustness.

I: What spatial requirements do you have for each individual escape room puzzle?

So I think it would be interesting if there were games that take up relatively limited space. And there can also be games that are spread over the whole thing. But I say OK, I think there's one part that... But I don't know how it will be in terms of playability. So those are points that elude me, whether that's possible. But I find it very exciting in itself and the other thing was that we always said that we shouldn't be able to be solved by one person alone, so there are still games that require other people. Need other people. What comes to mind now is something I once did for a children's birthday party. I knew that my daughter wasn't the fastest and that if someone else got the object of desire first on her birthday, that would create a lot of unrest, so I practically divided the 2 groups. And they then go to the pill game and have to guide them. So that ensures that the two players or the two game groups can't be at the destination, because the person guiding comes after them, only if both directions match, so to speak. I could also imagine correct coordinates and something like that in a way, that you just say OK. If there is someone who sees through things very quickly and says, we have to do this now, that they then always have to interact and say, OK, can you press a button on the ID over there and you on the other side and I can then do something here. That would be a cool thing. I want to utilize the whole room somehow, but it doesn't have to be for every game, but it would be good for one or two games.

I: What are the visual or design requirements for each puzzle? (How must it (not) look)

Oh, that's something... Because looking at it in detail now, I'm not really a visual person. But when I'm asked, what do I see when I see something? I usually say nothing, it's not quite right. I do have an idea of what it looks like, but it's not the most important thing for me, these points, it's more about the look and feel. You should actually really enjoy spending time in it, but at the same time this game element, that you only have one hour, that can also be noticeable somehow.

I: How high do you think the production complexity of each puzzle should be? (How much technology can you handle)

Oh, good question. Well, it just depends when I think about these keyboards, for example, which I soldered together myself in the Hacker Space workshop. Theoretically, of course, you could also include something like that in the external workshops. So you say, OK, there's someone there. I don't know how that would be feasible, but Hackers Base has those little soldering irons and then you build something there. Of course, I would also find it exciting if that were to happen virtually live. Uh, it would always have to be something that's not so complicated that it can't be repaired when it's broken. Or at least there would have to be several similar parts. That's the way it is now. Otherwise, it just really depends on whether they can do it, i.e. how much money you have. So if something looks cool and someone says: "Hey, that's really cool." And it has to be the same, it can certainly cost more. At the same time, however, the GAG of my idea of all this solar or steampunk is that it can also be used parts, that it looks like she assembled the things in the junkyards of the time to build her system, this Dorothy. That's why I definitely prefer recycled materials, but that doesn't mean you don't have to put a lot of work into

it. I would say that the material shouldn't be of such high quality, but it always depends on what the end product is. In terms of working time, it can be a bit more time-consuming, because that's what you do, so it's also part of building something together.

I: What other requirements could you name?

Well, there were a few things that I just mentioned. So that's one in terms of the skills that you would ideally have in the workshop. There was someone who took a close look, there was someone who worked together with the others, who was creative, who covered things like that a bit. Then possibly actually this ability to say "Aha", and that is as honest as, for example, with the points or something.

But what explains what actually has to do with climate change? And the other thing I always say is that it should certainly have an ethical claim at some point, i.e. it should be self-made but resemble the characteristics of a person. And that's why it has plants in it and a bit of floristic elements, I don't know.

I: Is there anything else you would like to add to what has been said?

Well, I think pretty much everything has been said now. For me, it's still interesting how you can manage to embed it in a larger context, so you say something like this. Computer games have something to do with our thing, but not, as I said, you don't have to have played the room in the computer game and vice versa, so that you say, yes, these are further building blocks or quasi deepening elements that I find exciting or this community idea.

I: Thank you very much for your time.

2-D. Respondent 4.

I: What is your function in the project?

My function is that I am the project manager of the Airstream project, and I am also the only one who finances it.

I: What design phase are you in with your project?

Roughly between the first three. Emphasize we have finished. Unfortunately, we didn't do it exactly scientifically, so they weren't worked through serially, but rather randomly. The first three have already been started, but none of them are really finished yet.

I: What difficulties have you overcome so far in building the facility?

First of all, the car had to be made ready for transportation, so that the interior could be used and the car could drive, let's say the basics of the basics. Next, we were able to prove the design basics, i.e. Solarpunk, which we also managed to do. We also set up the power supply so that all the necessities of life could be supplied, such as showers and so on, and we managed to do all that.

I: What design process are you following?

We have a gamemaster, who is paid by myself, who deals with the design, and before him there was another one from an association who also dealt with it. They are transparent about it because I find it exciting myself, but I don't think they follow a procedure like an academic has written and proven, I think they rely more on their experience of what works and what doesn't work. But they also mentioned something along the lines of evaluation, that you should always get a second opinion, for example, you might think an idea is very good and then be told it was boring, and we've often seen that ideas have to be killed off. We've already done rapid prototyping sessions, so we all got together and generated ideas with cardboard, and we realized that not everyone can think of an idea so quickly because of the different backgrounds. We also realized that game design is harder than you think.

I: What user experience are you designing for? (What should the visitor feel and when?)

There are three groups of customers: A state, where the bus is parked in a plaza for a certain period of time and can be visited by the public, individual groups that can book the escape room for an hour and, lastly, companies that want to transform themselves and use the Airstream to playfully learn how to act in a climate-conscious way. And then there are also educational institutions, schools and so on, but no children, because that causes problems with the parents and shocking material, so the users are always adults over 16. So the customers are business and the users are the adults.

I: How have end users reacted to the bus prototype so far?

The Aistream attracts people like light insects, it has a very special, unusual shape, looks like it has fallen out of time, it is a very special model that is no longer produced today, with an iconic shape reminiscent of aircraft construction. The second impression is disappointment, like "Oh well, it's not finished yet, I can't play it yet." But we haven't had any rejection yet, whenever people visit the Airstream they are positive, they like to offer to help, they say they really like the shape. There is also something mysterious about it, something to do with flying.

I: How much experience do you personally have with technology?

So I'm not a technical person, I'm a person person. What I'm good at is putting together high-performance teams. I'm also good at evaluating user journeys because I can put myself in the user's shoes. So I have a certain assessment competence, but I can't build it myself, if that's the question.

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I: How do you envision the final escape room?

It's supposed to be a great gaming experience where a group has to solve a puzzle in 60 minutes. The topic is climate change, a climate crisis in which we should all take more action. This room is there to increase the probability that someone will act differently in their everyday life by just one mili percent, modestly. In other words, the information that a person takes with them in this escape room, for example in a company later on, if I can choose between A and B, will tilt me more towards B. And the best thing, of course, would be if people could be inspired by it. So that's roughly why this room exists.

I: What spatial requirements do you have for each individual escape room puzzle?

As you can see, the original core furnishings have been preserved, such as the oven, fridge and so on. I could well imagine that such places would be suitable for puzzles. It would probably be good to keep themes somehow, like an oven has something to do with heat, for example, and a fridge has something to do with food. I myself would find it interesting if these places were to undergo a transformation themselves, just like the rest of the room. Incidentally, we also continued to think about reintroducing a separation. There were two doors in these places, which we removed because the room was otherwise too small for four, but I could well imagine that this would be exciting and motivating for players when they realize: Hey, it was bigger on the outside!" and then have to go into the last room. But otherwise, floor, ceiling, nothing is excluded, everything is usable.

I: What are the visual or design requirements for each puzzle? (How must it (not) look)

So the style is clearly meant to be solarpunk, which is an older concept that refers to the reconciliation between technology and nature. In such a world you can also be part of the solution, but also part of the problem, but what I would really like would be if, for example, a computer or a machine looked like it had leaves. And rather avoid new plastic, unless there is no other way. We've painted the car white for now, and are trying to stick to white, gray and green. Then a red lamp will also stand out more, and players can be better guided for hints, I can imagine. Signal colors can then be used selectively. What I can't imagine here would be large areas of red and yellow and such, that would pretty much contradict Solarpunk. Silver is also a great color, because the bus itself is also silver, but I imagine it to be more puristic with the colors.

I: In your opinion, how high should the production complexity of each puzzle be? (How much technology can you handle)

Ultimately, it will be something you can touch and grab, so robustness plays a major role. As little as possible should be pluggable, because if they can, people break everything. I've also accidentally broken things myself during prototyping, it happens. For example, you could hide something fragile behind Plexiglas so that they can't reach it. I would say that the complexity lies more in the back curtain. Of course, the worst thing would be if a puzzle fails and nothing works anymore, the whole game would fall flat. It would be good to have a workaround so that it would still work, for example the game master gets a code and passes it on to the player.

I: What other requirements could you name?

I am a professional climate advocate and I always say: "The climate crisis is a communication crisis.". We already hear enough about the climate crisis in our everyday lives, and we've noticed that only very few people get involved with education, and unfortunately not the people we want to reach. That's why we want to build intuition through play, it shouldn't just be based on facts, it should be exciting and entertaining. The fun should never take a back seat to the complexity, it shouldn't necessarily be an informative escape room in the sense that I would rather have a little less information woven into it than give up the fun.

I: How durable and robust should the puzzle be (how often should it be used)?

So, it should be as robust as possible. It should be able to fall down and not break immediately or if someone steps on it. It should also be reproducible, so that if something breaks, it can't be made again. It shouldn't require any major reprogramming that we can't do without. So, we are expecting about 3-5 years of constant use, for this time it should last and work well. After that time we will also try to scale, so it would be nice if it was backwards compatible, but it doesn't have to be.

I: To what extent should the materials in the puzzle be interchangeable?

There are people in our group who could repair something like this, but in general, the simpler the better. It should also be a minimum requirement that there is documentation that a normal mortal person can understand. So, the less, the better.

I: To what extent should the puzzle be repairable?

Yes, it should be repairable. Either there should be a way to continue the game without the puzzle or a work-around.

I: What is the atmosphere you want to create for the experience?

Ultimately, it's supposed to have something to do with solar punk, the reconciliation of man and technology. It will be like this: they will perform in a dark room, then the lights will slowly come on, just like Tension. We could also use LED strips to guide them in the dark. So, I'm just thinking about it. What's important is that the Airstream is a motorhome, so it symbolizes a kind of journey, and that should be reflected somehow, this travel feeling. Such a journey can be local, but it can also be temporal. Then it would also be an idea to keep a kind of travel diary somewhere, where you can read about all the places you've lost. So the theme of a kind of journey should be captured. I can also imagine that rooms will change over time, through time travel. So you can ask yourself what this place will look like in 40 years' time. We had the idea of hanging screens in front of the window, so you could see: "Oh, that church there is different now", or something like that, so it kind of implies the feeling of a journey. Time travel is actually a leap, you're suddenly from one place to the next. There were a lot of time travel paradoxes that we haven't solved yet, so let's do it this way with the video. Implicitly, the feeling of travel should be present. Then of course you also ask yourself which journey, for example the idea of the soul, is also a journey somehow. It has something to do with mystery. So somehow it would be nice if the theme of travel were interwoven into it.

I: What is the "common thread" of the puzzle within the installation?

So, fun and entertainment would be the first. Solving the puzzles in 60 minutes and creating a good feeling, having fun together would be one. Then there are also some themes that always come back, like the climate, and that can be in the form of resources, so water and so on, but can also be the environment, the relationship as a species to the environment could also be something, ne. And the topic of travel should also be noticeable in some places. The last link would then be how we get the message across implicitly. I think we do that with the topic of traveling, it's connected. If someone says "Hey, we humans are dying, you have to change your behavior", nobody wants that. That's why all puzzles should somehow convey this message implicitly and indirectly. The question is then, of course, how can it be packed into such a puzzle without it coming across as intrusive.

I: Is there anything else you would like to add to what has been said?

Yes, it's important that you dock the ideas you have in the group so that we can start prototyping productively. So, we're meeting on October 27th, it would be good if you already have a certain idea, better 3 even, of what you would like to put together so that we can determine the puzzle hierarchies. So that would be the interfaces, the locations and the input-output.

I: Thank you very much for your time,

2-E. Respondent 5.

I: What is your function in the project?

My role is to moderate the creative process and contribute my expertise as an experienced game designer. I try to bring many ideas together to produce a result.

I: What design phase are you in with your project? (Explain with room2educ8)

I think we are still in the rough concept phase, we have ideas and are trying to build a concept from them.

I: What difficulties have you overcome so far in building the facility?

I think a big difficulty is the many different ideas about how much you want to work, when and what. It's a bit chaotic with this group because most of them are volunteers, which means that they're only motivated by fun. For example, there was one person who wanted to lead the creative process and there was a conflict. I then told her that it wasn't possible, that she could either leave it to me and join in, or she had to leave, and she then opted for the second option.

I: To what extent was there a conflict?

Yes, she kept interrupting me and telling me what we should do instead, and that didn't work. But overall, it's difficult to work with these people because they have no experience in designing EERs. Exactly, because in this group X is the only one who has already designed escape rooms and I have, of course. And X, who was there at the beginning, is no longer there or no longer active and so, yes, they are. The people are motivated, but they don't have any experience with it yet and that's why we're further behind schedule in terms of the puzzles than I actually thought. So we've already done a bit of decor and technical infrastructure, electricity and so on. Exactly, but the puzzles are late and it's not that easy to do with these people.

I: What design process are you following? / How have you experienced the design process so far?

So we, we work iteratively. I don't know if we... no, I don't think we use an official method. It's like this. Maybe a mixture of different things, but... Yes, I don't know exactly either, so I've never studied or tried out these methods quite so strictly, I have. So I developed many, many things during my studies and then later in my work, or saw them with other colleagues or experienced them in different teams. And yes, it's not an official method, it's an iterative, intuitive process and I don't just work in a results-oriented way. So because there are so many volunteers. Or because there are volunteers, the fun is important and the identification with the project and also the self-efficacy, i.e. the feeling that you can contribute something and that's why it's important that if someone suggests an idea that only fits a little or halfway, but not quite, that I take it anyway and treat it very appreciatively and see where it can be tweaked.

I: What user experience are you designing for? (What should the visitor feel and when?)

I think it should be an exciting group experience. They should have a bit of excitement in their stomachs and they should look forward to this day where they have booked this game and they experience something together. So there's a team-building component to it.

Am. Yes, so it should. Adrenaline and dopamine should be released. Yes. So it is and that, but the project is split into two parts. First there's the escape room and then the follow-up workshop, and the follow-up workshop is a bit more adult.

So that the game is at the beginning. A quick, bright fire. And once it's burning, then you can use these fires to start something deeper, slower, and that should be a realization. The situation is serious, but I can make a difference. I am a small part, but it is important that as a small part I also change something. So it's a kind of empowerment, a kind of self-reflection and it should be fun to think about it and it should be fun to become active.

So motivating then in that direction.

I: How have end users reacted to the bus prototype so far?

People see it from afar and they find it interesting. Uh, and many want to go inside. Mhm. At the event in Nuremberg, there were also some people who were disappointed because they thought everything was already finished. They thought it was already there. There is already a finished escape room, but there was only a backdrop and yes, there were some who were disappointed.

So we got a lot of good feedback for our video that we put on Instagram, where you can see the interior. Um. And people said it looks, it looks great. Like that. Solarpunk-ish and that's the feedback we got. And then there's, we did some testing of the follow-up workshop, these climate action cards. One version is in 2 versions, you can just take them from a stand and take them with you. And the other version was a card game where you can play with each other.

Suggests and chooses and so on, that's a bit more personal, because you try to do that.

Find out more about what suits your own personality.

And I saw that people enjoyed it, and we want to continue doing that and turn it into a product that is part of the workshop. And perhaps it can also be marketed independently of it.

I: How much experience do you personally have with technology?

Well, I'm definitely very interested in technology. And we also have a similar course here at the art college in Halle. Similar to Creative Technology, it's called Multimedia becomes Reality Design but also includes things like Arduino and Tactical ne Tangible Computing and things like that. And I always look at that. So I'm not a technology maker or anything like that. I can't really program or anything, can I? Hm, because I've tried programming a few things or soldering or something, but I'm still a beginner at it, but I'm very interested and I can also imagine and understand things well.

I: What specifically did you try to program?

So that was 10 years ago now. We made a game for young people so that they could find out what job they wanted to do. And we had the idea that there would be a tablet, you could choose a profession and you could take photos of yourself.

In this profession with the outfit in a scene with the profession. And I programmed the prototype of it on a Windows tablet and the prototype was quick and dirty and worked and we saw that it was fun and then in the next step we commissioned a real programmer to clean it up again

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I: How do you envision the final escape room?

I imagine it to be very atmospheric, it's a mixture of solar punk, steampunk and cyberpunk, so you can tell that this interior is put together from different times because it's a time machine. Not just futuristic, but also a mixture of history. And a lot of plants too. Um, in keeping with solar punk and the climate theme. And I imagine that there are some easy puzzles at the beginning to give the players a good feeling. They realize: Wow, we can do this, we're getting in and this is maybe 3 complex or 4 complex puzzles there. And when you've cracked them all, a message is played from the future, a message that rewards the players and motivates them to follow this important workshop very closely because they can make a difference. And then there will be the workshop and I think there will be 2 different workshops. Maybe we still need to discuss that.

I think that X will be doing a workshop for children and young people.

And that we, as a group, will perhaps also develop a workshop for Stefan that is more for adults who are already a bit familiar with climate issues and who don't have to learn everything from scratch, but rather just need to be motivated. Not necessarily instructed.

I: But I understood that the target demographic was teenagers to adults, which means that children are not allowed in the escape room.

So I think the escape room will work for both target groups.

Also for children.

I: What spatial requirements do you have for each individual escape room puzzle?

So you shouldn't have to climb, at least not dangerously.

So not necessarily on the ceiling, which I have to hold up with a robber's ladder or something. The puzzle can't go in the power distribution box to the right of the toilet because it's closed and there.

Yes, there's electricity in there. I think there's probably bedding underneath the two beds. So maybe no mystery there either. The motorhome must still be able to be used as a motorhome because the people traveling in it also live there. So it doesn't have to look like a normal motorhome, it can look like an escape room, but you should still be able to sleep there.

I: What are the visual or design requirements for each puzzle? (How must it (not) look)

Yes, it should perhaps follow this steampunk cyberpunk solar punk aesthetic, with a focus on solar punk, i.e. mixing technology and nature. That's a bit of an aesthetic that will run through the first Dream. But it could also be that it contains a microscope that just looks like a microscope. And there's a plant next to it and then it's also in the MCI, so to speak. So not every object has to cover everything. So precisely because this story is that time travel is mobile and different things have been added in different centuries, there can therefore be a variance.

I: In your opinion, how high should the production complexity of each puzzle be? (How much technology can you handle)

So my experience was that it's important that things are very resilient, because they're going to be moved around a lot and different people are going to be operating it, players as well as different supervisors, and they don't have time to keep fixing things or anything. So it's very important that it's always running. And if it, if it can't always run, then there has to be a plan B. So if that. I don't know, if the Windows operating system crashes and the face is blank. The projected face and you can't see or hear anything, then maybe there must be a letter that explains this and still makes the game playable. Or to the end.

I: Would you say it would also be possible to design static objects? Something that can't be moved?

Yes, definitely. That is possible, i.e. stationary objects. And they don't have to, they don't have to have a mechanical component. They can also be experienced differently, for example, you could just feel something, there could be a hole and you have to feel something.

And there is a script and you have to feel this script. And that's it. No mechanical component. Still a puzzle.

I: What other requirements could you name?

It's not a hard requirement. So we noticed in Nuremberg that only 5 people at most can enter and play in the first one and the air stream is then blocked for maybe 45 minutes or 5 or an hour, and that's why it's important to gather and buffer the people on the outside, that there are also things on the outside. And it would also be possible to develop something for outside that fits the theme and is not a puzzle from the game.

But right now I have the feeling that there are so many things that it's taking a back seat for now and I didn't want to bring it up yesterday either. I have a feeling.

Ah yes, as others have also said, we have to be completely focused and maybe not always want everything. It's cool when an escape is simply created and it doesn't have to redefine the genre and be completely different or anything like that. It's enough if something cool comes out in the end.

I: How durable (long-lasting) and robust (solid) should the puzzle be (how often should it be used)?

It should be able to be used for half a year or 3 months without having to be repaired. Yes. So I think I think it will probably be used for 2 years or so or 3. But you should, you can repair it from time to time. But not, but not now. Uh after every use or even not after every fifth use, that would be too costly, if that would happen, probably the puzzle would be sorted out. Somehow.

I: What is the atmosphere you want to create for the experience?

A bit creepy and mystical at first. And magical. And very energetic and motivating at the end.

I: OK, then there should be a switch in the atmosphere, halfway or so?

Yes.

I: What is the "common thread" (connecting features) of the puzzles within the installation?

So I think that probably every puzzle or puzzle chain gives you a letter that you enter at the end to get the message. So, and that letter can be that you feel it. It can be that there's an object that has the letter on it, or it can be laser painted somewhere. It can be spoken. It's already certain that it will be a letter, so it's no longer in the ideation phase or something. So the idea as it is now works and it will. We work with it until there is a big problem or until someone has a much better idea that also works better. So yes, I work with the group in such a way that there is an overall draft and we always look at where there are the biggest gaps, the biggest problems.

And that's not such a problem right now.

I: Is there anything else you would like to add?

I know there are a lot of requirements and the robustness thing is difficult because it's a student project and not a paid job or anything. Um, it's not a paid job or anything and I think you can do something that you like, a puzzle object that you think is great and we'll find a way to put that in there and... Exactly. And I'm looking forward to that. I can already see that you're creative and that you want to do it and that's, that's great. Yes, let's keep working on it, that's what I wanted to say.

Appendix 3. Target group interviews

3-A. Respondent 1

Interviewer: Would you tell me 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 detail

3-B. Respondent 2

Interviewer: You indicated that you once went to an escaperoom, could you maybe explain what that escaperoom was about, was 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 color 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 colors 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 colors 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 yes it is more fun for me to do other thing than to do an escaperoom.

3-C. Respondent 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

3-D. Respondent 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 destracts a little bit from the atmosphere, but the decoration that was there was all 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

3-E. Respondent 5, 6 and 7

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 color 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 color 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 guys want to add that I haven't asked about yet?

1,2 and 3:: No.

Appendix 4 - Interviews escape room Münster

4-A. Group 1

Targetgroup Interviews at “TeamEscape (Münster)”
Group 1, 11 people, Room: Temple escape

Context: For these rooms, two teams compete against each other in an identical room. The theme is about a Mayan pyramid in which puzzles have to be solved in order to escape.

Which elements or details did you like the most?
- When something opens on its own
- Sound design in the puzzle was very good
- I liked that the final door opens automatically
- Golden pedestal that opens automatically was cool
- Translation board was difficult but nice to solve
- Chain reactions are like fireworks (quick sequence of puzzles)
- Building the excitement level like a movie is good(Climax)

Was there anything in the room that you would improve?
- There were too many locks/combination locks
- Variety would be better
- In the team room 2 a button wobbled a little and therefore didn't work properly. In this case you should let us know or repair it
- One Gamemaster per room would be good (the employe had to watch 3 rooms at the same time)
- A little more story would be nice. Every now and then a little text that contributes to the story. You can also do puzzles with it (date on the text, for example)

Difficulty level
- approx. 8

Did the decoration add to the atmosphere?
- Yes, very consistent
- You felt like you were in the movie Indiana Jones

How was the darkness in the room? (It was not complete darkness but you needed a flashlight. 4 Flashlights per Team were handed out(no phones allowed))
- It was cool and added to the mood
- sometimes too little (everyone needs a lamp)

Were there moments when it was important to work as a team?
- whenever one found a lock, the other person had the code straight away

4-B. Group 2

Group 2, 5 people, Room Blood Diamonds
Context: In this room, a team of a maximum of six players competes and has to try to get into the secret vault in order to steal something. You first have to find clues in the office in order to open the secret door.

Which elements or details did you like the most?
- Second room was unexpected (Hidden tresor room behind bookshelf)
- Special effects like James Bond were cool
- Cameras dazzle as a sensor
- Magic feeling is always nice
- Puzzle chains add to the excitement

- Weight sensor in the safe to stop alarm

Was there anything in the room that you would improve?
- Safe beeped loudly
- Everything that was screwed or glued in place directly implied that it had nothing to do with the room

Difficulty level
- 7 (Too difficult is stupid/too easy is also stupid)

Did the decoration add to the atmosphere?
- The contrast between the rooms immediately created a great feeling
- Well chosen decorations, matched all the same time

Were there moments when it was important to work as a team?
- Collaborate between the two rooms
- Blinding two cameras at the same time needed teamwork

Hints (On Screen)
- Not too much not too little
- Depends on the type of room (TeamvsTeam or Normal)
- With Walky Talky it would be more exciting
- Also good on display to read again

Appendix 5 -Expert Interview

What is your experience with (educational) 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.

How would you define an escape room?
So, when you talk about an escape room in the old term, than 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.

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 the 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!

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 lo 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.

Than we have a loot 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 than 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.

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.

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 to 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.

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 can not 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.

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.

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 change of a really ,really nice escape room due to the caravan!

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 that 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 6. Questionnaire

User test Graduation Project - Hilke van den Born

* Indicates required question

1. I recieved the following number:

   (With this number your response and the observational notes will be matched anonymously, as mentioned in the information brochure)

   _____

2. I solved the 'earth in the oven' puzzle *

   Mark only one oval.

   - ◯ Yes, without hints
   - ◯ Yes, with hints
   - ◯ No

3. The general theme of the 'earth in the oven' puzzle can be described as:

   _____

   _____

   _____

   _____

   _____

4. What did you learn from the 'earth in the oven' puzzle?

5. The 'earth in the oven' puzzle was difficult to solve.

Mark only one oval.

	1	2	3	4	5	
Stro	◯	◯	◯	◯	◯	Strongly agree

6. I had fun solving the 'earth in the oven' puzzle

Mark only one oval.

	1	2	3	4	5	
Stro	◯	◯	◯	◯	◯	Strongly agree

7. The 'earth in the oven' puzzle encouraged teamwork

Mark only one oval.

	1	2	3	4	5	
Stro	◯	◯	◯	◯	◯	Strongly agree

8. During the first phase of the puzzle (The earth was not yet saved), I felt the following emotions:

Check all that apply.

- [ ] Fear
- [ ] Disgust
- [ ] Joy
- [ ] Gratitude
- [ ] Shame
- [ ] Amusement
- [ ] Compassion
- [ ] Anger
- [ ] Enjoyment
- [ ] Pride
- [ ] Anxiety
- [ ] Worried
- [ ] Contempt
- [ ] Sadness
- [ ] Happiness
- [ ] Excitement
- [ ] Suprise
- [ ] Confusion
- [ ] Calmness
- [ ] Hope
- [ ] Other: _____

9. During the second phase of the puzzle (The earth was saved by selecting the correct measures), I felt the following emotions:

Check all that apply.

- [ ] Fear
- [ ] Disgust
- [ ] Joy
- [ ] Gratitude
- [ ] Shame
- [ ] Amusement
- [ ] Compassion
- [ ] Anger
- [ ] Enjoyment
- [ ] Pride
- [ ] Anxiety
- [ ] Worried
- [ ] Contempt
- [ ] Sadness
- [ ] Happiness
- [ ] Excitement
- [ ] Suprise
- [ ] Confusion
- [ ] Calmness
- [ ] Hope
- [ ] Other: _____

10. what problems did you encounter while solving the 'earth in the oven' puzzle?

_____

_____

_____

_____

_____

11. What were the two most positive attributes of the 'earth in the oven' puzzle?

12. What are two attributes of the 'earth in oven' puzzle which can be improved?