

Towards a serious game for assessing civilians' self-reliance in a crisis

Bachelor Thesis for Creative Technology by

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18 July 2019

Acknowledgements

There are certain people that I specifically want to thank, as they have been more than helpful during this project.

First of all, I would like to express my deep gratitude to Dr. Mariët Theune, my graduation project supervisor, for her continuous guidance, support and incredibly useful feedback throughout the project. Her willingness to give me her time and attention has been very much appreciated.

Second, I would like to give my thanks to Dr. Job Zwiers, my critical observer, for taking the time to give me feedback on my thesis during the GP evaluation and read and grade my thesis.

Thirdly, I want to thank my client contacts: Ymko Attema for his feedback during the project and for getting me in contact with interesting people for the brainstorm and the evaluation, and Thomas de Groot for sharing his knowledge in the field of serious game design and for helping me get starting with the project with the first brainstorm.

Lastly, I would like to thank everyone who helped me out by participating in the scenario playtests, as well as in the evaluation tests of the prototype and all other people that have supported me during the project.

Abstract

While the safety regions in the Netherlands do everything they can to help as many people as possible in case of emergency, many of their decisions crisis management remain guesswork. Hence their quest for more information about the self-reliance of civilians in specific areas. Therefore, a prototype of a serious game has been developed, commissioned by Safety Region Twente, to assess the self-reliance of the players. To make sure the game is fun, aesthetics from the MDA framework are used. Aspects of self-reliance have been researched, as well as existing methods of measuring it, which did not result in any existing methods of measuring crisis-related self-reliance. Therefore, existing situations in which the most self-reliant option is known are used in a scenario, where the player must make decisions that serve as self-reliance indicators. This concept resulted in a Unity application with a part of the complete scenario that was created based on brainstorming with both the Safety Region and TXchange. An evaluation of this prototype showed that the serious game is indeed able to measure self-reliance and participants indicated they found the game to be fun in general. However, the participants also gave several points of improvement, that have been described in the recommendations. To continue this project, a team of professional game designers is needed to completely finish the game. Moreover, the game must be promoted in a way that can reach lots of people and as putting the game online costs money, a revenue model must be created. If all this has been achieved, the game can actually be used, after which Safety Region Twente can really learn from players' self-reliance.

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1. Introduction

This graduation project is conducted for the Veiligheidsregio Twente (VRT) and is aimed at finding a way of assessing self-reliance by use of a game. In this chapter, the current situation will be introduced, followed by the challenges that accompany this project. Subsequently, a statement of the research questions and sub-questions will be presented, after which an outline of the upcoming chapters is provided.

1.1 Current situation

The Netherlands is divided into twenty-five safety regions. These regions are areas in which multiple boards and services work together with respect to tasks in the fields of fire brigade, disaster management, crisis management, medical assistance and the maintenance of public order and safety. Veiligheidsregio Twente (VRT) is one of these regional organizations. The main focus point of this graduation project is the crisis management.

Crisis management comprises all the measures taken, and the provisions made by the government to ensure safety in the Netherlands. It takes place before, during and after a disaster. This implies that effective crisis management consists of three parts. Firstly, prevention of disasters and crises: identifying risks and making customized preparations. Secondly, fighting of the disaster or crisis: taking effective action during a disaster to confine the damage. Thirdly and lastly, recovering after the disaster or crisis: supporting the victims, aftercare and restoration of material damage.

The Netherlands is slowly changing from the many years of welfare state towards a so-called participation society, where it is expected of everyone who can, to take responsibility for their own lives and to be as self-reliant as one can be. Because of this, self-reliance, which is how well people are able to take care of themselves, has become an increasingly large part of crisis management. The problem, however, is there is not much known about how civilians can help themselves and others, or what they do in situations where it is needed from them to take care of their own safety. If this were clear for, and known by the VRT, they and the emergency services they cooperate with could receive great benefit from the aforementioned change in society. When civilians are able to judge risks, prepare for possible disaster scenarios and play an active role in crisis situations instead of being passive victims waiting for others to rescue them, the emergency services can better divide their manpower and assess the situation and the people in it. Once this information can be accessed and therefore assessed, the emergency services can incorporate this in their trainings to be even better prepared for the next crisis.

In order to gather useful data on how self-reliant people are from the civilians themselves, a serious game will be the tool of this graduation project. It is believed to be a tool which can reach out to a large proportion of the target group and is better able to persuade people into cooperating with the VRT than a simple questionnaire. This cooperation may in turn lead to a shared responsibility in crisis management and may therefore even indirectly give the people a role in the crisis management. The serious game will be made in collaboration with TXchange, which is a company specialised in the design and development of serious games. The goal of this project is to acquire useful data about the self-reliance of civilians through a serious game.

1.2 Challenges

The goal of the project comes hand-in-hand with some challenges. It is desired to be able to reach a group as large as possible, because having a large reach ensures a large amount of data. To reach a lot of people, the tool must be enjoyable to use. It may be challenging to find a way to make the game attractive enough for people to play it. Ideally, people want to play the game because it looks fun and interesting, and people also want to keep playing once they started, because they find the game engaging and intriguing.

In addition, for the serious game to be effective, the players must give honest answers, which is only in their hands. However, they might give different responses unconsciously, where the users believes they give an honest response to a given scenario, while in reality, they would act completely

different. Thus, the challenge here, is to develop the game in such a way, that people genuinely want to answer or respond honestly, and not only respond in a socially desirable way.

1.3 Research Questions

To better research and specify the aforementioned challenges, a research question has been formulated. The research question and its sub-questions are focused on getting a deeper understanding of how self-reliance can be measured with a serious game.

- RQ: How can a serious game be developed that provides insight into the self-reliance of residents of Twente in a crisis?
 - SQ1.1: What is self-reliance?
 - SQ1.2: How can self-reliance be measured in a game?
 - SQ1.3: What are elements of (serious) games that make them fun and enjoyable?
 - SQ1.4: How can the gathering of respondent information about self-reliance through a serious game be made fun and enjoyable?
 - SQ1.5: How can a serious game be designed in such a way that only honest responses are given by its users to portrayed scenarios?
 - SQ1.6: How can crisis scenarios be implemented into a serious game?

1.4 Outline of Report Structure

In this paragraph, the structure of the report will be explained. Chapter 1 focused on what this project is about and what the challenges and questions are within the project. The next chapters will answer the research questions stated in section 1.3.

Chapter 2 focuses on the State-of-the-Art review on research and applications related to the subjects of this graduation project: self-reliance and (serious) games. The goal of this chapter is to find out what related studies have been conducted already and how similar applications can be utilized to better design the tool, the serious game, developed in this project. At the end of this chapter, SQ1.1-1.4 will be answered.

Chapter 3 discusses the concept of the game. This includes what options there are when creating a (serious) game and the decisions made during the concept phase of the project. Based on the narrative structure, player motivation, setting, the target customer, and more, the requirements will be stated and the needed assets for the game engine are listed. SQ1.5 will be discussed here, as well as SQ1.6.

Chapter 4 is about implementing the concept in Unity, the chosen game engine for this project. The scope of the implementation, the data processing and other aspects of the development will be described in this chapter.

Chapter 5 discusses the evaluation and its results. Next, the requirements are discussed, including whether they have been met and how they must be changed for future work according to the evaluation results.

Chapter 6 contains the conclusion, in which the research questions will be discussed, i.e. in what way they have been answered throughout the project. The chapter concludes with a section discussing recommendations for future work.

After chapter 6, a list of references used in this thesis will follow, after which the appendices will fill the last pages of this paper.

2. State of the Art on Self-Reliance and Serious Games

In this chapter, background research will be presented as to deepen the understanding of the research area this graduation project is focused on. First, the definition and general meaning of self-reliance will be examined, after which the current methods of measuring self-reliance will be explored. Secondly, the interesting and fun aspects of (serious) games will be explored. Subsequently, similar existing (serious) games will be reported. Throughout this chapter, SQ1.1-SQ1.3 will be answered.

2.1 Self-Reliance

The background research is meant to get a deeper understanding about the subject. For this, definitions will be examined, and after these have been established, further research into measuring self-reliance will be disclosed. In this section, SQ1.1 and SQ1.2 will be answered.

2.1.1 Background research

In the previous chapter of this paper, the subject of the project's serious game is mainly referred to as self-reliance, which is the translation of the Dutch word "zelfredzaamheid". However, international papers often use the term "community resilience", or just "resilience". The terms are very similar, but there are definitely some differences.

Self-reliance

A first way of looking at self-reliance is from The First Dutch Systematic Organized Encyclopaedia (abbreviated to E.N.S.I.E. in Dutch), who define self-reliance as someone's ability to take care of themselves, solve problems and go through life independently (Ensie, 2013). Adding to this definition is the vision of Veiligheidsregio Twente (VRT, 2015) or Safety Region Twente, who are mainly interested in self-reliance in relation to disaster scenarios. According to them, self-reliance comprises the capacities and actions of residents to help themselves and others in preparation for, during and after an incident or crisis, facilitated by the government if possible and necessary.

Helsloot and Van 't Padje (2011) went into more detail about what self-reliance means for a community. They revealed six concepts of self-reliance:

- C1. Self-reliance as a way and as goal for a safer society.*
- C2. Self-reliance as protest power.* (being able to protest for what you find important)
- C3. Self-reliance as shift of responsibilities.* (more responsibility for civilians)
- C4. Self-reliance as emergency connection for professional crisis management.*
- C5. Self-reliance as threat for professionals and civilians.* (less work for professionals, more responsibility for civilians)
- C6. Self-reliance as policy plan.* (incorporate self-reliance of civilians in policy plans)

These concepts are each a different view of what it means if self-reliance is incorporated in the crisis management approach of the VRT and other safety regions. However, the concepts are related to each other. To the VRT, a safer society (C1) is the goal, which can be reached by incorporating an emergency connection (C4) into the policy plans (C6). To establish the policy plans, the influences of crisis-related self-reliance on responsibilities of professionals and civilians (C3 and C5) need to be considered. A relatively small part of civilians depends on the government for their safety and care. The VRT will always have to take a target group into account that may not have the ability to perform the correct actions to keep themselves safe in the event of an incident. This inability could be caused by, for example, a visual or physical impairment, linguistic problems, a mental disability, a young or old age, or the lack of a social network. These "lesser-self-reliant" individuals will be taken into account in the development of the serious game, mainly for data processing purposes, as their previously mentioned

causes are indicators for their level of self-reliance, but highly dependent on the person. In other words, age and disability should be data the game gathers to see whether, and how much, a person is self-reliant.

Community Resilience

Just like self-reliance, the term “resilience” is often associated with the ability to take care of oneself. However, there are slight differences. In like manner as the definitions of self-reliance, Rapaport et al. (2018) formulated a definition for the term community resilience, being “the community’s ability to utilize its current resources in order to adapt to an adversity or sudden disturbance, and eventually to be able to absorb the disturbance, get back to routine, and even perform better in comparison with the pre-disturbance situation” (p. 471). A second definition of resilience, which is very much in line with the first definition, is “the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events” (Sharifi, 2016, p. 631). A third, comparable definition comes from the United Nations (UNISDR, 2012, p. 3): “Resilience is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner including through the preservation and restoration of its essential basic structures and functions”. In similar fashion, a fourth definition Cohen, Leykin, Lahad, Goldberg, and Aharonson-Daniel (2013) have for community resilience is the community’s ability to maintain functionality amidst disruptions.

A rather different view on resilience comes from Rus, Kilar, and Koren (2018), who found two dominant theoretical perspectives in their literature research. It was found that the phenomenon can be both result-oriented and process-oriented. In the prior view of the term, resilience is seen as the “bouncing back to the same [stable] condition [as] before an adverse event” (p. 324), whereas in the latter, resilience is more adaptive, and comprises “how to respond to, recover from, and adapt to new conditions” (p. 324). Hence, resilience can be viewed as static, i.e. before, during, *or* after an incident, but also as dynamic, where it comprises all three of those aspects.

Differences Between Self-Reliance and Community Resilience

The difference between self-reliance and resilience lies in for who it is applicable, as can be seen in Table 1. As Bohland, Harrauld, and Brosnan (2018) stated, self-reliance is mostly a term used in the Netherlands, whereas in most studies from other countries, the term resilience is used. They argue that self-reliance (“zelfredzaamheid”, as the Dutch call it) is a capacity of citizens, and “is not based on the more comprehensive and fundamental approach as presently promoted through the concept of resilience” (p. 144). Thus, self-reliance is of the individual, and resilience of the collective. Resilience, however, is not a combination of everyone’s self-reliance, because it also contains things that are not properties of an individual, such as facilities for shelter in an area. Hence, a person can be self-reliant, and a community can be resilient.

	Self-Reliance	Resilience
What?	The preparedness for a crisis, the ability to help themselves and others during a crisis, and the ability to recover from a crisis.	The ability to utilize current resources in order to adapt to an adversity or sudden disturbance, and to be able to absorb the disturbance and get back to routine.
Who?	Individuals	Communities
When?	Before, during and after an incident	Before, during and after an incident
Operating size	Micro	Macro
Post-incident situation	Same as before	Same as or better than before

Table 1. Comparison of the terms self-reliance and resilience.

Conclusion

Throughout this section, different definitions and views on self-reliance and resilience have been discussed. It can be said that the phenomenon the VRT call self-reliance (as directly translated from the Dutch “zelfredzaamheid”), is but a part of the internationally more widely known term resilience. The terms differ in their appliance; where self-reliance is something an individual can have, resilience is something of a community, where impersonal properties are also considered. In this paper, the name and definition of the VRT will be used. In other words, self-reliance will be the term used in this paper, with the following definition: “the capacities and actions of residents to help themselves and others in preparation for, during and after an incident or crisis, facilitated by the government if possible and necessary”. As this project aims to gain knowledge about the (individual) behaviour of civilians in a crisis, self-reliance is the appropriate term to use here. However, this does not mean resilience will be completely neglected from now on. Self-reliance has similar properties as resilience, which is why resilience will be taken into account in the next steps of the project.

2.1.2 Methods of Collecting Self-Reliance/Resilience Data

As self-reliance and resilience are rather new fields of study, not many measurement tools have been developed for them. The ones that have been found will be discussed here in two separate sections for the two terms. The section concludes with the answer to SQ1.2.

2.1.2.1 Resilience Measurement

Measuring resilience is currently done in a few ways. One of the first disaster resilience indices is the Baseline Resilience Indicator for Communities, or BRIC (Cutter, Burton, & Emrich, 2010). Cutter et al. examined 36 resilience-indicating variables throughout the southeast of the United States and compared their values with each other, so they could determine the level of resilience of the different communities. Their variables include elements associated to social connections, the economy, institutions (i.e. police and fire department), infrastructure, and communities. Variables that may be of interest for this project can be found in table 2. In the table, percentages are used. However, as this project is focused on measuring self-reliance, the variables could be used as inspiration for questions for individuals (taking out the percentage). For example, the *transportation access* category can be inspiration for questions like: “do you have access to a car?” and “how will you go to work in stormy weather?”

Category	Variable	Effect on Resilience
Social Resilience		
Age	Percent non-elderly population	Positive
Transportation access	Percent population with a vehicle	Positive
Communication capacity	Percent population with a telephone	Positive
Special needs	Percent population without a sensory, physical, or mental disability	Positive

Table 2. Selection of variables from Appendix A1 that are perceived as measurable by individuals.

Jordan and Javernick-Will (2012) went a different way and studied research articles with perspectives of engineers, social scientists, practitioners and economists. They classified the indicators of community resilience into four categories: infrastructure, economic, institutional, and social. A qualitative coding program, QSR NVivo, into which they imported all journal articles, allowed the researchers to manage and query the data. By querying the articles, they found what terms were used the most in articles concerning resilience. The terms that are interesting for self-reliance are listed in table 3.

Term	Possible in-game usage/measure:
Emergency preparedness	Level of preparedness for an emergency
Recovery planning	The things planned after a crisis
Previous [crisis] experience	Level of experience with crises
Age distributions	Age of the person
Attachment to place	Ease of leaving a place
Gender	Gender
Disabled	Disabled in any way
Health services	Access to health services
No vehicles	Access to a vehicle
Non-English speakers	Non-Dutch speakers in this case
Social networks	Size of social network
Access to information	Access to information

Table 3. Search terms used by Jordan and Javernick-Will (2012) with usable elements for in the serious game.

Where Cutter et al. and Jordan and Javernick-Will respectively used data banks and research articles, Cohen, Leykin, Lahad, Goldberg, and Aharonson-Daniel applied empirical research to measure resilience. Their tool, called the Conjoint Community Resilience Assessment Measure, or CCRAM, consists of two tools: a survey and a checklist. The survey covers a multitude of resilience indicators, demographic details and information about experience of the respondent (individual information). The checklist is used to collect objective information about infrastructure and local and municipal service accessibility (location information). The survey (see Appendix A2) consisted of statements, on which the participants had to respond how much they agreed with the statement on a 5-point Likert scale. Thirty-one statements were related to one of the following six domains: leadership, collective efficacy, preparedness, place attachment, social trust and social relationship. The statements in table 4 are interesting for the serious game, as they are either related to individuals or their social connections, which is related to self-reliance as well.

Q. Nr.	Statement
2	I can rely on people in my town to come to my assistance in a crisis.
8	Officials in my town routinely demonstrate leadership ability.
16	The relations between the various groups in my town are good.
17	There is trust among the residents of my town.
18	In my town, there are sufficient public protection facilities (such as shelters).
28	The residents of my town will continue to receive municipal services during an emergency situation.
29	The health services in my town will continue to function properly in an emergency situation.
31	I trust the information which is provided to me by the authorities.
32	I remain in my town for ideological reasons.
33	In an emergency situation I intend to leave the town where I live.
35	When I feel the need, I usually consult with people from my town.
36	Many of my neighbours are my friends.
40	My personal level of resilience is high.

Table 4. Statements from Appendix A2 which can be useful for the serious game (Cohen et al., 2013).

Another empirical research method, used by Keating et al. (2017), was solely focused on flood resilience. Their framework and tool is called the Flood Resilience Measurement for Communities (FRMC), in which they compare characteristics of communities before floods to the outcomes of those floods as a way to “empirically verify sources of resilience” (p. 77). The forty-four indicators they found were divided into five categories: Human, Social, Physical, Natural and Financial. The indicators were also scored on properties of a resilient system: “robustness (ability to withstand a shock), redundancy (functional diversity), resourcefulness (ability to mobilize when threatened), and rapidity (ability to contain losses and recover in a timely manner)” (ZFRA, 2019, p. 3). The data is collected with surveys,

interviews, focus group discussions and secondary sources by use of a mobile app. After this, the sources receive a grade between A and D (A being best practice, D being poor).

This method is quite extensive as compared to the other methods mentioned earlier, as this method categorises each variable into two categories (capitals and properties) instead of one and collects the data in four ways instead of in just one or two ways. The abilities that describe the properties of a resilient system can also be applied to individuals. “Is the player able to mobilize when threatened?” is a question that could be answered in the game, accompanied by sub-questions about vehicle access, physical disability, and other factors that could inhibit the player from quickly mobilizing.

2.1.2.2 Self-Reliance Measurement

Self-reliance, as compared to resilience, seems to be the lesser-researched subject of the two. Most self-reliance assessments are based on professional judgements of people working in the healthcare sector. A first example of this is the Self-Sufficiency Matrix (Lauriks et al., 2017), which is developed for social workers to be able to score the self-reliance of their patients according to eleven fundamental domains of life: finance, daytime activities, domestic relations, housing, mental health, physical health, addiction, daily life activities, social network, community participation, and judicial matters. The professional scores each domain using a 5-point Likert-scale. Each level of each domain contains indicators of that specific level of self-reliance in that specific domain, so the social worker knows how to score their patient. For example, an indication for self-reliance in the domain of *social network* on level 4-adequately self-reliant is *sufficient amount of supportive contacts*.

The matrix includes all sorts of personal factors that indicate the level of self-reliance. However, for the serious game in this project, not much of it can be used. The Self-Reliance Matrix works with facts about a person’s life, not with how people respond to certain situations. It is, however, a useful indication of how they measure self-reliance.

While Lauriks et al. use a matrix, Van Loven en Partners (2014) use a monitor, not only for self-reliance, but also for participation. The measuring tool, called the Monitor for Self-Reliance and Participation (Monitor voor Zelfredzaamheid en Participatie (MvZP)), comprises a set of questions that relate to nine areas of life: physical functioning, psychosocial functioning, self-care, household and living, social network, daily activities and participation, finance and administration, purpose and work and education. A professional in the care sector fills in the answers to the questions, from which they can draw their conclusion about the self-reliance of the patient. Unfortunately, as the list of questions cannot be accessed without being a customer of Van Loven en Partners, the specific questions that are used in the monitor are unknown. However, it is good to know on what domains the monitor differs from the matrix to get a better understanding of what aspects self-reliance entails.

A more visual approach is taken by the *Zelfredzaamheidsradar*, or Radar of Self-Reliance, which visualizes the client’s self-reliance on a radar with a scale of one to five in fifteen domains: learning ability, eating and drinking, continence, posture, mobility, day and night rhythm, (un)dressing, body temperature, hygiene, safety, communication, contact with others, sense of norm, daily activities, and recreation in play (see figure 1). If the client scores lower than normal, the professional in the care sector and their client will search for improvements in the area of concern. How they will do this depends on the client and in what domain of self-reliance the client scores lower than usual.

In like manner as the self-reliance radar, monitor, and matrix, the *zelfredzaamheidsmeter* (self-reliance meter) also uses a division of domains of life: daytime activities, living situation, physical functioning, psychic functioning, cognitive functioning, household, activities of daily living, social network, mobility, and financial situation. Each domain receives a score of one to four on the level of self-reliance. Next to that, each domain is also scored on dependence, on a scale of one to three.

2.1.3 Conclusion

The first half of this section (2.1) contained the background research; the difference between self-reliance and resilience has been revealed, and the definition of self-reliance has been confirmed to be “the capacities and actions of residents to help themselves and others in preparation for, during and after an incident or crisis, facilitated by the government if possible and necessary”. The second part aimed at researching existing methods of measuring self-reliance and resilience. The methods that were found were either for resilience or for general self-reliance. In other words, no existing methods have been found for the measurement of self-reliance in relation to a crisis. What can be used are some of the domains of resilience and self-reliance found in the different methods, as some of them seem to be applicable to crisis-related self-reliance, such as people’s social connections. A comparison of the domains of the different self-reliance measurement methods can be seen in table 5, wherein the grey domains are thought to be relevant for crisis-related self-reliance. The methods found in this state-of-the-art research were either survey-based, or based on existing data from a national source, so nothing close to measurement with a serious game.

	Self-reliance Matrix	Self-reliance Monitor	Self-reliance Radar	Self-reliance Meter
Learning ability			X	
Eating and drinking			X	
Continence			X	
Posture			X	
Mobility			X	X
Day and night rhythm			X	
(Un)Dressing			X	
Body Temperature			X	
Hygiene			X	
Safety			X	
Communication			X	
Social contact	X	X	X	X
Sense of norm			X	
Daily activities	X	X	X	X
Recreation and play			X	
Finances	X	X		X
Housing	X	X		X
Domestic relations	X	X		
Mental health	X	X		X
Physical health	X	X		X
Addiction	X			
Community participation	X	X		
Judicial matters	X			
Cognitive functioning		X		X
Self-care		X		

Table 5. Comparison of domains used by four self-reliance measuring tools. Grey domains are thought to be relevant to crisis-related self-reliance.

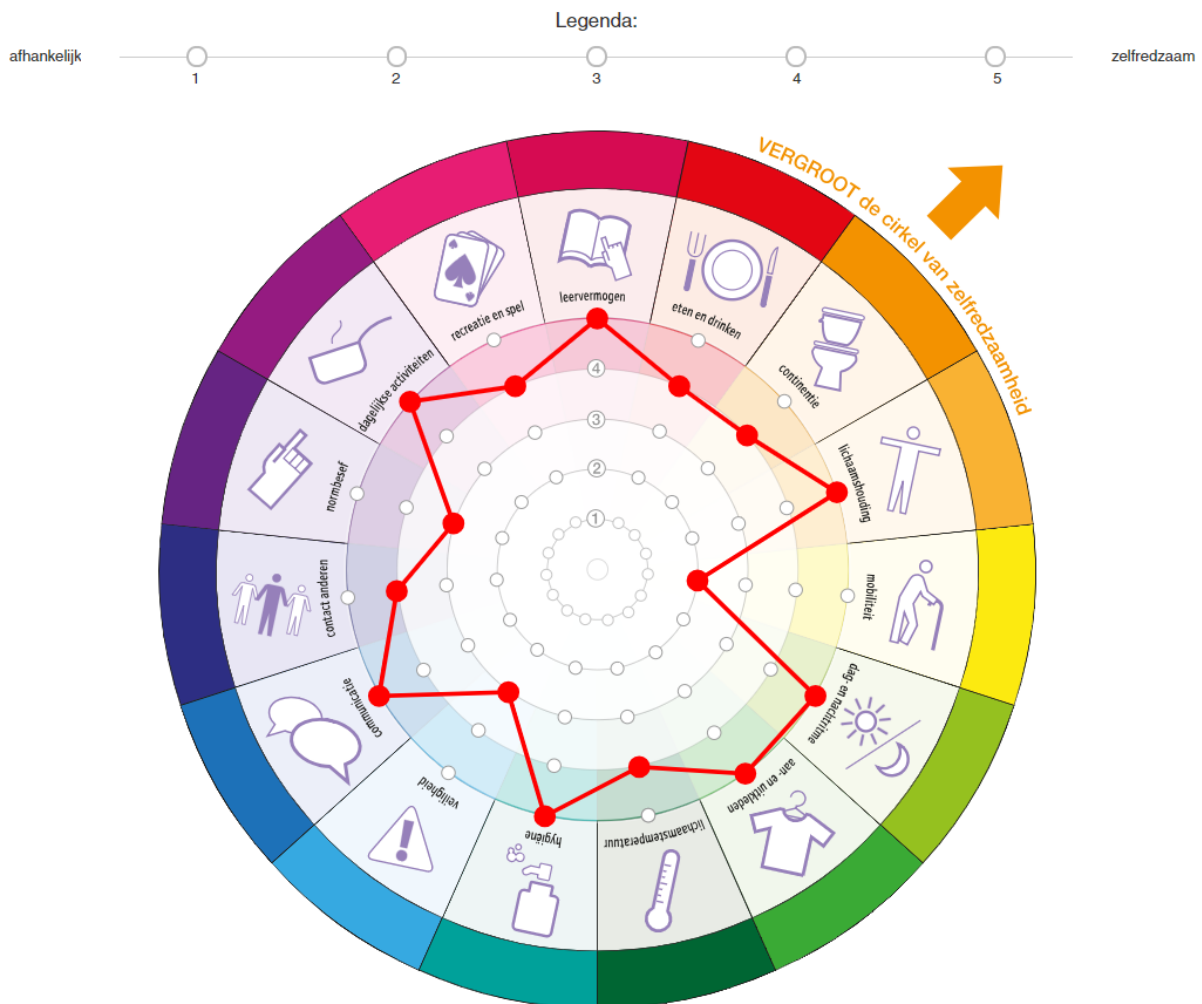


Figure 1. An example of the Radar of Self-Reliance. Translated to English, clockwise starting from the top: learning ability, eating and drinking, continence, posture, mobility, day and night rhythm, (un)dressing, body temperature, hygiene, safety, communication, contact with others, sense of norm, daily activities, and recreation in play.

2.2 (Serious) Games

The background research in serious games is meant to get a deeper understanding into how to look at games from a developer's perspective and how to make games fun. Once the background knowledge has been established, existing, related games and serious games will be examined. In this section, SQ1.3 will be answered.

2.2.1 Game Enjoyment

In this section, aspects of (serious) games will be examined. Game mechanics, dynamics and aesthetics will be discussed to get a better idea of how games work.

The MDA Framework

The MDA Framework, developed by Hunicke, Leblanc, and Zubek (2004), is a formal approach to understanding games and stands for Mechanics, Dynamics, and Aesthetics. Mechanics consist of dynamic system behaviour, which in turn consist of aesthetic experiences. The framework is meant to "clarify and strengthen the iterative processes of developers, scholars and researchers alike, making it

easier for all parties to decompose, study and design a broad class of game designs and game artefacts” (p. 1), which indicates it could be a good way of developing a serious game.

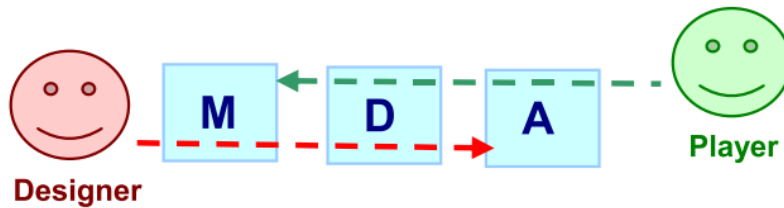


Figure 2. Visualization of how the perspective of designer and player of the MDA framework differ (Hunicke et al., 2004).

In the perspective of the designer, mechanics are made out of different dynamics, which in turn causes an aesthetic experience for the player. On the contrary, the player perspective starts at the aesthetics, which set the tone of the game. The aesthetics are made of observable dynamics, which in turn are made up from operable mechanics (see figure 2). The three parts of the framework are discussed below. For explaining purposes, the MDA model will be described in the order of the player’s perspective: aesthetics first, then dynamics, then mechanics.

Aesthetics

Hunicke et al. (2004) wanted a more directed vocabulary, away from words like “fun” and “gameplay”. The taxonomy they used includes, but is not limited to, the vocabulary that can be seen in table 6. A game can cause multiple aesthetic experiences. For example, The Sims creates the player experiences of *Fantasy*, *Discovery*, *Expression*, and *Narrative* and Call of Duty creates *Competition*, *Challenge*, and *Sensation*. According to the developers of the framework, the taxonomy helps in describing games and shedding light on what causes games to be appealing to players.

Of the types of aesthetic experiences shown in table 6, the following are most relevant for the serious game of this project: *Narrative*, as the game could follow a certain crisis scenario to make the player experience what it is like in a crisis. This experience is also *Sensation*, because the game-world could be pleasing to eye or ear. *Expression* can also be relevant, as the players can associate themselves with the game character going through the crisis scenario. *Challenge* might be interested in a scenario where difficult choices must be made.

Aesthetic Experience	Definition
Sensation	Game as sense-pleasure
Fantasy	Game as make-believe
Narrative	Game as drama
Challenge	Game as obstacle course
Fellowship	Game as social framework
Discovery	Game as uncharted territory
Expression	Game as self-discovery
Submission	Game as pastime
Competition	Game as power-measure

Table 6. Taxonomy of Fun according to the MDA framework, with grey aesthetics being most relevant.

Dynamics

To create these aesthetic experiences, dynamics are needed. For example, in order to provide a *challenge*, time pressure can be added to a decision-making dynamic. In like manner, sharing information with other players can be a dynamic in support of the aesthetic *fellowship*, and the ability to personalize a character can be good for *expression*.

Mechanics

The *mechanics* are a game’s most basic features. Mechanics include everything that can affect the play of the game: every action the player can take (for example: running, shooting, and jumping), rules, resources, environments, algorithms, etc. Mechanics can interact with each other through their dynamics. For example, when a player presses the button to shoot their gun (a mechanic), a bullet is fired from the gun, the gun gets a kickback, the number of bullets decreases, etc. The bullet hits another player,

and the bullet caused enough damage to decrease the health points of the other player to zero (all separate dynamics). The player dies (mechanic).

The 6-11 Framework

While the MDA framework uses nine different kinds of fun to provide a high level description of why players find a game appealing, the 6-11 framework (Dillon, 2011), which is contextualized in the MDA model, provides a taxonomy for game aesthetics based on six emotions and eleven instincts. The six emotions used are fear, anger, joy/happiness, pride, sadness and excitement. The eleven core instincts taken into consideration are survival, self-identification, collecting, greed, protection/care/nurture, aggressiveness, revenge, competition, communication, exploration/curiosity, and colour appreciation. These emotions and instincts continuously interact with each other in the game to eventually build a sequence that should end with excitement or joy to provide players with a fun and meaningful experience. “This network can then be related to game dynamics by realizing that, when different emotions are naturally aroused in the player by the game, these will trigger different instincts. These instincts, in turn, will force the player to act in the game, ultimately showing how the whole aesthetics can be linked to actual gameplay” (p. 3). Figure 3 shows an example of how the different instincts and emotions can work together in a game. This might be a good example of how the story of the serious game of this project can be developed. Causing the player to feel certain emotions might be a good way to make the players respond honestly (see SQL.5).

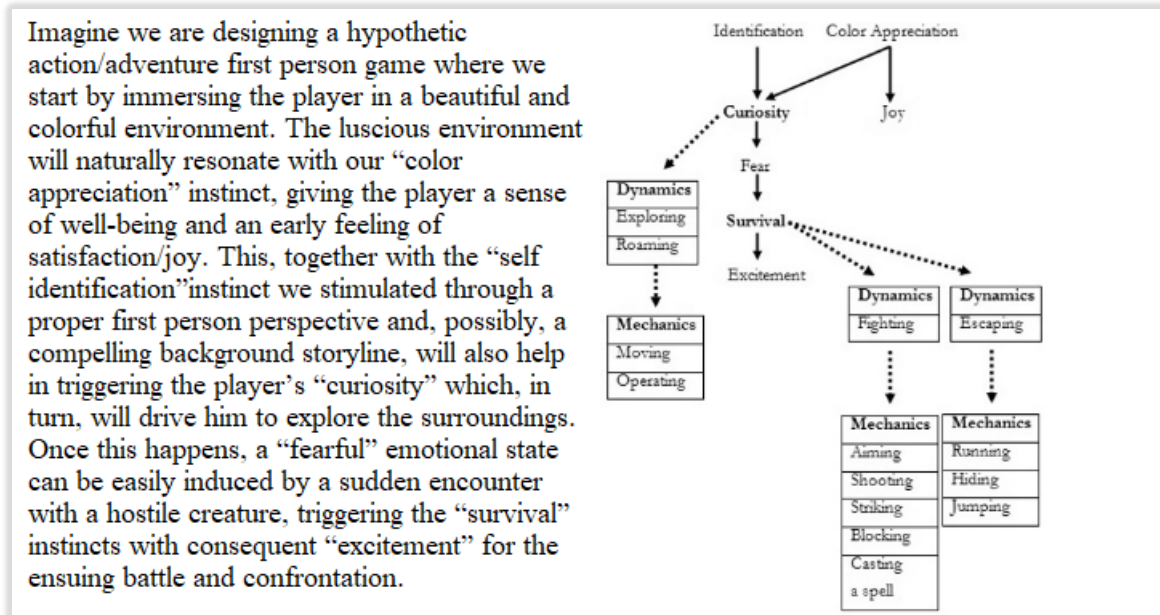


Figure 3. Example of the use of the 6-11 framework (Dillon, 2011, p. 3).

2.2.2 Player Engagement

The players need to be motivated to play the game. Schoenau-Fog and Henrik (2014) state that “a player could be motivated to begin playing due to boredom, but it is not until the player becomes excited and wants to continue playing that engagement is experienced” (p. 4). So, to achieve player engagement, the player must get excited and must have some sort of motivation to want to continue playing. Schoenau-Fog and Henrik developed the OA3 framework for this purpose. OA3 stands for Objectives, Activities, Accomplishments and Affect, which work together as follows. At the beginning of a game, the game usually sets up an objective, or the player makes up a self-defined objective (e.g. explore the complete map). Subsequently, the player performs certain activities to accomplish this objective, which affects the player’s emotions and experience. If this affect is perceived as positive, then player engagement can be sustained.

Another view on player engagement comes from Lankoski (2011), who argues that engagement depends on two processes: *goal-related* and *empathic engagement*. The former is similar to Schoenau-Fog and Henrik's view on player engagement and looks at goals and affects and focuses on aspects that relate to playable characters. The player acts to reach the goal. The latter consists of the concepts of *recognition*, *alignment* and *allegiance*. Recognition is described as "a viewer's construction of a character, including the interpretation of the personality of the character" (Lankoski, 2011, p. 300). In other words, how the player perceives the character. With alignment, the process of how events and information unfold within the sequence of play is meant. This is divided into two structures: one where the player is only given information about what the player thinks, feels and sees (detective structure), and another where the player knows more about characters than any single character knows themselves (melodramatic structure). The last concept of empathic engagement, allegiance, is connected to the moral and aesthetic evaluation of characters: the player must evaluate whether the playable character has a morally preferable set of traits than other characters in the game.

2.2.3 State-of-the-Art Research On (Serious) Games

Research on similar game applications is conducted with the purpose of learning from existing practice in the field of game design. This section shows the existing games that are similar to the serious game to be developed during this project, in what way they are similar, what can be learned from them and how this serious game will be different.

Railway Safety Game

For her master's thesis, Jong-Kamphuis (2016) developed a serious game about railway safety. More specifically, the research had the objective of examining whether the self-reliance regarding railway transport of hazardous substances could be positively affected by a serious game. The project was, just like this project, a collaboration with the VRT and TXchange. In the game, the player passes through a railway safety themed scenario, in which they are confronted by nine dilemmas they have to solve within a maximum of twenty-five minutes (see figure 4). The focus of the game lies with the practice of recognizing, assessing and acting in case of emergency. The players can gather information or advice from people involved, passers-by, a telephone and social media, which the player can use to make his/her decision. At the end of the game, the players can get feedback on the choices they made, with the purpose of explaining why certain choices are wise or not.

This game is similar, as it also focuses on people's self-reliance. The game discussed here is a decision-based game, which the game developed during this project will also highly likely be due to its potential in getting answers to the questions the VRT has about self-reliance in specific crisis scenarios. However, this railway safety game aims at improving the player's knowledge about self-reliance, whereas the game in this project has the main goal of gaining knowledge about the player's self-reliance. The railway safety game is also quite static in its appearance, whereas the self-reliance game aims to be more dynamic and to be more engaging to the player through visual effects and sound effects (VFX and SFX, respectively).

Next to this game about railway safety with hazardous substances, TXchange (n.d.) has made numerous other games based on the same approach. They call this approach the "Dilemma Games", in which, as the name states, dilemmas are given to the player in different scenarios depending on the company the game is developed for. The game is then used to improve knowledge and skills of the employee playing the game, which is, as previously stated, a different goal than this project's goal.

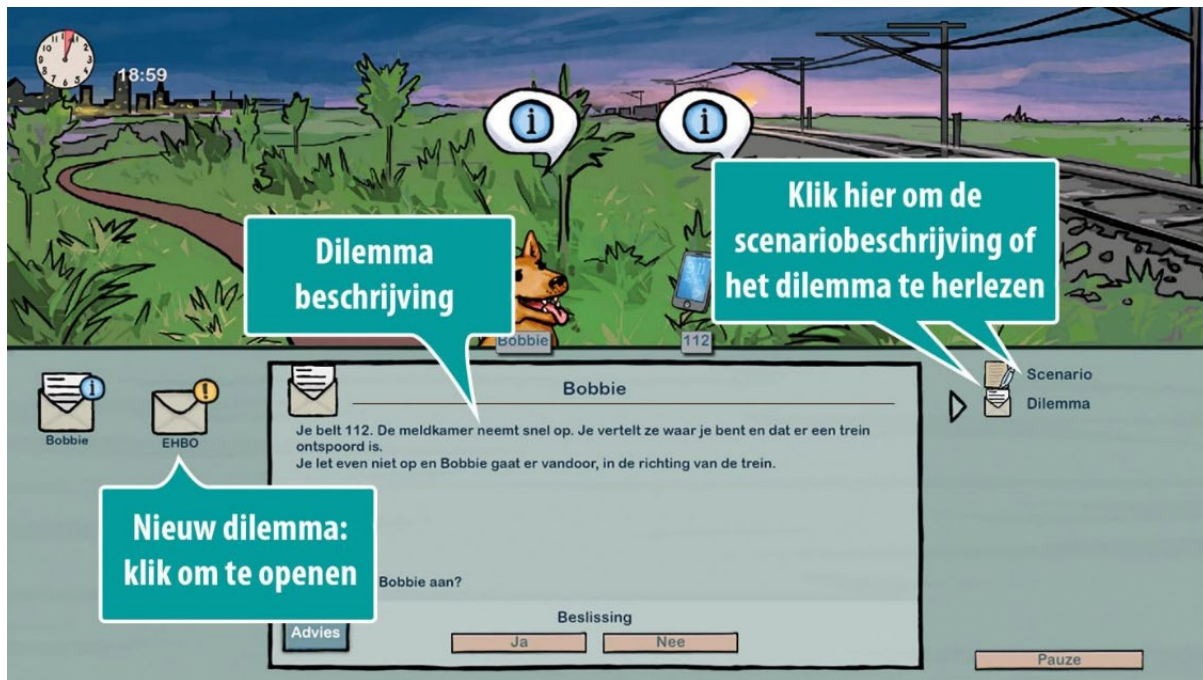


Figure 4. Screenshot of the game by Jong-Kamphuis (2016) in collaboration with TXchange and Veiligheidsregio Twente.

Tipping the Scales: The Resilience Game

The Center on the Developing Child at Harvard University developed a serious game focusing on “how the choices we make can help children and the community as a whole become more resilient in the face of serious challenges” (Harvard, 2019). The game aims at how the community must counteract negative events, such as crime waves and job losses, after they occur. Figure 5 contains an image of the gameplay. The player starts with 20 ‘resilience bucks’, i.e. points to spend on counteractions. The game lets negative events occur, and the player must choose which counteraction is the best choice in solving the problem. The children in the game all have scales, which, according to the player’s actions, are either tipping to the negative side, or the positive side. Each choice the player makes affects the children’s scales.

This game about resilience is a similar game to this project’s game, as it is a decision-based game, with a topic related to resilience. However, the purpose of Tipping the Scales is not to measure self-reliance of an individual (as is the purpose of the game of this project), but rather to teach people how to overcome setbacks, and therefore teaching resilience. Tipping the Scales focuses on children, whereas this project will focus on adults.

The game uses in-game money the player can use to “buy” counteractions. A version of this can be used in this project, in order to let the player feel pressured to make choices. In real life, you can’t do or choose everything you want either. Some sort of point system can help in achieving this need for choice. Next to the currency, the white circles (as seen in figure 5) are also interesting for this project, as a version of this can be used as choice option or as way point in the scenario of the game. For example, if there is an option to close the window or leave it open, a clickable circle can be placed near the window for closing it, and another circle can be placed somewhere to continue the story.



Figure 5. Gameplay of *Tipping the Scales: The Resilience Game*.

Flood Resilience Game

The Flood Resilience Game is an educational game about the flood risks and resilience of communities in river valleys. It is a board game, designed to help identify new strategies of improving flood resilience. In the multiplayer game, players interact with each other, and each player represents a different kind of citizen, such as farmers or entrepreneurs. The game has been designed in alignment with the Flood Resilience Measurement for Communities (ZFRA, 2019), which has been discussed in section 2.3.1.

While the goal of this project's game is to gain knowledge about people's self-reliance, the goal of the Flood Resilience Game is to gain knowledge about improvement strategies of flood resilience. It is a comparable purpose, however, not much of the game can be used in this project, as the resilience they focus on is different and the type of game is different. The Flood Resilience Game provides an insight into the different applications of serious games, as it is a board game. However, the self-reliance game will not be a board game, but rather a digital game.

Life Is Strange

Life Is Strange is what is called an "episodic graphic adventure game", which means the game consists of multiple episodes of the story, just like a tv-series. It is a 3D game from a third-person point of view, where you can walk around and examine and interact with objects related to different quests. The player can make decisions in several parts of the game, such as the one shown in figure 6. These choices have impact on the near-future, but also on the distant future. However, at any point in the game, the player can rewind time up to a certain point, causing the player to be able to redo their previous action(s).

This game is similar, because the story is based on the player's decision. This can be used in the serious game, as it can be a good way to concretely measure the opinion or choice of the player. The game slows down time when a choice needs to be made, which is also a useful way of giving the player a fixed time frame in which they must act. As people in real life don't always have all the time in the world to respond, this can be a nice way of recreating that time pressure.



Figure 6. Screenshot from *Life Is Strange* with a moment of choice (Ledger, 2016).

Until Dawn

The survival horror adventure game *Until Dawn* is designed to be played several times. Because the player makes choices in the game that affect the future of the story, the player cannot see all the game's content in a single playthrough. Any choice the player makes can cause unforeseen consequences later in the game. The mechanics and the script of the game make it possible to have all eight characters survive, but also to have all of them die. The player can walk around the game world, just like in *Life Is Strange*. They can interact with objects and the environment, which are all actions that influence upcoming events. An example of one of the choices the player can make in *Until Dawn* is shown in the screenshot in figure 7.

Until Dawn and *Life Is Strange* are very much alike. Just as in *Life Is Strange*, the player can walk around in the game world while making choices. *Until Dawn*, however, always has just two choices. These choices have a limited time, displayed as a circle above the choices the player can make. This way of showing time pressure can also be used as inspiration for time pressure in the serious game of this project.

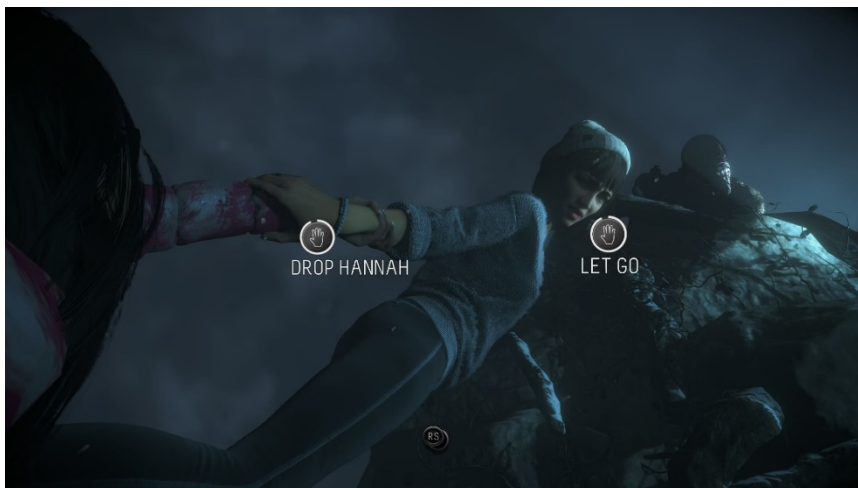


Figure 7. Screenshot of a moment of choice in *Until Dawn* (Sharmlock, 2018).

2.2.4 Conclusion

Games have been investigated on how they work and what the process is of designing a game. This section has explained the MDA framework, and the 6-11 framework, the latter being an adaptation of the MDA framework. After this, similar game applications were investigated. These games were decision-based games, and/or had the topic of self-reliance or resilience but were always focused on something other than the gathering of self-reliance in a crisis. As there has not been found an application that

has the same objective as this project, it can be concluded that the project of this thesis is novel. This research brought up games that are comparable but were always different from the game that this project will form.

2.3 Concluding Remarks

As stated, the goal of the game is to assess the level of self-reliance of the civil players. To do this, the challenge of making the game fun has to be overcome, which can be done with either the MDA framework, or the 6-11 framework. For now, it seems that the 6-11 framework suits this project the best, as this framework is related to emotions to a greater extent than the MDA framework. This connection with emotions can come in handy when designing the game, because if we can play with the emotions of the player, the player might feel more intrigued by and more engaged to the game. This can also be helpful regarding the other challenge that was raised, which was the challenge of gathering honest responses or answers within the game. The main reason for this is that by engaging the player with the story of the game, the player might be more likely to answer as they would in the real situation. All this can also be achieved with the MDA framework, but for now, the 6-11 framework is thought to be more convenient for the purpose of this game.

3. Game Concept

The goal of the conceptualization phase is to develop an idea for the application of the serious game, and to consider the options to eventually come up with a concrete idea that can be further developed in the realization phase (chapter 4).

3.1 Brainstorms

During the conceptualization phase, two brainstorms have been performed: one with TXchange, going deeper into the serious game aspects of the project, and one with the VRT, discussing scenarios where self-reliance plays a part. In these brainstorms, four specific rules were followed (Hender & Dean, 2001):

1. No criticism is allowed.
2. The more ideas, the better.
3. Unconventional ways of thinking are welcome.
4. Combine and build on existing ideas where possible.

3.1.1 TXchange Brainstorm

The aim of the meeting with TXchange was mainly to find out in what way they could help during the project. However, it turned out to be an unprepared free-form brainstorm about all the possibilities there are with serious games. TXchange came with questions regarding things that weren't thought of before, which gave new insights into the development of a game. All the questions and ideas were put in a mind map afterwards, as a summary of the brainstorm, which can be seen in Appendix D. The main insights gained from the brainstorm are listed below:

- The game will be in a 3D-environment viewed from the side (2.5D side-scroller), as this is thought to be the most feasible in the timeframe of this project and with the previous knowledge of 3D-programs and how to work with 3D game-engines. Furthermore, a 3D-environment is thought to be the best way of engaging the player in a realistic story (also see 2.2.3) and by only viewing from one side, the environment only has to be made realistic from that side-view.
- There are multiple game engines that can be used, of which Unity seems most suitable. Reasons for choosing this game engine are familiarity and ease of use with 3D-environments.
- The location of the scenario should be a fictional one, as using an existing location can cause people to think differently about the in-game decisions. For example, a player might choose a certain option based on his knowledge about the personality of his neighbour.
- A game can be played as one person, a group, God, etc., but in this game, the player will be play as one person, as this is viewed as the most realistic perspective and most suitable for the purpose of assessing self-reliance. After all, self-reliance is something of the individual, not of a group.
- To limit the answer options for better data processing, as well as keeping the answer fairly open to players, multiple choice dilemmas will be used, with the option of explaining the choice that was made.
- In order for the project to remain feasible, assets need to be kept simple. Moreover, existing assets can be used, because they will only be used for the prototype in case of the current phase of the project. When the game is at the stage of going public, then existing assets can only be used if the creator allows it.
- For feasibility reasons, the game prototype developed during this project will be a computer application, as this is the standard export method of Unity and the easiest way to test out the concept of the game.

3.1.2 VRT Brainstorm

The people of the VRT have more in-depth knowledge and experience when it comes to self-reliance, which is the reason why the brainstorm with the VRT had the purpose of gathering as many indicators of self-reliance and events where people need to rely on themselves as possible. These can be used to create a scenario for the serious game. The brainstorm revealed that the scenario for the project should be a scenario about extreme weather (in terms of heavy rain, strong winds and floods) that causes a power outages lasting for multiple days. This scenario is thought to be relatable to most people, as most people experienced some form of heavy weather in their lives, which can happen again any day. A power outage also is a highly realistic situation that happens once in a while. Subjects concerning desired civilian-actions and worst-case scenarios, among others, were discussed. The questions and the results of the brainstorm have been summarized in a mind map again, which can be found in Appendix E. The exact scenario will be the first thing to determine next, as the story determines all the measures and in-game surroundings. However, an example scenario that emanated from the brainstorm and could be one to work with during the project, is the following:

You are watching TV, and the news warns for very strong winds later today. However, you still need to get groceries. Do you go by bike, car, or do you stay in? Later that day, you need to pick up your child from school, but you get an emergency broadcast message telling you to not go outside until further notice. Do you listen to the message, or do you ignore it and pick up your child anyway? Let's assume the player picks the latter option. In this case, the player is outside, where a car has been hit by a tree. Do you get out of your car and help, or do you stay in the car and drive on to the school?

This is but a small part of what is possible. However, the project does need to be feasible in the available timeframe. This means the story cannot be too long. A way to make sure this is not the case, some key points in the scenario must be defined that will be designed and developed in any case, with additional points in the scenario that can be added if there is time. In the next section, the scenario and the workings of the game will be further explored.

3.2 Requirements

Functional requirements:

- FR1: The game must be able to measure self-reliance during a crisis.
- FR2: The game must be in Dutch.
- FR3: The game must log the data generated by the game for the VRT to use it.
- FR4: The game should contain a proper introduction to the situation.
- FR5: The game should run on smartphones in the future.
- FR6: The game could give an overview of the given responses after the game has been completed.
- FR7: The game could give feedback after the game has been completed on the moments of choice.
- FR8: The game could give a visualization of the data as part of the data overview.

Non-functional requirements:

- NFR1: The game must be relatable for people.
- NFR2: The game must be playable without any explanation about the controls beforehand.
- NFR3: The game must contain meaningful moments of choice.
- NFR4: The scenario of the game should be based on the three-act-structure.
- NFR5: The game should mentally challenge the player.
- NFR6: The game should be fun to play.
- NFR7: The game should cause intrinsic motivation in the player.

3.3 High Concept

In the view of Ernst W. Adams (2008), the founder of the International Game Developers Association (IGDA, 2015), a high concept document (HCD) consists of the core concept, key features, key commercial considerations, and further details the designer thinks the reader needs to know about the game concept. In this project, the key subjects of an HCD will be discussed.

Game Features

The core concept of the game is as follows:

A game with the purpose of measuring self-reliance by means of several dilemmas and questions the player must answer, in a scenario with extreme weather and a long-lasting power outage.

The features of the game concerning the look and feel are listed below:

- The point of view will be 2.5D: the camera only moves sideways, like in a side-scrolling platformer, but also contains 3D objects to create a fuller, more realistic world. Use of this perspective accelerates the development, as fewer assets are needed which also only need to look good from the side.
- The scenario takes place inside a house with the weather consisting of heavy rain, strong winds and floods, which can be seen in-game by, for example, leaves flying around and loose objects moving with the wind. The player can also go outside into this weather, depending on their own decisions. Later, the power goes out, which causes the lighting to be dim and to consist only of candle light and torch light. A setting like this is believed to be relatable and to contain many options for measuring self-reliance, which will be specified further into this report.
- The players answer a short set of questions before starting the game, which are anonymous and about their life, which are used to change some key points later in the storyline of the game. For example, if they have access to a car, then a car can be a transportation option in the game. This gives the player a stronger feeling of control over the events in the scenario, which is one of the gaming motivations described by Kellar (as cited in Bostan, 2009).
- Exclamation marks are placed above locations where the player must make a decision. This can serve as a way of steering the player in the right direction; a so-called “weenie” (Schell, 2008).
- The player can move left and right and can interact with the exclamation mark locations.
- Interacting with an exclamation mark location brings up an overlay with a question and the possible actions the player can choose to make.

Appendix B contains a mood board, which gives the potential players a feeling about how the game will approximately look. It is also a way of reminding the designer what the original idea was for the visuals of the game.

Player Motivation

As can be seen in table 5 in section 2.2.1, the theory of the MDA framework consists of nine aesthetics a player can have in a game. The aesthetic experiences the player should have while playing the game should be related to the goal of the game: to measure the self-reliance of the player. For this, the MDA framework is the framework that was worked with in this project and the following aesthetic experiences the player could have were kept in mind:

- The *Narrative* aesthetic could play an important role in the game, as the VRT often works with scenarios that could be implemented as the story of the game. Several scenarios are already being used for trainings and practices of the VRT. These scenarios could be the basis of a playable scenario for the game. This is supported by Lisa Cron, as cited in Peterson (2017), “stories allow us to simulate intense experiences without having to actually live through them. Stories

allow us to experience the world before we actually have to experience it.” Thus, it is highly valuable to write a story for the serious game, as it helps in engaging the player in the game.

- *Expression* is an important part of the goal, as this aesthetic requires a personal relation with the game, which could prove useful for measuring self-reliance of the player. The game aims to receive genuine responses from the player. This could be achieved by encouraging the player to answer as they would in real life so they can express themselves.
- The game could have the *Challenge* aesthetic, as the questions the player needs to answer can be quite challenging. It is needed that the options in the moments of choice in the scenario are all realistic. These decisions are also very hard to make in real life, which only makes the game more realistic.

Aesthetics that are not going to be used, as these are counteracting the goal of the game, are the following:

- *Competition* is not wanted in this game, as this aesthetic is thought to work against the aim of receiving genuine responses. The reasoning behind this is that when a player can compete against another player, the players will do anything to win. This includes responding in a way that is not genuine, but is instead in a way that the player thinks is most likely to be the best possible response.
- The aesthetic *Submission* is not very interesting for this game, as the aesthetic implies that the player does not have to think about what he/she is doing in the game. Because the aesthetic is just a relaxing pastime, the player does not think about how he/she would respond in the situation in question. In other words, submission is not valuable, as the player needs to have a clear head to think about what is asked in the game.

Other aesthetics that are neither valuable nor counteracting to the goal are *Sensation*, *Fantasy*, *Fellowship* and *Discovery*. These are not necessarily bad or useless, but they do not seem to be adding any value to the goal of the game.

Genre

With the term genre, the type of game is meant. This does not concern the story of the game, nor its visual properties, but rather the gameplay. As the project is developing a serious game, the main genre is *a game with a purpose*. However, this is not the only genre. The game with a purpose will also be *a decision-based simulation adventure game*, as it follows a scenario that in its essence is a simulation of a real-life situation where decisions need to be made by the player. As the player can decide how the story plays out, adventure is also part of the genre.

Target Player

Usually an HCD discusses the target customer, which is in most cases the same as the target player. Here, however, it is more relevant to discuss the target user, as this is not the same as the target customer in this case. The *target customer* of the serious game is the VRT. The *target player* of the game is the one who is actually going to play the game. To find the target user, the requirements of the VRT must be considered. The VRT wants to have the game made for the region of Twente. For this reason, the population of Enschede is taken as an example population distribution of the region. In figure 8, the age distribution of residents in Enschede can be seen (OpenInfo.nl (2019), graph from AlleCijfers.nl (2019)). Clearly, the largest part of the residents are adults within the range of 25 to 65 years old. Adults up until the age of sixty-five are expected to be able to take care of themselves and others the most, as people older than 65 are more likely to have one or several limitations or disabilities as a result of the deterioration of physical, cognitive and emotional skills (Wever et al., 2006, as cited in Don and De Jong, 2008). As it is generally known that this age-group contains the most lesser self-reliant individuals, these are for now taken out of the target group, while the lesser self-reliant individuals under 65 are taken in. In the Netherlands, anyone over eighteen is called a person of age, and anyone over twenty-one is called completely independent and full-grown. For this project, however, anyone over eighteen

is considered an adult. And so, the target user is anyone between the ages of 18 and 65, including the lesser self-reliant individuals.

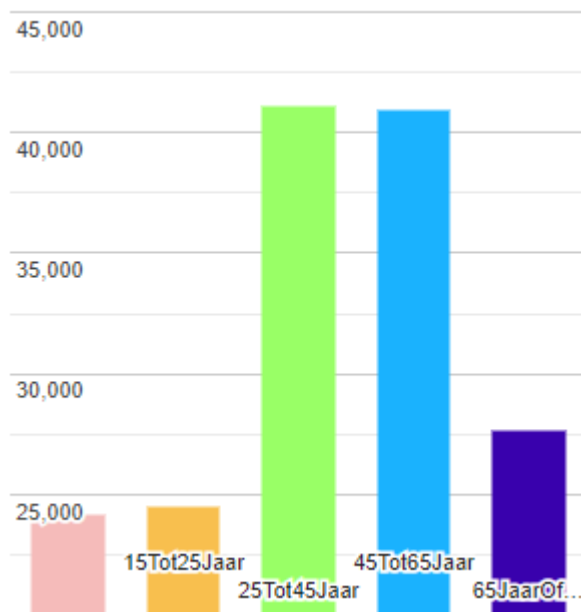


Figure 8. Residents of Enschede grouped by their age with data from April 2019 (allecijfers.nl, 2019).

Target Hardware

It is wise to consider beforehand on what device the game is going to be played. For reasons regarding the reach the game must have, a mobile phone could be the most effective device, as almost everybody nowadays always carries one with them. However, to keep the project feasible within the limited timespan, a simpler device is considered to be better for now. Such a device is a computer. If this device would be chosen, there are still choices to be made. The game can be a PC-app, or a browser-app. Again, for feasibility reasons, the PC-app seems to be the best option, as this is the standard export method in most game engines. This does not put any restrictions on the game design, as controls on a phone (touchscreen) are comparable to the controls that can be used on a PC. For example, an arrow can be put on screen for when the player wants to move right, which can easily be assigned as control for walking to the right as the right-arrow button.

Setting

The story will take place in and around the house of the main character and outside on the streets. The location is in the Netherlands. The location should be representative of Twente, as the game is meant to be for residents of Twente. The time the scenario plays out is in the afternoon, as well as in the evening in the present time. The overall setting is in the real world, only the circumstances are somewhat extreme due to the weather. This is precisely what is needed for the goal of this game, as the aim is to gain knowledge about the player's self-reliance in these circumstances.

Gameplay

It is a single player, first-person game. This is thought to be the best way of engaging the player into the main character of the game. How the gameplay works in detail will be described next, using a method by Weitze and Ørngreen (2012). They argue that there are six major game elements: goals, actions, rules, choices, challenges and feedback. These elements of gameplay have been explored for the serious game below.

Goals

The main goal of the game for the player is to safely go through the heavy weather scenario. This goal can be reached by the sub-goal of choosing the responses to each of the moments of choice that are best for their overall self-reliance.

Actions/Choices

To reach the goal, the player must make important decisions that influence the rest of the story. Apart from making the decisions at certain points in the game-world and story, the player can walk around the world freely (to some extent).

Rules

The rules of the game are mainly originated from real life. For example, the laws of physics apply to the game world, which means there is gravity, the player cannot walk through walls, etc. Another rule is that the moments of choice have a limited duration, so the player cannot wait for too long to decide. Following this, is that the player can only pause the game when he/she is not currently in a moment of choice. This prevents the player from having the option to take forever on making a decision.

Challenges

The challenge of the game lies in the difficulty of the player choices. Most of the choices leads the player down a certain path, but whether that path is the best option is unknown. Another challenge is making timely decisions, which is caused by the limited choosing duration.

Feedback

For the same reason the *competition* aesthetic is not taken into account, the game should not have a display of the player's score. A score causes the player to shift his/her reasons for choosing certain options, which is not wanted. The feedback the player does get, is the feedback on their option of choice. For every decision, they get feedback *at the end of the game* to gain insight in how they could improve their self-reliance.

4. Game Implementation

In this chapter the concept built up in the previous chapter will be developed in Unity. The narrative structure was developed, playtests for the scenario have been done and the scope of the project has been established. That is, a choice will be made about which parts of the concept will be built during this project, and which parts will be omitted from the project to reserve for future work and recommendations. Next, the assets needed for the project will be made and/or acquired, and the scoring system will be further worked out.

4.1 Narrative Structure

The narrative structure can be described as the framework for the order and manner in which a narrative is presented. One form of narrative structure is the classical narrative structure. This is also called the three-act structure, consisting of the acts *Set up*, *Confrontation*, and *Resolution* (Moura, 2014). The story of the self-reliance game will follow this structure. However, because of the different options the player can choose, the story is not linear. Every choice the player makes brings him/her to a different plot point.

A brief summary of the story can be given as follows: During a heavy rainstorm, the main character must go to the supermarket for food. When he comes back, the power goes out. It turns out the power will not go back on shortly. The main character now needs to take action in order to survive and to make sure others are safe as well. During this scenario, the player must make a multitude of choices regarding his own safety, as well as the safety of others. The complete story with all the dilemmas and questions can be found in Appendix C in a table, as well as in a flow chart.

4.2 Playtests

To test whether the scenario contained the right answer options and to see whether things are missing or unclear, a paper prototype was made to playtest the scenario. The playtest contained all the questions of Appendix C, printed out on separate cards. The participant would go through the questions in the way they would in the game. Every choice lead to the next question in the scenario according to a schema made beforehand, so every choice could be easily tracked. After each choice, a new card was given to the participant. If there was anything unclear, or the participant thought there was an option missing, a note was made of the question or suggestion. A detailed overview of the playtest results can be found in Appendix F. The playtests sparked some interesting changes within the scenario, that seemed to be improving the comprehensibility of the story. The changes made to the scenario concerned clarifications, such as what code has been given off in the scenario (yellow, orange, or red), but also the possibility of choosing multiple answers instead of just one was added to the questions where it appeared to be of importance.

4.3 Asset list

To bring the concept to life, a 3D-world must be created. This can be done with self-made assets, but existing assets can also be used, as the result of this project won't be a finished product but will rather be a proof-of-concept, or hi-fi prototype. The list of needed assets is as follows, including intangible assets:

- | | |
|---|-----------------------------------|
| 1. Main character, including animations | 14. Man (who falls from his bike) |
| 2. Landscape | 15. Roof tile |
| 3. Background | 16. Broken rooftile(s) |
| 4. House 1 (main character's home) | 17. Tree(s) |
| 5. TV | 18. Text cloud / thought cloud |
| 6. Smartphone | 19. Torch |
| 7. Laptop | 20. Candles |
| 8. Bucket | 21. Old man |
| 9. Bicycle | 22. Fire place |
| 10. Car | 23. Curtains |
| 11. Water (fluid physics) | 24. Clouds |
| 12. House 2 (where roof tiles fall off) | 25. Rain |
| 13. Tunnel | 26. Wind |

4.4 Scope of the Implementation

For the scope of this project, the development of the complete scenario with all 3D locations and objects will not be feasible in the given timeframe. This means the scope of the project must be narrowed down to something that is feasible. Appendix C contains the complete scenario, which must be cut up while maintaining the essence of the game to make a successful project. To catch this essence, the power outage must be in the scenario, as this is the essential part of the crisis the VRT wants to capture in the game. Therefore, the part that will be developed will start outside with scenario question number 14 (see Appendix C1). The next dilemma is number 18, where the power outage starts. Then, number 20 is asked - to also implement a social dilemma - after which dilemma 22 is asked the next morning. A snippet including these to-be-implemented scenario questions can be seen in table 7.

Location	Number	Dilemma
Outside	14	There is a damaged tree hanging slanted over the road. A: I call 112, because the tree is about to fall. B: I don't call 112, because I don't see any acute danger. C: I don't call 112, the fire department has more serious situations to worry about with this weather.
Home	18	You come home and take off your jacket. Suddenly the light goes out and the heating stops working. That's not so bad during the day, but tonight it is. What is the first thing you do? A: There is nothing I can do. I'll stay inside and search the internet on my phone for what happened, and I'll keep an eye on the news. B: I'm going to look for a flashlight and candles in case I'm still without power tonight. C: I call or send messages to others who live in the area to ask if they are out of power too.
Home	20	Your neighbour is old and lives alone. He'll probably won't stand the cold. A: I will visit him to see if there is anything I can do for him. B: I'll just stay home; the man can take care of himself. C: I stay at home, because there are dozens of other neighbours who can help.
Home	22	You wake up and see that the power is still not working. You hear that the power outage can last two days. What do you do? A: I still have enough in stock to take care of myself for a while, even without power, so I just stay at home. B: I just stay at home, because I'm scared to leave my house. C: I'm leaving my house.

Table 7. Snippet of Appendix C1, translated to English. This is the part that will be worked out during this project.

4.5 Assets and Scripts

Building the 3D-environment starts with the gathering and making of the most essential models. In this case, those are the streets between the supermarket and the home of the main character. This is where dilemma number 16 starts, which is the start of the part of the game's scenario that will be built within the timeframe of this project. The other location built for the prototype is the home of the character. All assets are taken from the asset store or another online source for 3D assets (see Appendix H for all resources).

As Unity is not just a place to arrange objects in a 3D space but is also used to make things interactive. For example, as the scenario is in stormy weather, the trees should move with the wind, which can be done with Unity's "Wind Zone" and "Tree Editor". All scripts that have been used can be found in appendix G.

In figure 9 a screenshot is displayed with how the surroundings look like outside. The tree on the right side is the visualization of dilemma 14 (see table 7).



Figure 9. Screenshot of the serious game, without any questions or UI-elements. For models see Appendix H.

4.6 Data Processing

The answers given by the players are valuable to the VRT, as the VRT is interested in information they can actually use, instead of a score (like in the existing methods in section 2.1.2) of the average self-reliance of a neighbourhood. For example, if people in a certain part of Enschede turn out to not know when to call the emergency telephone line, the VRT can use that information to promote the actions that should be taken in such a situation. Another example: if it is discovered that a large part of a neighbourhood leaves their house to go to friends or family during a long-lasting power outage, then in that neighbourhood the emergency services do not need to provide much emergency facilities, because they now know that most of the residents are gone. The data will be saved to be used later in what could be an interactive visualization. However, this is not in the scope of this project.

The data needs to be saved in a way that is easy to process and visualize later on. For this purpose, the CSV file format has been chosen. CSV (comma-separated values) are easy to use in data software such as Tableau. With Unity, it is also fairly easy to save the data in such a CSV-file. In the prototype, this works as follows:

1. One string list (rowData) and one string (rowDataTemp) is created. rowDataTemp is assigned as a new string with the length of the amount of dilemmas in the game. This is in this case seven: age, rural area (yes/no), gender and four dilemmas.
2. The player steps in an area that triggers the dilemma to be shown on screen.
3. The answer given by the player to the dilemma is saved as a value of the rowDataTemp string, in the corresponding place of the string with using rowDataTemp[number].
4. Once all dilemmas have been answered, the rowDataTemp string, which is full at this point, is added to the rowData string list.
5. A new StringBuilder is created, which is used to add a comma after every rowData-value to create the CSV-format.
6. The string is added to the CSV-file in a new row.

Thus, after every play of the game, the data will be added in a new row, so the CSV-file will grow with every player. For now, this will be the way of saving the data. In future development, the data must be saved on a server. Otherwise, all data cannot be saved into one place, as people will play the game on their own devices. This is not in the scope of the project, but in section 6.2 a recommendation is given on this subject.

5. Evaluation and Discussion

This chapter is about the final evaluation of the game developed in this project. The results are discussed, and the requirements set up in section 3.5 are assessed and altered for use in future work. A discussion section follows, concerning what went well and what could have been better executed.

5.1 Evaluation Method

The method used to evaluate the serious game was an evaluation interview after a playtest. The participants were either university students, employees of the VRT, or employees of TXchange. The participant received a brief introduction to the project and the game they were about to play. They were informed on the intentions the researcher had with the data they were to provide, all according to the guidelines of the Ethics Committee of the University of Twente. They signed a consent form after having read the information brochure, after which they could start with the game. Eventually, five people have been interviewed (see table 8 for more information), in which questions were asked related to the requirements stated in section 3.2, meaning the questions concerned player experience, relatability and understandability. During the evaluation, it became clear that the participants expected to get some feedback on the consequences of their actions (what happens because of their actions), as well as on whether those actions were the right ones to take regarding their self-reliance. Next to that, not everyone had experience with computer games, so the controls were not totally clear for every participant. They also thought that the story was incomplete, partly due to the lack of consequences. The evaluation will continue with a more thorough discussion of the requirements in the next section. The complete list of questions asked can be found in Appendix I.

Participant	Type	Gender	Game Experience
1	Student	Male	Yes
2	VRT employee	Male	No
3	VRT employee	Male	Yes
4	TXchange employee	Male	Yes
5	VRT employee	Female	No

Table 8. Information about the participants.

5.2 Requirements Analysis

In this section, the requirements set up in section 3.5 are assessed based on the evaluation described in section 5.1. The requirements are separately discussed, ending with whether the requirement has been met and why they have or have not been met.

5.2.1 Functional Requirements

FR1: The game must be able to measure self-reliance during a crisis.

The game measures self-reliance by means of dilemmas the player answers. On the question whether this is a good way of acquiring the wanted information, all participants said they think it is. One of the reasons for this was that a game is more interesting for civilians than a questionnaire. However, there were some remarks, stating that collecting data you don't know the nature of is difficult. In other words, you can't know what you don't know, therefore, one person mentioned that dilemmas should be more open in order to get more responses that might not be expected. Another participant did think the current method is a good method, but not if it was the best method. Other remarks concerned the consequences of the player's choices. They were interested to know why certain choices were better than others, and, for example, why they should listen to an NL-alert. One participant made the justified point of stating that the answer options are fairly closed, which means no new insights can be found without knowing the thought process of the player by giving the player a follow-up question. Despite the suggestions of

the participants for improvements, it can be said that this requirement has been met, as they all agree that the game does measure self-reliance.

FR2: The game must be in Dutch.

The complete front-end of the serious game is in Dutch, as requested by the client of the VRT before the start of the development phase. Thus, this requirement is met.

FR3: The game must log the data generated by the game for the VRT to use it.

As mentioned in section 4.3.2, the data the player generates by playing the game is saved in an external CSV-file. The file can be easily accessed and can therefore be directly used to make a data report or visualization. This requirement has therefore been met.

FR4: The game should contain a good introduction to the situation.

When asked if the participant knew what had occurred in the game's scenario before the start of the demo they played, three people said it was clear and two said it wasn't. The latter two thought that there was too much text, which discouraged and withheld them from playing. One person mentioned they briefly read it, but didn't remember what they had read after the demo was finished. The other thought that everything that was in the text had to be important to the rest of the story, while in reality, it was just to introduce them into the situation. Not every choice that would have been made in the part of the scenario that hadn't been implemented in the demo has an effect on the storyline. This person suggested to write the intro shorter and subtler, as most information about the weather was already made clear by the in-game visuals and sounds. Otherwise, they would be discouraged by having to read the whole text. For example, the urgency of it being code red could be made known along the demo, instead of the introduction text. In conclusion, it cannot be said that this requirement has been met, as the participants showed that not everything was clear and that there were too many points for improvement to be able to state that the introduction was good.

FR5: The game won't be built for smartphones.

The serious game is currently a computer application, which was a conscious choice made with time constraints in mind. However, when asked about participants' preferred platform to play the serious game on, all of them mentioned their iPad/tablet, as they are easily accessible, have a large screen, and would optimise the ease of play. However, it might be better for the player motivation not to sit on the couch, but instead sit behind a desk and play on a computer, as this is believed to be a more active posture that encourages the serious state of mind that is needed for realistically and honestly playing the game.

FR6: The game could give an overview of the given responses after the game has been completed.

After having answered all in-game dilemmas within the implemented scenario, the player was given an overview of the choices they made. Thus, this requirement has been met.

FR7: The game could give feedback after the game has been completed on the moments of choice.

The game does not yet give feedback on the given answers. Some participants mentioned that they think this is essential for getting people motivated to play the game, as people probably won't play the game if there is no personal gain. This requirement has not been met.

FR8: The game could give a visualization of the data as part of the data overview.

The game does not give a visualization of the data, as this turned out not to be feasible in time. The game does, however, provide the data in a format that is easily usable in data visualization software, such as Tableau. It is clear that this requirement has not been met.

5.2.2 Non-Functional Requirements

NFR1: The game must be relatable for people.

One interview question was about the relatability of the game. All of the participants indicated that they could relate to the dilemmas and the game in general, as they were all in agreement that the dilemmas were realistic and could therefore also happen in real life. One participant mentioned that the game made him think about his choices, and that he thought it made him act differently were the situation to occur in real life. Another participant wondered if they really had enough provisions in stock, which indicates the question raised some awareness on the subject.

Next, the participants were asked if they felt mentally involved in the situation of the scenario. All of them indicated that they were, due to the scenario being realistic and because they were triggered to really think about how they would respond. One participant mentioned the mental involvement was also due the different uses of media. With this, they meant the sound of the rain and thunder, the visual effects, and the questions in text.

Furthermore, it became clear that the participants' experiences were divided into feeling they experienced the scenario themselves on the one hand, and feeling like they were controlling an avatar on the other hand. Some players experienced both, some only one of the two. For one participant, this was partly due to the fact that she filled in that she was a woman, but the in-game avatar turned out to be a man anyway. This is a useful observation that can be of good use in future work, as the player's input could alter the appearance of the character in further development. Another participant mentioned the game can be quickly related to oneself, and moreover, another participant stated that there was not a moment where he didn't think the scenario could happen to him in real life.

To conclude, it can be said that the game was relatable for all participants, even with the female participant included. Hence, this requirement has been met.

NFR2: The game must be playable without any explanation about the controls beforehand.

Before the participant would start to play the game, a brief explanation of the in-game possibilities was given to the players. This only included that they could use the mouse to make decisions, and that they could walk around with ASWD or the arrow keys. To the question whether the controls were clear beforehand, most participants answered they were. However, when in the game they were supposed to walk around was not clear. It was also not entirely clear what the goal was and where the player should go. Being able to freely walk around the game-world was a conscious decision, however the goal and directions towards that goal should have been made clearer. One participant made the point that it would be good to reflect on whether the game is easily playable to all target players. Not everyone has experience in playing games, which became even clearer in some of the playtests. One player kept pressing the arrow keys to move around, where it was thought to be clear that the key needed to be held down to walk around. This must be taken into account in the further development of the game.

In conclusion, it can be said that the controls were clear to most participants, but in order for the game to be easily playable, there need to be clearer instructions about the controls, or the controls should be made simpler. Thus, this requirement has only been partly met.

NFR3: The game must contain meaningful moments of choice.

As already stated at FR1, the moments of choice appeared to be able to measure self-reliance. This, in combination with the relatability of the game discussed at NFR1, already implies that these dilemmas are meaningful. After all, they both impact the player and provide useful data for the VRT.

One remark a participant did make was having the feeling of wanting to call 112 after having made the choice of not calling 112, which had the in-game consequence of the tree falling onto a car (this was a visual effect as consequence of the choice). However, calling 112 after the tree fell was not possible in the game. Another participant thought about the possibility to add time pressure to the dilemmas, but immediately realised that in the real-life scenarios there would also not be time pressure.

NFR4: The scenario of the game should be based on the three-act-structure.

As explained in section 3.3, the three-act structure was meant to be followed. This has also been implanted in the scenario, but the participants had some remarks about this. They were asked whether they

felt like the story was complete, with the clarification that this meant if they felt like there was a clear start of the story and a clear end, with something big and important happening somewhere in between. Most of them indicated that they felt that there was something missing. One participant missed a dilemma after the power has been out for a day. Other things that could have been added according to the participants was the option to turn off your phone and only use it when it is absolutely necessary and the option of walking the streets to seek for people who know where to find emergency power. The overall feedback on the scenario concerned the consequences of actions. Most participants wanted to know what happens when they pick a certain option, and what happens because of that choice. For example: “does my neighbour suffer because I decided not to check on him?”

In hindsight, the formulation of this requirement was distant from the more interesting question asked during the interview: “Did you think the story was complete?”. Therefore, the requirement has been met, but the underlying goal of this requirement has not been met, as the participants did not think that the scenario was complete.

NFR5: The game should mentally challenge the player.

The challenge of the game was mainly aimed at the dilemmas. Therefore, in the interview, the participants were asked whether they thought the dilemmas were challenging. It turned out that all of the participants stated that they needed to think hard in order to answer the questions. One of the participants stated that the dilemmas must not be too complex, and that the questions were clear and simple, yet challenging. While there were some suggestions as adding the option to do nothing, there were also suggestions of adding more pro-active options. However, as the general opinion remained positive, it can be said that this requirement has been met.

NFR6: The game should be fun to play.

As explained in section 2.2.1, ‘fun’ is a broad term with many aspects that can be implemented in a game as aesthetics. The aesthetics that were focused on in this serious game were *Challenge*, *Expression* and *Narrative*. To be able to judge whether the requirement has been met, these aesthetics have to separately evaluated. The *challenge* aesthetic has already been evaluated with NFR5, which was met. The *expression* aesthetic concerns the personal relation someone has with a game. In case of the serious game that was developed in this project, the players can express themselves by choosing what they would do, were the dilemma to play out in real life. As can be seen at NFR1, the participants found the dilemmas to be relatable and realistic. Furthermore, they really felt like they were in the situation themselves. However, there were several participants who at least once would have wanted to choose an option that was not possible in the game. This means that they could not fully express themselves. The *narrative* aesthetic concerns the story of the game. As said earlier, participants would have liked to see the consequences of their actions. One even suggested to give feedback after every choice. However, all of the participants liked the visual aspect of the game, as well as the audio, which they stated to be amplifying their engagement to the story. On the contrary, another participant felt like the story was still a bit brief but did understand the essence of it all. Another participant, who mentioned he identified himself as a gamer, did not feel like the game element was present enough. To him, it felt more like a questionnaire with an audiovisual aspect. There was also the question whether the game would be easily playable for elderly people, upon which a participant suggested to use a mouse-click for walking instead of keyboard-keys.

In conclusion, the game succeeded in invoking the challenge aesthetic, but did not fully succeed with the expression and narrative aesthetic, as there were missing options in the dilemmas. This caused the player to not answer exactly the way they would want and the story to be incomplete. Therefore, in terms of game theory, this requirement has not been met. However, this does not mean the participants did not enjoy playing the game.

NFR7: The game should cause intrinsic motivation in the player.

To the question whether they were motivated to play through the whole demo, all of the participants responded they were. They stated this was either because of curiosity, the game’s realism, the game’s duration, or the feeling of having influence on the story. One participant suggested giving more feedback and gathering more information by, for example, asking why someone is walking on the road

instead of on the sidewalk. This way, the game could observe player behaviour. Another example is if people stay away from windows during a thunder storm, and if they do, why they do. A participant also suggested the question whether people unplug their electronics when the power goes out.

The participants indicated that a “self-reliance score” would not help them to be more motivated. One stated that should there be a score, they would play the game three times: once for real, once to choose all the good options, and once to choose all the bad options. Another participant warned about this and said that you should have a way of telling them apart (in case a score is implemented). An important thing learned from the participants is that implementing a score depends on what the goal of the game is. This indicates that a score is not a useful addition with the current goal considered. When the goal is to gather information, a score would not be helpful. However, if the goal is to teach the player about their self-reliance, then it could be helpful. In that case, one participant mentioned, the player should also receive tips and tricks on how to improve their self-reliance, next to an explanation of the received score. Then again, the current goal is *not* to teach the player about self-reliance, so for the current purpose a score is *not* desired.

To conclude, it can be said that the players were motivated throughout the playtest, which was not caused by any reward, but rather by their own curiosity and the thoughts and feelings that were invoked by the game’s scenario and audiovisual aspects. Thus, this requirement has been met.

5.3 Discussion

Generally speaking, the participants had a positive attitude towards the serious game demo they played and gave it the average grade of an 8. Reasons to give such a grade were based on the way the game looks, its realism and the fact that there has not yet been developed a game quite like this. There have been made serious games for the VRT before, but one participant, who is an employee of the VRT, mentioned those games were more static and not as realistic as this one. Of course, the game is not finished. Therefore, the grade is based on the current state of the game. One participant stated he could only give a grade once the game is finished.

The evaluation brought up a lot of possibilities for improvement. These improvements were mainly focused on completing the scenario and the moments of choice within the scenario by giving the player more freedom in the answers they can give. Another improvement that came to light was giving feedback to the player either after every choice, or at the end of the game. This needs to be further researched in order to know what the best option is to improve player motivation, while still being able to acquire answers the player would also give in real life.

The playtest, or user evaluation, was aimed at finding out whether the requirements set up pre-development were met. After they have been discussed in the previous section, the requirements will now be presented again, including the improvements found through the evaluation. The requirements in bold text are requirements that have been added or altered.

Functional requirements:

- FR1: The game must be able to measure self-reliance during a crisis.
- FR2: The game must be in Dutch.
- FR3: The game must log the data generated by the game for the VRT to use it.
- FR4: The game must give feedback on how the player can improve their self-reliance, based on the answers the player has given in the game.**
- FR5: The game must be understandable to and easily playable by anyone over the age of 18.**
- FR6: The game should be designed for use on an iPad or any other tablet.**
- FR7: The game should give an overview of the given responses after the game has been completed.
- FR8: The game should have a scenario where after every choice the consequences are made clear.**
- FR9: The game should have the function of altering the surroundings and the main character according to the player’s pre-game input.**
- FR10: The game could give a visualization of the data as part of the data overview.

Non-functional requirements:

NFR1: The game must be relatable for people.

NFR2: The game must contain a clear instruction on how the controls work.

NFR3: The game must contain meaningful moments of choice.

NFR4: The story of the game should be complete.

NFR5: The story of the game should not leave the player with any questions afterwards.

NFR6: The game should mentally challenge the player.

NFR7: The game should be fun to play.

NFR8: The game should cause intrinsic motivation in the player.

6. Conclusion and Recommendations

In this chapter the project is briefly summarized and the research questions are answered. This is followed by the recommendations for future work, where an overview is given of things that were not implemented within this project or that proved to be useful after the evaluation and therefore could not be implemented right away.

6.1 Conclusion

This research aimed to find an effective way of assessing crisis-related self-reliance by using a serious game as tool, as the Veiligheidsregio Twente noticed there was a lack of knowledge about self-reliance and because a game was thought to be a good way to involve civilians in their search for answers about self-reliance. Based on brainstorming with the two clients who commissioned the project, a method was identified to assess self-reliance using a game. This method involved a crisis-scenario where the player's decisions influence the course of the story and are saved by the game for further data processing.

6.1.1 Sub-Questions

The sub-questions are discussed first, as they are needed to be able to answer the main research question.

SQL.1: What is self-reliance?

Self-reliance can, on the one hand, be seen as general self-reliance, which is applicable to daily life. It concerns how well a person is able to take care of themselves on a daily basis. On the other hand, however, when the term is related to a crisis, the term is more complex and the definition was found to be as follows: “the capacities and actions of residents to help themselves and others in preparation for, during and after an incident or crisis, facilitated by the government if possible and necessary”.

SQL.2: How can self-reliance be measured in a game?

Without many related existing methods of measuring crisis-related self-reliance found in the state-of-the-art research, the method of measuring in the serious game is done through a scenario with dilemmas. The dilemmas serve as judgements for the level of self-reliance of the player. Games almost always have a story, which makes this a logical measuring method for a game. Through the evaluation, the method used was found to be a working and useful method, that, once completely implemented into the game, can effectively measure self-reliance.

SQL.3: What are elements of (serious) games that make them fun and enjoyable?

Research brought up game design methods used to make a game fun. In the MDA framework, as well as in the 6-11 framework (see section 2.2.1), aesthetics are used to categorize types of fun a player can have in a game. For the serious game developed here, the aesthetics focused on were challenge, expression, and narrative.

SQL.4: How can the gathering of respondent information about self-reliance through a serious game be made fun and enjoyable?

The gathering of respondent information is done with posing dilemmas that are challenging to answer. Challenge is one of the main aesthetics (ways of fun) focused on for this serious game. The answers given by the player contain the information about self-reliance, as one option contains a more self-reliant answer than the other. Learning from people's reactions in certain crisis-situations is a highly useful to the VRT.

SQL.5: How can a serious game be designed in such a way that only honest responses are given by its users to portrayed scenarios?

Section 2.2.3 taught us that by engaging the player in the game, the player can empathize with the in-game situation, which leads to a higher realism. The players feel like they are experiencing the situation themselves, which causes them to answer as they would in real life.

SQL.6: How can crisis scenarios be implemented into a serious game?

Crisis scenarios are implemented as the story of the game, wherein the player must make important choices that indicate a certain level of self-reliance.

6.1.2 Main Research Question

The main research question of this project was: “How can a serious game be developed that provides insight into the self-reliance of residents of Twente in a crisis?” It can be concluded that the developed method can be useful once completely implemented, as players indicated that the serious game was enjoyable and caused them to better empathize with the situations, but the scenario needed to be complete in order to really get the feeling of in-game freedom that was desired. The game requires to give more information about consequences, together with getting feedback on the chosen actions. Feedback appeared to be important, as without it, people would not have a motivation that did not regard providing the VRT with information.

In general, it can be concluded that the concept for and a prototype of a serious game has successfully been developed. However, there are several points of improvement that could and should be implemented in future development of the game. Once the recommendations have been assessed and implemented, the game can eventually be made public so people can play it and actual data can be gathered from the public to improve the knowledge on self-reliance. The next section will address these recommendations.

6.2 Recommendations for Future Work

As stated before, the evaluation resulted in several improvement points. These are separately addressed in this section as recommendations for further development of the project. The section concludes with a part on what needs to happen for the serious game in order to be useable for the VRT.

6.2.1 Recommendations

Second Goal: Teaching Player How to Be More Self-Reliant

Some participants of the evaluation mentioned that they thought they would be more motivated to play the game if they had something to gain from it. In this case, that is learning about self-reliance. Thus, the first recommendation is to add this goal to the serious game. Moreover, it is perhaps needed to change the approach of the game to this (learning about self-reliance), as the same data currently gathered can also be gathered when teaching the player about self-reliance using the same dilemma-based scenario. This way, the game would have two goals: teaching the player about self-reliance and assessing the self-reliance of the player.

Add Score

Adding a score can be added as part of the above recommendation, as it can also be a way of motivating the player. However, if this would be implemented, then research should be done in how to still gather truthful responses. Adding a score can shift the motivation, as the player might want to choose the socially desirable option. This could, for example, be countered by letting the player choose how they want to play the game (showing their intentions). Thus, the recommendation would be to be careful when adding a score, as it could be counter-productive when handled poorly.

Add Feedback

Participants of the evaluation also indicated that they would like to get feedback on the decisions they made in the dilemmas. In other words, they wanted to know whether their answer was the best one in regard to self-reliance, and if not, how they could improve their self-reliance. This would also help in staying motivated throughout the scenario.

Add Open Answer Option(s)

It was mentioned by one of the participants that if only closed off options can be chosen in a dilemma, there is no chance of getting new insights. After all, you cannot know what you don't know. To improve on this aspect, I recommend adding an open option for every dilemma where the player can fill in their own answer. However, in that case, research should be done on how open answers can be saved and processed, which is a lot easier if the answers are limited.

Consequences of Actions

Participants of the evaluation indicated that they would like to know how their actions influence the story. As this was not always clear in the demo, players indicated the story was not complete. This has a negative effect on the player engagement because the scenario becomes less realistic. To counter this, the scenario should be broadened by adding consequences of the actions the player takes. These consequences could be new dilemmas following from the chosen option of the previous dilemma, but can also be just some visual feedback on what happened due to the choice made. An example of this can be the following: in the dilemma where the player has to choose whether they will assist their neighbour during the power outage, it should be clear what happens after the player has chosen to help or not help the neighbour. This could help make the player more aware of the consequences of their actions in real life.

Adjust Surroundings and Character(s) Based on Player Input

As was mentioned by two of the participants, when you fill in that you are female, the character you play remains male. This should be changed in future work on this serious game, as this, again, helps in getting the player more engaged due to its increased realism. This can also be implemented for the surroundings. In the demo the player must fill in whether they live in a rural area or not. This could just as well be input for the altering of the complete scenario, or at least where the scenario takes place.

Build the game for iPad/tablet

I recommend building the game for tablets. Most participants indicated they would like to play the game on their iPad, but to also include other tablets, it is ideal if the game can be played on all tablets. However, as the iPad was by far the most used tablet in the third quarter of 2018 (IDC, 2018), this seems to be the best device to focus on.

Adjust Controls for Better Ease of Play for Non-Gamers

As some participants of the evaluation never play games, struggled with the controls and indicated that elderly people would have the same problems, the controls should be simplified. The arrows and ASWD-controls should be replaced by, for example, clicking the location the player wants to go with the mouse. However, further research should be done in this to find the best possible controls.

Observe Player Behaviour Outside of Dilemmas

Data could be gathered from other sources than the dilemmas only. How a player handles the game-world and the overall situations can be interesting to the VRT. For example, if the player keeps walking on the road when the side-walk is just as easy to walk on, the player could be prompted to explain why they were walking there. Maybe this is purely unconsciously, but maybe there is more to it than we would expect. Another example could be to ask why they walked so close towards to dangling tree (in the second dilemma of the demo)

Shorter Intro for Future Demos

Participants indicated they didn't read or didn't want to read the text explaining the events that took place before the demo of the serious game they just played. They stated it was too long and discouraged them from wanting to play. In future development it is highly likely that more demos will be tested, for which I recommend shortening the introduction and only showing the things that are really necessary. A sentence like "You are outside on your way home" can already be enough to let the player know what the goal is, for example.

Upload Data to Server

Once the data has been gathered, the data must be uploaded to a certain location where data can be stored from all the players. This can be done on a server hosted by the VRT, so they can easily process the data. To upload the data to a server, UnityWebRequest can be used, which is a Unity object used to communicate with web servers. It is recommended to research this option, as well as other options to find the optimal method.

6.2.2 Realization of Prototype

To really be able to make the serious game work for the public to use, a couple of other things must be figured out. Some of these are directly related to the serious game, others are more related to marketing and finance. After all, developing such a game and keeping it working online costs money. Following this, the first recommendation would be to hire some professional game developers in order to create a version of the game that is ready for distribution. For this, the following two recommendations are important. Once the game is ready to be played, the latter two recommendations below should be kept in mind.

Use of Assets

In the demo played for testing the game concept, all assets were free to use assets from Unity's Asset Store or another online 3D model provider. However, as this was only used for demonstrating the concept, not all assets are free to use for commercial purposes. When the game goes public, this should be countered by either making all assets, or using assets of which the creator has indicated that commercial use is allowed.

Story

As already said in chapter 5.2.2 and 6.2.1, the story should be complete, including branches in the story to show the consequences of player actions. Without a complete story, players will be left with questions and the realism of the scenario will be at stake.

Promotion of Serious Game

Civilians won't play the game if they do not know that the game exists, so, people should be made aware of the existence of the game. To achieve this, some sort of promo campaign should be started or the news should dedicate an article about it to make people curious. However, further research should be done in the field of marketing to find the best possible way of raising this awareness.

Revenue Model

Keeping the game online and working, including regular updates and bug fixes costs money. To finance this, a revenue model should be created. This model could include advertisements of interested parties, such as companies that sell products related to safety, or any other company that has the same target group as the game. However, the same goes for the revenue model as for the promotion: further research is needed into what is the best option.

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Appendices

Appendix A1: Variables of BRIC

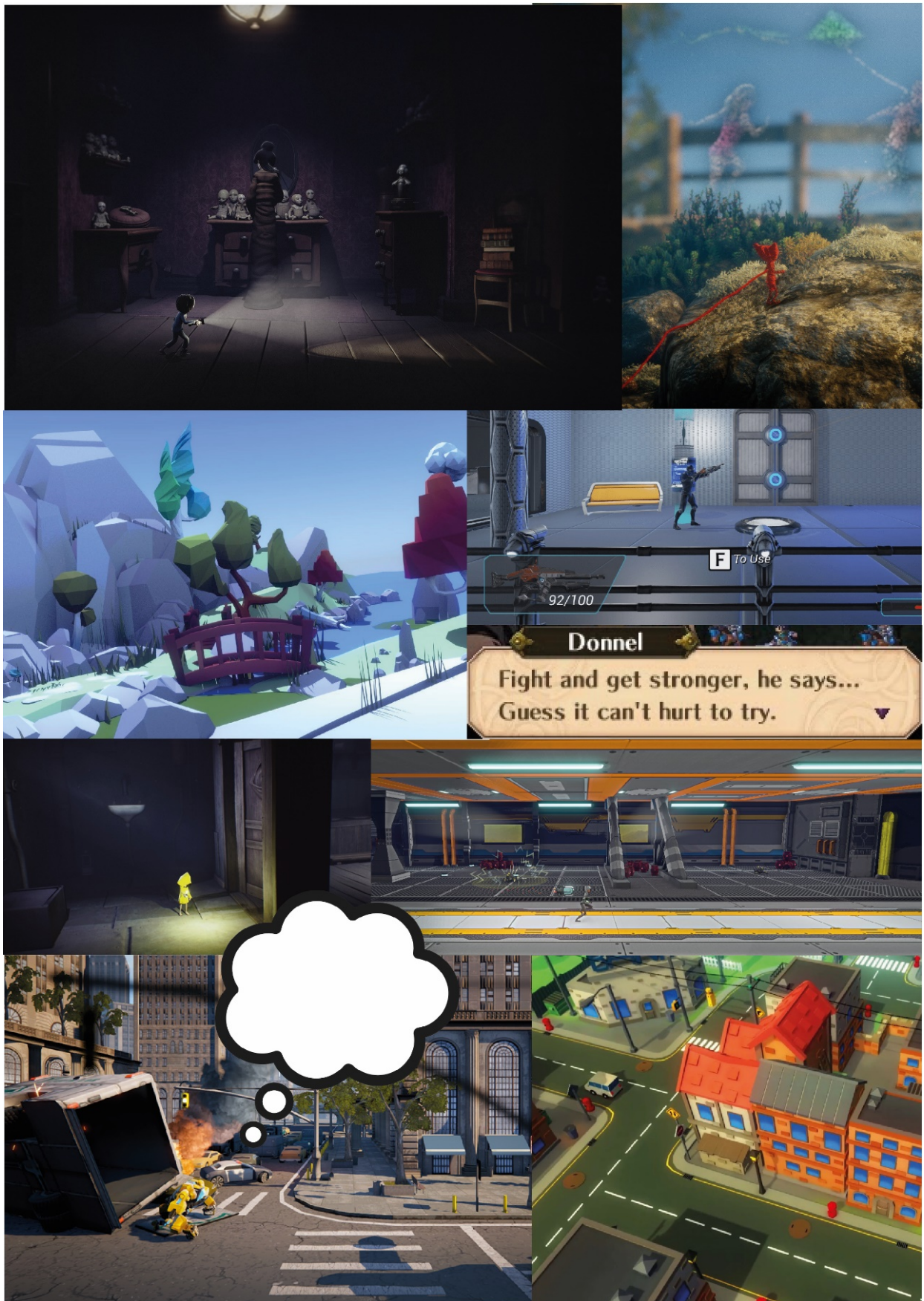
Category	Variable	Effect on Resilience	Justification	Data Source
Social Resilience				
Educational equity	Ratio of the pct. population with college education to the pct. population with no high school diploma	Negative	Norris et al. 2008 Morrow 2008	U.S. Census 2000
Age	Percent non-elderly population	Positive	Morrow 2008	U.S. Census 2000
Transportation access	Percent population with a vehicle	Positive	Tierney 2009	U.S. Census 2000
Communication capacity	Percent population with a telephone	Positive	Colten et al. 2008	U.S. Census 2000
Language competency	Percent population not speaking English as a second language	Positive	Morrow 2008	U.S. Census 2000
Special needs	Percent population without a sensory, physical, or mental disability	Positive	Heinz Center 2002	U.S. Census 2000
Health coverage	Percent population with health insurance coverage	Positive	Heinz Center 2002	U.S. Census 2000
Economic Resilience				
Housing capital	Percent homeownership	Positive	Norris et al. 2008 Cutter et al. 2008a	U.S. Census 2000
Employment	Percent employed	Positive	Tierney et al. 2001	U.S. Census 2000
Income and equality	GINI coefficient	Positive	Norris et al. 2008	Computed from U.S. Census 2000
Single sector employment dependence	Percent population not employed in farming, fishing, forestry, and extractive industries	Positive	Berke & Campanella 2006 Adger 2000	U.S. Census 2000
Employment	Percent female labor force participation	Positive	NRC 2006	U.S. Census 2000
Business size	Ratio of large to small businesses	Positive	Norris et al. 2008	County Business Patterns (NAICS) 2006
Health Access	Number of physicians per 10,000 population	Positive	Norris et al. 2008	U.S. Census 2000
Institutional Resilience				
Mitigation	Percent population covered by a recent hazard mitigation plan	Positive	Burby et al. 2000 Godshalk 2007	FEMA.gov
Flood coverage	Percent housing units covered by NFIP policies	Positive	Burby et al. 2000	bsa.nfipstat.com
Municipal services	Percent municipal expenditures for fire, police, and EMS	Positive	Sylves 2007	USA Counties 2000
Mitigation	Percent population participating in Community Rating System for Flood (CRS)	Positive	Godshalk 2003	FEMA.gov
Political fragmentation	Number of governments and special districts	Negative	Norris et al. 2008	U.S. Census 2002
Previous disaster experience	Number of paid disaster declarations	Positive	Cutter et al. 2008a	FEMA.gov
Mitigation and social connectivity	Percent population covered by Citizen Corps programs	Positive	Godshalk 2003	citizen.corps.gov
Mitigation	Percent population in Storm Ready communities	Positive	Godshalk 2003	stormready.noaa.gov
Infrastructure Resilience				
Housing type	Percent housing units that are not mobile homes	Positive	Cutter et al. 2003	U.S. Census 2000
Shelter capacity	Percent vacant rental units	Positive	Tierney 2009	U.S. Census 2000
Medical capacity	Number of hospital beds per 10,000 population	Positive	Auf de Heide and Scanlon 2007	American Hospital Directory www.ahd.com
Access/evacuation potential	Principle arterial miles per square mile	Positive	NRC 2006	GIS derived from National Atlas.gov
Housing age	Percent housing units not built before 1970 and after 1994	Positive	Mileti 1999	City and County Databook 2007
Sheltering needs	Number of hotels/motels per square mile	Positive	Tierney 2009	County Business Patterns (NAICS) 2006
Recovery	Number of public schools per square mile	Positive	Ronan and Johnston 2005	Gnis.usgs.gov
Community Capital				
Place attachment	Net international migration	Negative	Morrow 2008	census.gov
Place attachment	Percent population born in a state that still resides in that state	Positive	Vale & Campanella 2005	U.S. Census 2000
Political engagement	Percent voter participation in the 2004 election	Positive	Morrow 2008	City and County Databook 2007
Social capital-religion	Number of religious adherents per 10,000 population	Positive	Morrow 2008 Murphy 2007	Assn. of Religion Data Archives
Social capital – civic involvement	Number of civic organizations per 10,000 population	Positive	Morrow 2008 Murphy 2007	County Business Patterns (NAICS) 2006
Social capital – advocacy	Number of social advocacy organizations per 10,000 population	Positive	Murphy 2007	County Business Patterns (NAICS) 2006
Innovation	Percent population employed in creative class occupations	Positive	Norris et al. 2008	USDA Economic Research Service ers.usda.gov

Variables used by Cutter et al. (2010) to construct disaster resilience index by subcomponent.

Appendix A2: Statements of the CCRAM survey

Q No.	Phrase	Min	Max	Mean	SD
1	There is mutual assistance and concern for others in my town	1	5	3.84	1.076
2	I can rely on people in my town to come to my assistance in a crisis.	1	5	3.90	1.106
3	There are people in my town who can assist in coping with an emergency situation.	1	5	3.97	1.015
4	I am proud to tell others where I live.	1	5	4.31	.989
5	My remaining in my town is connected to beliefs and values which are common to the community members	1	5	3.37	1.396
6	I believe in the ability of my community to overcome an emergency situation.	1	5	3.94	1.026
7	The residents of my town are greatly involved in what is happening in the community.	1	5	3.42	1.078
8	Officials in my town routinely demonstrate leadership ability.	1	5	3.15	1.196
9	Officials in my town can demonstrate leadership in an emergency situation.	1	5	3.33	1.214
10	The municipal authority of my town functions well during routine situations	1	5	3.14	1.247
11	The municipal authority in my town functions well in emergency situations.	1	5	3.33	1.199
12	The residents of my town wish to continue to live there.	1	5	3.89	1.018
13	My family and I are acquainted with the emergency system of my town (to be activated in times of emergency).	1	5	2.99	1.328
14	The residents of my town are acquainted with their role in an emergency situation.	1	5	2.98	1.254
15	The federal/state government cares about my town.	1	5	2.36	1.165
16	The relations between the various groups in my town are good.	1	5	3.47	0.983
17	There is trust among the residents of my town.	1	5	3.46	0.998
18	In my town, there are sufficient public protection facilities (such as shelters).	1	5	3.12	1.238
19	I feel a sense of belonging to my town.	1	5	4.16	1.011
20	The municipal authority provides its services in fairness.	1	5	3.14	1.172
21	I feel safe in my town.	1	5	4.04	1.024
22	I feel a security threat in the place where I live.	1	5	3.74	1.296
23	I am satisfied with the quality of life in my town.	1	5	3.51	1.129
24	My town is organized for emergency situations.	1	5	3.15	1.117
25	In my town, appropriate attention is given to the needs of children.	1	5	3.44	1.125
26	I have faith in the ability of the elected/nominated head of my town to lead the transit from routine to emergency management of the town.	1	5	3.07	1.221
27	I have faith in the decision makers in the municipal authority.	1	5	2.93	1.245
28	The residents of my town will continue to receive municipal services during an emergency situation.	1	5	3.33	1.091
29	The health services in my town will continue to function properly in an emergency situation.	1	5	3.56	1.150
30	The educational system will continue to function properly during an emergency situation.	1	5	3.31	1.174
31	I trust the information which is provided to me by the authorities.	1	5	3.28	1.148
32	I remain in my town for ideological reasons.	1	5	3.19	1.438
33	In an emergency situation I intend to leave the town where I live.	1	5	3.77	1.421
34	I would be sorry to leave the town where I live.	1	5	4.04	1.287
35	When I feel the need, I usually consult with people from my town.	1	5	3.41	1.229
36	Many of my neighbors are my friends.	1	5	3.58	1.223
40	My personal level of resilience is high	1	5	4.04	0.900
41	My community' level of resilience is high	1	5	3.71	0.975

Appendix B: Mood board for the game visuals



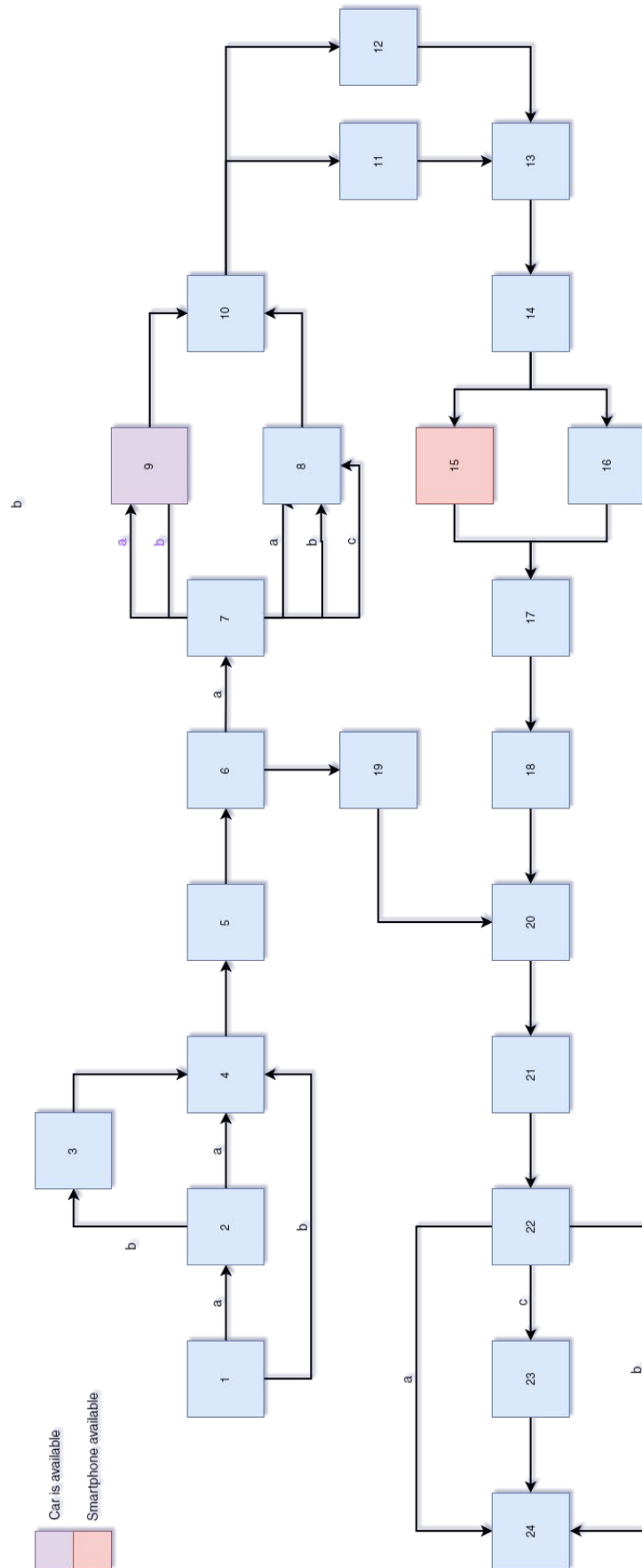
Appendix C1: Main and optional scenario points

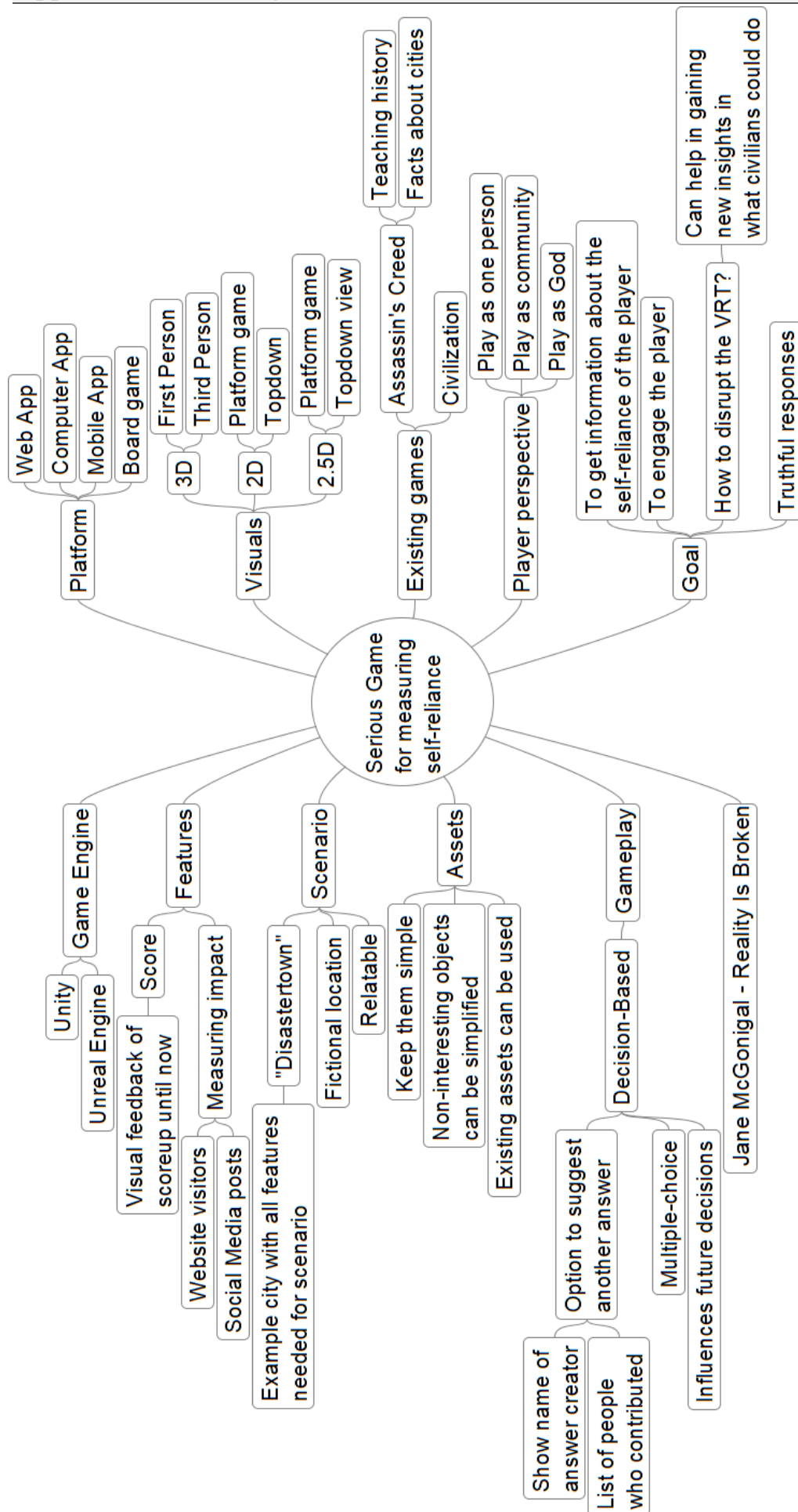
Waar?	Nr.	Wat?
Thuis: Extreem weer	1	Je wil weten wat er allemaal om je heen aan de hand is. A: Ik weet waar ik deze informatie vandaan kan halen. (1) B: Ik heb geen idee waar ik deze informatie vandaan haal. (-1)
	2	Zoek je op Google naar informatie, of ga je eerst naar een specifieke website/app? A: Ik Google meestal eerst. (0) B: Ik ga naar specifieke websites. (0)
	3	Op welke websites/apps kijk je dan? A: Buienradar (0) B: The Weather Channel (0) C: KNMI (0) D: NOS (0) E: Anders, namelijk: (0)
	4	Je leest dat code rood afgegeven is. Wat verwacht je van de overheid bij een situatie als dit? A: Ik verwacht dat er noodmiddelen beschikbaar worden gesteld. (0) B: Ik verwacht dat er opvang locaties geregeld worden. (0) C: Ik verwacht duidelijke informatie over de situatie te ontvangen. (0) D: Anders, namelijk: (0)
	5	Door de hevige regen kan je dak het vele water niet meer aan, waardoor er water naar binnen lekt. Wat doe je? Heel heftig is de lekkage niet, maar als je niks doet, krijg je wel waterschade. A: Ik zet er voor nu een emmertje onder, als de harde wind en regen voorbij is kijk ik naar hoe ik het kan repareren. (1) B: Ik bel een loodgieter, die kunnen ook met dit weer vast wel helpen. (0.5) C: Ik bel 112, de brandweer kan mij helpen. (-1)
	6	Je moet boodschappen doen voor het eten vanavond. Je krijgt echter net een NL-alert met de waarschuwing dat je beter binnen kunt blijven. Wat ga je doen? A: Ik ga toch naar de supermarkt. (-1) B: Ik blijf binnen en maak wel een diner met wat ik in huis heb. (1)
	7	Hoe ga je naar de supermarkt? A: Ik ga met de fiets naar de supermarkt, dat doe ik namelijk altijd. (-1) B: Het is niet zo ver, dus ik loop naar de supermarkt. Dat lijkt me het veiligst. (-1) C: Ik ga met de auto naar de supermarkt, dan ben ik het meest beschermd tegen het weer. (1)
	8	Wat doe je nog even voor je vertrekt? A: Ik check of de ramen dicht zijn en check of er geen losse objecten in mijn tuin liggen. (1) B: Ik check of de ramen dicht zijn. (-1) C: Ik check of er geen losse objecten in mijn tuin liggen. (-1) D: Ik doe niks. (-1)
	9	Wat doe je nog even voor je vertrekt? A: Ik check of de ramen dicht zijn en zet mijn auto op een veilige plek neer. (1) B: Ik check of de ramen dicht zijn. (-1) C: Ik check of er geen losse objecten in mijn tuin liggen. (-1) D: Ik check of de ramen dicht zijn en of er geen losse objecten in mijn tuin liggen. (1)
Buiten (heenweg)	10	Je buurman heeft wateroverlast, zijn kelder is voor een deel ondergelopen. A: Ik bel 112 omdat mijn buurman wateroverlast heeft. (0) B: Ik help mijn buurman zelf met zijn wateroverlast. (1) C: Ik help mijn buurman niet. Hij kan het zelf wel aan en ik heb andere dingen te doen. (-1)
	11	De route die je neemt gaat door een tunnel die door regen half onder water staat. Wat doe je? A: Ik ga gewoon door de tunnel. Dat kan geen kwaad. (-1) B: Ik neem een andere route. Tunnels zijn niet veilig nu. (1)
	12	De route die je neemt gaat door een tunnel die door regen half onder water staat. Wat doe je? A: Ik ga gewoon door de tunnel. Dat kan geen kwaad. (-1) B: Ik neem een andere route. Tunnels zijn niet veilig nu. (1) C: Ik rijd rustig door de tunnel, dan haalt mijn auto het wel. (-1)
	13	Je ziet dat er dakpannen losgeraakt zijn van een huis waar je langs komt. A: Ik bel 112 omdat vallende dakpannen gevaarlijk zijn voor langslappende mensen. (1) B: Ik bel 112 niet, ik zie namelijk geen acuut gevaar, aangezien er niemand langs loopt. (-1) C: Ik bel 112 niet, de brandweer heeft ernstigere situaties om zich druk over te maken met dit weer. (-1)

Appendix C1: Main and optional scenario points (continued)

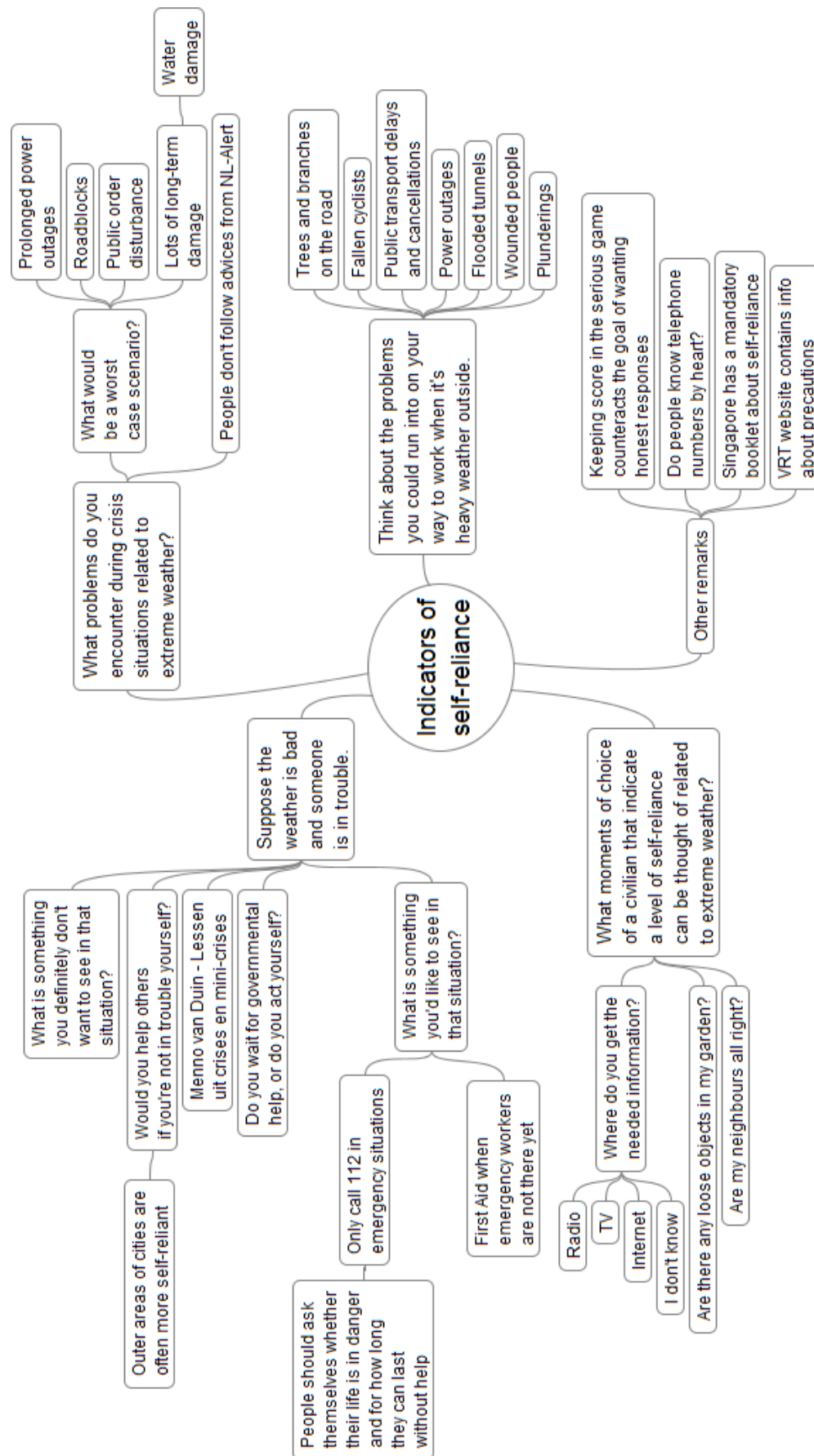
Supermarkt		<i>Geen keuzeopties hier.</i>
Buiten (terugweg)	14	Er hangt een beschadigde boom erg schuin over de openbare weg. A: Ik bel 112 omdat de boom dreigt te vallen. (1) B: Ik bel 112 niet, ik zie namelijk geen acuut gevaar. (-1) C: Ik bel 112 niet, de brandweer heeft ernstigere situaties om zich druk over te maken met dit weer. (-1)
	15	Door de harde wind vliegt er van alles door de lucht en complete dak delen beginnen van huizen los te raken. Wat doe je? A: Ik kijk even, en ga dan snel weer verder. Wat een guur weer! (1) B: Ik blijf kijken, want ik verbaas me over de kracht die wind kan hebben. (-1) C: Ik film de situatie. Dit moet ik delen met mijn vrienden! (-1)
	16	Door de harde wind vliegt er van alles door de lucht en complete dak delen beginnen van huizen los te raken. Wat doe je? A: Ik kijk even, en ga dan snel weer verder. Wat een guur weer! (1) B: Ik blijf kijken, want ik verbaas me over de kracht die wind kan hebben. (-1)
	17	Een stukje verderop is iemand van zijn fiets gevallen door een harde windvlaag. Wat doe je? A: Ik help hem overeind en zorg dat hij veilig weer verder kan. (1) B: Ik loop/fiets/rijd snel verder. Hoe eerder ik weer binnen ben, hoe beter. (-1) C: Ik bel 112, die kunnen hem wel verder helpen. (0)
Thuis: Stroomuitval	18	Je komt thuis en doet je jas uit. Dan plotseling valt het licht uit en de verwarming doet het ook niet meer. Nou is dat overdag nog niet zo erg, maar vanavond is dat wel vervelend. Wat is het eerste wat je doet? A: Er is niks wat ik kan doen. Ik blijf binnen en zoek op internet op mijn telefoon op wat er is gebeurd en houd het nieuws in de gaten. (1) B: Ik zoek alvast een zaklantaarn en kaarsjes voor het geval ik vanavond nog steeds zonder stroom zit. (1) C: Ik bel of stuur berichtjes naar anderen die in de buurt wonen om te vragen of zij ook geen stroom meer hebben. (1)
	19	Plotseling valt het licht uit en de verwarming doet het ook niet meer. Nou is dat overdag nog niet zo erg, maar vanavond is dat wel vervelend. Wat is het eerste wat je doet? A: Ik blijf binnen en zoek op internet op mijn telefoon op wat er is gebeurd en houd het nieuws in de gaten. (1) B: Ik zoek alvast een zaklantaarn en kaarsjes voor het geval ik vanavond nog steeds zonder stroom zit. (1) C: Ik bel of stuur berichtjes naar anderen die in de buurt wonen om te vragen of zij ook geen stroom meer hebben. (1)
	20	Je huidige buurman is oud en woont alleen. Hij kan vast slecht tegen de kou. A: Ik ga even bij hem langs om te kijken of ik iets voor hem kan doen. (1) B: Ik blijf gewoon thuis, die man redt zichzelf wel. (-1) C: Ik blijf thuis, want er zijn nog tientallen andere buurtbewoners die kunnen helpen. (-1)
	21	Het begint steeds kouder te worden in huis en je wil zo gaan slapen. Wat doe je? A: Ik heb een open haard die ik aan kan doen. (0) B: Ik trek extra kleren aan. (0) C: Ik ga in een kleiner kamertje zitten in mijn huis. (0)
	22	Je wordt wakker, het weer is weer wat rustiger geworden. Je kijkt of de stroom het alweer doet, maar helaas, nog steeds niet. Je hoort dat de stroomstoring nog twee dagen kan duren. Wat doe je? A: Ik heb nog genoeg in huis om mezelf nog wel een tijdje te redden, ook zonder stroom, dus ik blijf gewoon thuis. (0) B: Ik blijf maar gewoon thuis, want ik ben bang om mijn huis te verlaten. (0) C: Ik verlaat mijn huis. (0)
	23	Wat ga je doen? A: Ik ga naar vrienden in de buurt die ook geen stroom hebben. Liever samen zonder stroom dan alleen. (0) B: Ik ga naar familie die wat verder weg wonen. Ik ben wat langer onderweg, maar dan heb ik in ieder geval wel stroom. (0)
	24	Als je terugkijkt op wat er allemaal gebeurd is, wat ga je dan nu doen om beter voorbereid te zijn de volgende keer? (denk aan voedselvoorraad, noodstroomvoorzieningen, etc.) (Open vraag)

Appendix C2: Flowchart of chain of events





Appendix E: VRT Brainstorm



Appendix F: Playtest Results

	A	C	D	E	F	G	H	I	J	K	L	M	N	O
Question/ Participant	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	Comments		Alterations due to comments
1 Age	18-24	18-24	18-24	18-24	18-24	18-24	18-24	25-35	56-65	25-35	56-65	46-55	-	
2 Residency	Enschede (Campus)	Enschede (Noord)	Enschede (West)	Enschede (Campus)	Enschede (Noord)	Enschede (West)	Enschede (West)	Amsterdam	Workum	Amsterdam	Enschede (West)	Hengelo	-	
3														
4 Q1	A	A	A	A	A	A	A	A	A	A	A	A	Some people have looked on Buienradar already	Delete question
5 Q2	A	A	A	B	B	B	B	B	B	B	B	B	Someone was wondering why this question was asked in the first place. Depends on where you need to go, someone didn't have NL-alert set up, only go outside for important reason(s)	Fuse with Q9 for clarity of purpose to go outside
6 Q3	A	B	A	A	A	A	A	A	A	A	A	A	Some people would want to choose both options here. Most people would first search on google or look on specific weather websites or apps (buienradar, weather channel, knmi, nos)	Verandering vraag: Zoek je op google naar informatie of ga je eerst naar een specifieke website? Als ze naar een specifieke website zoeken, dan daar naar vragen.
7														
8 Q5	B	-	-	-	-	C	-	-	-	-	-	-		
9 Q6	-	-	Anders	-	Anders	Anders	Anders	Anders	-	Anders	Anders	Anders		
10 Q7	A	A	A	A	A	A	A	A	A	B	B	A	Some people would first put a bucket under the leakage, then call a plumber. Others couldn't answer because it would depend on the scale of the leakage.	Add possibility of choosing multiple options, and specify the severity of leakage
11 Q8	B	C	C	C	C	C	C	C	C	C	C	-	Almost everyone expects clear information, that seems to be most important. For someone it was not clear that this question was about the weather, not just about the leakage	Specify that situation is about the weather, not just the leakage
12 Q9	A	B	A	B	B	B	A	B	B	A	B	A	What code is active? Yellow, orange or red? For some people the supermarket is really close, so going outside would only take them a minute. Someone suggested the options of ordering food online	Specify what code has been given off
13 Q10	A	-	C	-	-	C	-	-	C	-	-	A	-	
14 Q11	B	-	A	-	-	C	-	-	C	-	-	A	Someone suggested adding the options of "doing nothing". Someone asked how would he know that the tree is fallen down?	Delete the part about the tree
15 Q12	-	-	-	-	-	-	-	-	-	-	-	-		
16 Q13	B	-	C	-	-	C	-	-	C	-	-	C		
17 Q14	A	-	B	-	-	B	-	-	B	-	-	B		
18 Q15	-	-	-	-	-	-	-	-	-	-	-	-		
19 Q16	C	-	A	-	-	A	-	-	A	-	-	C	Someone mentioned they would knock on the door of the concerned house to tell them	
20 Q17	C	-	C	-	-	C	-	-	C	-	-	-		
21 Q18	A	-	B	-	-	A	-	-	B	-	-	A		
22 Q19	-	-	-	-	-	-	-	-	-	-	-	-		
23 Q20	A	-	A	-	-	A	-	-	B	-	-	B		
24 Q21	C	-	C	-	-	C	-	-	A	-	-	A	Someone suggested combining B and C, and someone would first do C, then B. Also, not everyone has 4G, so A is not an option for those people.	Possibility of choosing multiple options
25 Q22	C	A	-	B	C	-	A	B	-	B	-	-	Someone suggested not putting the sentence "there's nothing I can do" in there	Delete "there's nothing I can do"
26 Q23	B	A	A	A	A	C	A	A	C	A	A	B	Some people don't know their neighbours and therefore wouldn't think to check on them. Others said it depends on the neighbours (they would help their current neighbours, but their previous neighbours not)	Specify it's about current neighbours, previous neighbours are not interesting because the data will be about their living locations
27 Q24	B	B	B	B	D	B	B	B	B	B	D	-	Most people wanted to give multiple answers here, some would do B and D. Someone also mentioned that their curtains would already be shut when they go to bed (very good point)	Possibility of choosing multiple options, but delete option D
28 Q25	A	C	A	A	C	A	A	C	A	C	C	C	Someone would try to stock up on some food now that the weather is better. Supermarkets are probably still closed though. Also, someone asked what the weather was outside	Mention that the weather has calmed down, and add the option of trying to stock up on food
29 Q26	-	A	-	-	A	-	-	B	A	A	A	A	Someone didn't know what an aggregate was. Someone mentioned that powerbanks still go empty, even without usage, so option B is quite difficult	
30 Q27	A	A	A	B	B	A	A	A	A	B	B	-	Someone suggested making this question completely open in order to get more input and to let people think about it themselves.	make this an open question

Appendix G: C# Scripts From Unity

CameraController.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;

public class cameraController : MonoBehaviour
{
    public Transform target;

    public float smoothSpeed = 0.125f;
    public Vector3 offset1;
    public Vector3 offset2;
    Vector3 desiredPosition;

    void FixedUpdate()
    {
        //as camera distance is different in the second scene, the offset is different depending on
        the scene that is loaded

        //get the scene that is currently active
        Scene scene = SceneManager.GetActiveScene();

        //if statement for which scene is active
        if (scene.name == "Main")
        {
            //the desired position depends on the position of the target and on the offset that is set
            in the inspector
            desiredPosition = target.position + offset1;
        }
        if (scene.name == "HomeScene")
        {
            desiredPosition = target.position + offset2;
        }

        //smooth out the camera movement
        Vector3 smoothedPosition = Vector3.Lerp(transform.position, desiredPosition, smoothSpeed);
        transform.position = smoothedPosition;

        //transform.LookAt(target);
    }
}
```

CarMove.cs

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class CarMove : MonoBehaviour
{
    public Vector3 finalDestination;
    public float carDuration;
    Renderer[] playerRenderer;

    private void Start()
    {
        playerRenderer = GetComponentsInChildren<Renderer>();
        foreach (Renderer r in playerRenderer)
        {
            r.enabled = false;
        }
    }
    // Start is called before the first frame update
    void Update()
    {

```



```

        if (CsvReadWrite.moveCar == true)
        {
            foreach (Renderer r in playerRenderer)
            {
                r.enabled = true;
            }
            StartCoroutine(MoveOverTime(gameObject, finalDestination, carDuration));
        }
    }

    public IEnumerator MoveOverSpeed(GameObject objectToMove, Vector3 end, float speed)
    {
        // speed should be 1 unit per second
        while (objectToMove.transform.position != end)
        {
            objectToMove.transform.position = Vector3.MoveTowards(objectToMove.transform.position,
end, speed * Time.deltaTime);
            yield return new WaitForEndOfFrame();
        }
    }
    public IEnumerator MoveOverTime(GameObject objectToMove, Vector3 end, float seconds)
    {
        float elapsedTime = 0;
        Vector3 startingPos = objectToMove.transform.position;
        while (elapsedTime < seconds)
        {
            objectToMove.transform.position = Vector3.Lerp(startingPos, end, (elapsedTime / seconds));
            elapsedTime += Time.deltaTime;
            yield return new WaitForEndOfFrame();
        }
        objectToMove.transform.position = end;
        CsvReadWrite.moveTruck = false;
    }
}

```

CsvReadWrite.cs

```

using UnityEngine;
using System.Collections;
using System.Collections.Generic;
using System.Text;
using System.IO;
using System;
using UnityEngine.SceneManagement;

```

```

public class CsvReadWrite : MonoBehaviour
{
    // Start is called before the first frame update

    //new string for csv file
    public List<string[]> rowData = new List<string[]>();
    public List<string[]> uitlegData = new List<string[]>();
    string[] rowDataTemp;
    //string[] rowDataTemp0;
    string[] uitlegDataTemp;

    public static readonly string a = "A";
    public static readonly string b = "B";
    public static readonly string c = "C";

    //demographic info that is asked at the start of the game
    string leeftijd = "";
    string stedelijk = "";
    string gender = "";

    readonly string introText =
        "Hoi!\n Wat leuk dat je deze serious game wil uittesten! Voordat je begint, zijn er een aantal dingen die je moet weten.Wat je zometeen gaat spelen is " +
        "slechts een deel van het verhaal dat ontwikkeld is voor deze game.Om je volledig te kunnen inleven in de situatie waarin je zo belandt, moet je weten " +

```

```

        "wat zich heeft afgespeeld voorafgaand aan die situatie.Het zit namelijk zo:\n " +
        "Je zat thuis toen het weer steeds slechter en slechter werd. Je zocht op wat er allemaal aan de hand was, waarbij je er achter kwam dat
er code rood is " +
        "afgegeven vanwege de harde wind en hevige regen. Je moest alleen nog boodschappen doen, dus ben je lopend naar de supermarkt
gegaan. Op de heenweg zag je " +
        "al dat het weer tot vernieling zorgt: dakpannen die van daken gevallen zijn, ondergelopen tunnels. Op dit moment kom je net terug van
de supermarkt, waar het " +
        "verhaal zo zal verdergaan en jouw spelervaring zal beginnen!\n " +
        "In het uiteindelijke spel laat je van tevoren weten of je een auto en een smartphone met of zonder 4g hebt, maar in deze demo heb je
geen beschikking tot " +
        "een auto en heb je wél een smartphone met 4g. \n \n Veel plezier!";
private string answer1;
private string answer2;
private string answer3;
private string answer4;
string completedText;
string deathText;
string openText16 = "";
string openText21 = "";
string openText23 = "";
string openText25 = "";

//dilemma questions
readonly string dilemma16 = "Wow! Die boom hangt wel erg schuin over de weg!";
readonly string dilemma21 = "Oh nee! De stroom is uitgevallen! \nWat zal ik eens als eerste doen?";
readonly string dilemma23 = "Mijn oude buurman zal ook zonder stroom zitten. Hoe zou het met hem gaan?";
readonly string dilemma25 = "Hmmm.. Er is nog steeds geen stroom. Ik kreeg net een melding op mijn telefoon dat het nog wel twee da-
gen kan duren.";

//antwoorden op dilemma's
readonly string antwoord16a = "Ik bel 112.";
readonly string antwoord16b = "Ik bel 112 niet, er is geen \n acuut gevaar.";
readonly string antwoord16c = "Ik bel 112 niet, de brandweer \n heeft betere dingen te doen.";
readonly string antwoord21a = "Ik blijf binnen en zoek op internet\nop wat er aan de hand is.";
readonly string antwoord21b = "Ik zoek alvast een zaklamp en kaarsjes\nvoor als ik vanavond nog geen stroom heb.";
readonly string antwoord21c = "Ik bel of stuur berichtjes naar anderen die in de buurt\nwonen om te vragen of zij ook geen stroom heb-
ben.";
readonly string antwoord23a = "Ik ga even bij hem langs om te \nkijken of ik iets voor hem kan doen.";
readonly string antwoord23b = "Ik blijf gewoon thuis. Volgens mij redt hij zich wel.";
readonly string antwoord23c = "Ik blijf thuis. Ik wacht eerst even af of er\nanderen zijn die bij hem langs gaan.";
readonly string antwoord25a = "Ik heb nog genoeg in huis om mezelf nog wel een tijdje te\nredden, ook zonder stroom, dus ik blijf ge-
woon thuis.";
readonly string antwoord25b = "Ik blijf maar gewoon thuis, ik \nverlaat m'n huis liever niet. ";
readonly string antwoord25c = "Ik verlaat mijn huis.";

//rectangles where text input is given
Rect leeftijdText = new Rect(200, 200, 200, 60);
Rect gebiedText = new Rect(200, 228, 200, 60);
Rect genderText = new Rect(200, 278, 200, 60);
//Rect dilemma16Input = new Rect(Screen.width-200,10,20,20);

//rectangles for label texts
Rect leeftijdInput = new Rect(390, 200, 200, 32);
Rect gebiedInput = new Rect(390, 237, 200, 32);
Rect genderInput = new Rect(390, 272, 200, 32);

//buttons for submitting answers: one for demographics (ok) and one for the answers
Rect okButton1 = new Rect(390, 309, 200, 60);
static float x = (Screen.width / 4);
static float y = (Screen.height / 4);
static float w = 400f;
static float h = 60f;
Rect okButton2 = new Rect(x, y, 1.5f * w, h);

//booleans to make sure answers are given at the right time and only once
private bool beginBool;
private bool isAvailable;
private bool bool16 = false;
private bool boolcheck16 = true;
private bool bool21 = false;
private bool boolcheck21 = true;
private bool bool23 = false;
private bool boolcheck23 = true;
private bool bool25 = false;
private bool boolcheck25 = true;

```

```

private bool lastDilemmaAnswered = false;
public static bool night = false;
public static bool completedBool = false;
public static bool moveTruck = false;
public static bool moveCar = false;
bool uitleg16 = false;
bool uitleg21 = false;
bool uitleg23 = false;
bool uitleg25 = false;
bool uitlegDataAppend = false;

Scene currentScene;
string sceneName;
private

void Start()
{
    beginBool = true;

    //DontDestroyOnLoad(this.gameObject);

    currentScene = SceneManager.GetActiveScene();
    sceneName = currentScene.name;
    if (sceneName == "Main")
    {
        //isAvailable = true;
    }
    else if (sceneName == "HomeScene")
    {
        isAvailable = false;
    }

    //make new temporary string to be filled in by the voids
    rowDataTemp = new string[7];
    uitlegDataTemp = new string[4];
}

void OnTriggerEnter(Collider collider)
{
    //if the player is in dilemma location #16 for the first time
    if (collider.gameObject.tag == "Dilemma16" && boolcheck16 == true)
    {
        //bool16 so the question pops up via onGUI
        bool16 = true;
        boolcheck16 = false;
    }

    if (collider.gameObject.tag == "Dilemma23" && boolcheck23 == true)
    {
        //bool16 so the question pops up via onGUI
        bool23 = true;
        boolcheck23 = false;
    }

    if (collider.gameObject.tag == "Dilemma25" && boolcheck25 == true)
    {
        //bool16 so the question pops up via onGUI
        bool25 = true;
        boolcheck25 = false;
    }

    if (collider.gameObject.tag == "ArrivedHome")
    {
        print("Thuis. Nu valt de stroom uit. :(");
    }
}

private void OnTriggerExit(Collider collider)
{
    if (collider.gameObject.tag == "Dilemma23")
    {
        bool23 = false;
        boolcheck23 = true;
    }
    if (collider.gameObject.tag == "Dilemma25")

```

```

    {
        bool25 = false;
        boolcheck25 = true;
    }
}
private void Update()
{
    if (Input.GetKeyDown(KeyCode.Escape))
    {
        Application.Quit();
    }

    if (lightsOut.LightsOut && boolcheck21 == true)
    {
        if (lightsOut.sendData)
        {
            bool21 = true;
            boolcheck21 = false;
        }
    }

    if (lightsOut.isNight)
    {
        bool25 = true;
        boolcheck25 = true;
    }
    //placeholder trigger for saving stuff
    if (lastDilemmaAnswered)
    {
        //uitlegDataAppend = true;

        print("Laatste dilemma beantwoord!");
        //adding the temporary data to the actual data
        rowData.Add(rowDataTemp);
        string[][] output = new string[rowData.Count][];

        for (int i = 0; i < output.Length; i++)
        {
            output[i] = rowData[i];
        }

        int length = output.GetLength(0);
        string delimiter = ",";

        StringBuilder sb = new StringBuilder();

        for (int index = 0; index < length; index++)
            sb.AppendLine(string.Join(delimiter, output[index]));

        string filePath = getPath();

        StreamWriter outputStream = System.IO.File.AppendText(filePath);
        outputStream.WriteLine(sb);
        outputStream.Close();

        print("Toegevoegd aan CSV!");

        lastDilemmaAnswered = false;
    }

    if (uitlegDataAppend)
    {
        rowData.Add(uitlegDataTemp);
        string[][] output = new string[uitlegData.Count][];

        for (int i = 0; i < output.Length; i++)
        {
            output[i] = uitlegData[i];
        }

        int length = output.GetLength(0);
        string delimiter = ",";

        StringBuilder sb = new StringBuilder();

```

```

        for (int index = 0; index < length; index++)
            sb.AppendLine(string.Join(delimiter, output[index]));

        string filePath = getPathUitleg();

        StreamWriter outputStream = System.IO.File.AppendText(filePath);
        outputStream.WriteLine(sb);
        outputStream.Close();

        uitlegDataAppend = false;
    }
}

private void OnGUI()
{
    GUIStyle introStyle = new GUIStyle(GUI.skin.label);
    introStyle.alignment = TextAnchor.MiddleCenter;
    introStyle.normal.textColor = Color.white;
    introStyle.fontSize = 20;

    GUIStyle labelStyle = new GUIStyle(GUI.skin.label);
    labelStyle.normal.textColor = Color.white;
    labelStyle.fontSize = 20;
    labelStyle.stretchWidth = true;

    GUIStyle inputStyle = new GUIStyle(GUI.skin.textField);
    inputStyle.normal.textColor = Color.white;
    inputStyle.fontSize = 20;

    GUIStyle okStyle = new GUIStyle(GUI.skin.button);
    okStyle.normal.textColor = Color.white;
    okStyle.fontSize = 30;
    okStyle.alignment = TextAnchor.MiddleCenter;

    GUIStyle buttonStyle = new GUIStyle(GUI.skin.button);
    buttonStyle.normal.textColor = Color.white;
    buttonStyle.fontSize = 20;
    buttonStyle.alignment = TextAnchor.MiddleCenter;
    buttonStyle.stretchWidth = true;

    if (beginBool == true)
    {
        //label with dilemma question 16
        GUI.Label(new Rect(100, 180, Screen.width - 200, Screen.height - 400), introText, introStyle);

        //three answers that can be given. for each answer, that answer is saved in the temp. data string
        if (GUI.Button(new Rect(100, Screen.height - 300, Screen.width - 200, 200), "Klik hier om te beginnen!", okStyle))
        {
            beginBool = false;
            isAvailable = true;
        }
    }

    //boolean with purpose of "destroying" the gui elements after OK is clicked
    if (isAvailable)
    {
        //text next to the input boxes
        GUI.Label(leeftijdText, "Leeftijd:", labelStyle);
        GUI.Label(gebiedText, "Woon je in een \nstedelijk gebied?", labelStyle);
        GUI.Label(genderText, "Geslacht:", labelStyle);

        //input boxes
        leeftijd = GUI.TextField(leeftijdInput, leeftijd, 25, inputStyle);
        stedelijk = GUI.TextField(gebiedInput, stedelijk, 25, inputStyle);
        gender = GUI.TextField(genderInput, gender, 25, inputStyle);

        //if the button is clicked, the input will be saved in the temporary row data string
        if (GUI.Button(okButton1, "OK", buttonStyle))
        {
            rowDataTemp[0] = leeftijd;
            rowDataTemp[1] = stedelijk;
            rowDataTemp[2] = gender;

            //button is removed when OK is clicked

```

```

        isAvailable = false;
        print("Je bent een " + leeftijd + "-jarige " + gender + "!");
    }
}
//boolean is turned on in OnTriggerEnter
if (bool16 == true)
{
    uitleg16 = true;
    //label with dilemma question 16
    GUI.Label(okButton2, dilemma16, labelStyle);

    //three answers that can be given. for each answer, that answer is saved in the temp. data string
    if (GUI.Button(new Rect(x, y + h, w, h), antwoord16a, buttonStyle))
    {
        rowDataTemp[3] = a;
        bool16 = false;
        windEffect.fallen = true;
        moveTruck = true;
    }
    if (GUI.Button(new Rect(x, (y + 2.25f * h), w, h), antwoord16b, buttonStyle))
    {
        rowDataTemp[3] = b;
        bool16 = false;
        windEffect.fallen = true;
        moveCar = true;
    }
    if (GUI.Button(new Rect(x, y + 3.5f * h, w, h), antwoord16c, buttonStyle))
    {
        rowDataTemp[3] = c;
        bool16 = false;
        windEffect.fallen = true;
        moveCar = true;
    }
}
if (uitleg16)
{
    GUI.Label(new Rect(x - 120, y + 4.75f * h, w, h), "Uitleg keuze:", labelStyle);
    //input boxes
    openText16 = GUI.TextField(new Rect(x, y + 4.75f * h, w, h), openText16, 100, inputStyle);

    if (GUI.Button(new Rect(x, y + 6f * h, w, h), "OK", buttonStyle))
    {
        uitleg16 = false;
        string uitleg = "Vraag 16: " + rowDataTemp[3] + ". Uitleg: " + openText16;
        uitlegDataTemp[0] = uitleg;
    }
}

if (bool21 == true)
{
    uitleg21 = true;
    //label with dilemma question 16
    GUI.Label(okButton2, dilemma21, labelStyle);

    //three answers that can be given. for each answer, that answer is saved in the temp. data string
    if (GUI.Button(new Rect(x, y + h, 1.5f * w, h), antwoord21a, buttonStyle))
    {
        rowDataTemp[4] = a;
        bool21 = false;
    }
    if (GUI.Button(new Rect(x, (y + 2.25f * h), 1.5f * w, h), antwoord21b, buttonStyle))
    {
        rowDataTemp[4] = b;
        bool21 = false;
    }
    if (GUI.Button(new Rect(x, y + 3.5f * h, 1.5f * w, h), antwoord21c, buttonStyle))
    {
        rowDataTemp[4] = c;
        bool21 = false;
    }
}
if (uitleg21)
{
    GUI.Label(new Rect(x - 120, y + 4.75f * h, 1.5f * w, h), "Uitleg keuze:", labelStyle);

```

```

//input boxes
openText21 = GUI.TextField(new Rect(x, y + 4.75f * h, 1.5f * w, h), openText21, 100, inputStyle);

if (GUI.Button(new Rect(x, y + 6f * h, w, h), "OK", buttonStyle))
{
    uitleg21 = false;
    string uitleg = "Vraag 21: " + rowDataTemp[3] + ". Uitleg: " + openText21;
    print(uitleg);
    uitlegDataTemp[1] = uitleg;
}
}

if (bool23 == true && rowDataTemp[4] != null)
{
    uitleg23 = true;
    //label with dilemma question 16
    GUI.Label(okButton2, dilemma23, labelStyle);

    //three answers that can be given. for each answer, that answer is saved in the temp. data string
    if (GUI.Button(new Rect(x, y + h, 1.5f * w, h), antwoord23a, buttonStyle))
    {
        rowDataTemp[5] = a;
        bool23 = false;
        night = true;
    }
    if (GUI.Button(new Rect(x, (y + 2.25f * h), 1.5f * w, h), antwoord23b, buttonStyle))
    {
        rowDataTemp[5] = b;
        bool23 = false;
        night = true;
    }
    if (GUI.Button(new Rect(x, y + 3.5f * h, 1.5f * w, h), antwoord23c, buttonStyle))
    {
        rowDataTemp[5] = c;
        bool23 = false;
        night = true;
    }
}

if (uitleg23)
{
    GUI.Label(new Rect(x - 120, y + 4.75f * h, 1.5f * w, h), "Uitleg keuze:", labelStyle);
    //input boxes
    openText23 = GUI.TextField(new Rect(x, y + 4.75f * h, 1.5f * w, h), openText23, 100, inputStyle);

    if (GUI.Button(new Rect(x, y + 6f * h, w, h), "OK", buttonStyle))
    {
        uitleg23 = false;
        string uitleg = "Vraag 23: " + rowDataTemp[3] + ". Uitleg: " + openText23;
        print(uitleg);
        uitlegDataTemp[2] = uitleg;
    }
}

if (bool25 == true)
{
    uitleg25 = true;
    //label with dilemma question 16
    GUI.Label(okButton2, dilemma25, labelStyle);

    //three answers that can be given. for each answer, that answer is saved in the temp. data string
    if (GUI.Button(new Rect(x, y + h, 1.5f * w, h), antwoord25a, buttonStyle))
    {
        rowDataTemp[6] = a;
        bool25 = false;
        lastDilemmaAnswered = true;
        lightsOut.isNight = false;
    }
    if (GUI.Button(new Rect(x, (y + 2.25f * h), 1.5f * w, h), antwoord25b, buttonStyle))
    {
        rowDataTemp[6] = b;
        bool25 = false;
        lastDilemmaAnswered = true;
        lightsOut.isNight = false;
    }
}

```

```

        if (GUI.Button(new Rect(x, y + 3.5f * h, 1.5f * w, h), antwoord25c, buttonStyle))
        {
            rowDataTemp[6] = c;
            bool25 = false;
            lastDilemmaAnswered = true;
            lightsOut.isNight = false;
        }
    }

    if (uitleg25)
    {
        UILabel(new Rect(x - 120, y + 4.75f * h, 1.5f * w, h), "Uitleg keuze:", labelStyle);
        //input boxes
        openText25 = GUI.TextField(new Rect(x, y + 4.75f * h, 1.5f * w, h), openText25, 100, inputStyle);

        if (GUI.Button(new Rect(x, y + 6f * h, w, h), "OK", buttonStyle))
        {
            uitleg25 = false;
            string uitleg = "Vraag 25: " + rowDataTemp[3] + ". Uitleg: " + openText25;
            print(uitleg);
            uitlegDataTemp[3] = uitleg;
            uitlegDataAppend = true;
            completedBool = true;
        }
    }

    if (NightScript.itsNightText)
    {
        UILabel(new Rect(100, 100, Screen.width - 200, Screen.height - 400), "Het is nacht.", introStyle);
    }
    //making the answers in the upcoming string dependent on what the player chose
    if (rowDataTemp[3] == a) { answer1 = antwoord16a; }
    if (rowDataTemp[3] == b) { answer1 = antwoord16b; }
    if (rowDataTemp[3] == c) { answer1 = antwoord16c; }
    if (rowDataTemp[4] == a) { answer2 = antwoord21a; }
    if (rowDataTemp[4] == b) { answer2 = antwoord21b; }
    if (rowDataTemp[4] == c) { answer2 = antwoord21c; }
    if (rowDataTemp[5] == a) { answer3 = antwoord23a; }
    if (rowDataTemp[5] == b) { answer3 = antwoord23b; }
    if (rowDataTemp[5] == c) { answer3 = antwoord23c; }
    if (rowDataTemp[6] == a) { answer4 = antwoord25a; }
    if (rowDataTemp[6] == b) { answer4 = antwoord25b; }
    if (rowDataTemp[6] == c) { answer4 = antwoord25c; }

    completedText = "Goed gedaan! Je hebt het laatste dilemma van de demo gehad. Het verhaal gaat hier nog even verder, waarna de
    stroom weer aan gaat en het 'normale' leven weer verder gaat" +
    ", maar helaas zit dat niet in deze demo. Hieronder vind je een overzicht van de antwoorden die je gegeven hebt:" +
    "\n\nSituatie 1: Er hangt een boom schuim over de weg.\n Antwoord: " + answer1 +
    "\n\nSituatie 2: De stroom valt uit.\n Antwoord: " + answer2 +
    "\n\nSituatie 3: Check je bij je burens? \n Antwoord: " + answer3 +
    "\n\nSituatie 4: Blijf je thuis? \n Antwoord: " + answer4;

    if (completedBool == true)
    {
        //label with dilemma question 16
        UILabel(new Rect(100, 100, Screen.width - 200, Screen.height - 400), completedText, introStyle);

        //three answers that can be given. for each answer, that answer is saved in the temp. data string
        if (GUI.Button(new Rect(100, Screen.height - 300, Screen.width - 200, 200), "Klik hier om af te sluiten.", okStyle))
        {
            Application.Quit();
        }
    }
}

//finding the right file in the right map to save the data in a csv file
private string getPath()
{
    #if UNITY_EDITOR
        return Application.dataPath + "/CSV/" + "Saved_data.csv";
    #elif UNITY_ANDROID
        return Application.persistentDataPath + "Saved_data.csv";
    #else
        return Application.dataPath + "/" + "Saved_data.csv";
    #endif
}

```



```

#endif
}

private string getPathUitleg()
{
#if UNITY_EDITOR
    return Application.dataPath + "/CSV/" + "Saved_uitleg.csv";
#elif UNITY_ANDROID
    return Application.persistentDataPath + "Saved_uitleg.csv";
#else
    return Application.dataPath + "/" + "Saved_uitleg.csv";
#endif
}
}

```

DontDestroy.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class DontDestroy : MonoBehaviour
{
    // Start is called before the first frame update
    void Start()
    {
        DontDestroyOnLoad(this.gameObject);
    }

    // Update is called once per frame
    void Update()
    {
    }
}

```

Floater.cs

```

// Floater v0.0.2
// by Donovan Keith
//
// [MIT License](https://opensource.org/licenses/MIT)

using UnityEngine;
using System.Collections;

// Makes objects float up & down while gently spinning.
public class floater : MonoBehaviour
{
    // User Inputs
    public float degreesPerSecond = 15.0f;
    public float amplitude = 0.2f;
    public float frequency = 1f;

    // Position Storage Variables
    Vector3 posOffset = new Vector3();
    Vector3 tempPos = new Vector3();

    // Use this for initialization
    void Start()
    {
        // Store the starting position & rotation of the object
        posOffset = transform.position;
    }

    // Update is called once per frame
    void Update()
    {
        tempPos = posOffset;
        tempPos.y += Mathf.Sin(Time.fixedTime * Mathf.PI * frequency) * amplitude;

        transform.position = tempPos;
    }
}

```

```

    }
}

```

LightsOut.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class lightsOut : MonoBehaviour
{
    Light[] lights;
    float offIntensity = 0.1f;
    float nightIntensity = 0f;
    string emissionColor = "_EmissionColor";
    public static bool LightsOut;
    public static bool sendData;
    public static bool isNight;
    public static bool nightbool = true;
    public static bool rainStop;

    void Start()
    {
        sendData = false;
        StartCoroutine(Delay());
    }

    void Update()
    {
        if (CsvReadWrite.night && nightbool == true)
        {
            StartCoroutine(Night());
            nightbool = false;
        }
    }

    IEnumerator Delay()
    {
        yield return new WaitForSecondsRealtime(8);

        lights = GetComponentsInChildren<Light>();
        foreach (Light light in lights)
        {
            light.intensity = offIntensity;
        }
        GetComponent<Renderer>().material.SetColor(emissionColor, Color.black);
        LightsOut = true;

        yield return new WaitForSecondsRealtime(1);

        sendData = true;
    }

    IEnumerator Night()
    {
        yield return new WaitForSecondsRealtime(5);
        print("It's night!");
        lights = GetComponentsInChildren<Light>();
        foreach (Light light in lights)
        {
            light.intensity = nightIntensity;
        }
        GetComponent<Renderer>().material.SetColor(emissionColor, Color.black);
        LightsOut = true;
        rainStop = true;

        yield return new WaitForSecondsRealtime(10);

        lights = GetComponentsInChildren<Light>();
        foreach (Light light in lights)
        {
            light.intensity = offIntensity;
        }
    }
}

```

```

        GetComponent<Renderer>().material.SetColor(emissionColor, Color.black);

        print("It's morning!");

        isNight = true;
    }
}

```

NextLevelScript.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.SceneManagement;
using UnityEngine.UI;

public class NextLevelScript : MonoBehaviour
{
    bool isAvailable;
    bool nextLevel;
    Rect nextLevelButton;
    // Start is called before the first frame update
    void Start()
    {
        nextLevel = false;
        isAvailable = true;

        int x = ((Screen.width - 200) / 2);
        int y = ((Screen.height - 200) / 2);
        nextLevelButton = new Rect(x, y, 200, 200);
    }

    // Update is called once per frame
    void OnTriggerEnter(Collider collider)
    {
        if (collider.gameObject.tag == "Player")
        {
            nextLevel = true;
        }
    }

    private void OnGUI()
    {
        GUIStyle buttonStyle = new GUIStyle(GUI.skin.box);
        buttonStyle.normal.textColor = Color.white;
        buttonStyle.fontSize = 20;
        buttonStyle.alignment = TextAnchor.MiddleCenter;
        buttonStyle.stretchWidth = true;

        if (isAvailable)
        {
            if (nextLevel)
            {
                if (GUI.Button(nextLevelButton, "Klik hier om \n verder te gaan!", buttonStyle))
                {
                    SceneManager.LoadScene("HomeScene", LoadSceneMode.Single);
                    isAvailable = false;
                }
            }
        }
    }
}

```

NightScript.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class NightScript : MonoBehaviour
{
    new Light light;
}

```

```

//float offIntensity = 0.1f;
//float nightIntensity = 0f;
//string emissionColor = "_EmissionColor";
bool nightbool = true;
public static bool itsNightText = false;
// Start is called before the first frame update
void Start()
{

}

// Update is called once per frame
void Update()
{
    if (CsvReadWrite.night && nightbool == true)
    {
        StartCoroutine(Night());
        nightbool = false;
    }
}

IEnumerator Night()
{
    yield return new WaitForSecondsRealtime(5);
    print("It's night!");
    light = GetComponent<Light>();
    light.enabled = !light.enabled;
    //GetComponent<Renderer>().material.SetColor(emissionColor, Color.black);
    //LightsOut = true;
    itsNightText = true;
    yield return new WaitForSecondsRealtime(10);
    itsNightText = false;
    light = GetComponent<Light>();
    light.enabled = light.enabled;
    //GetComponent<Renderer>().material.SetColor(emissionColor, Color.black);

    print("It's morning!");

    //isNight = true;
}
}

```

PlayerMovement.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class playerMovement : MonoBehaviour
{
    float moveSpeed;
    void Start()
    {
        moveSpeed = 5f;
    }

    // Update is called once per frame
    void Update()
    {
        transform.Translate(moveSpeed * Input.GetAxis("Horizontal") * Time.deltaTime, 0f, 0f);
    }
}

```

RainSwitch.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class RainSwitch : MonoBehaviour
{
    AudioSource rainAudio;
    bool audioCheck1;
}

```

```

// float startVolume;

// Start is called before the first frame update
void Start()
{
    rainAudio = GetComponent();
    audioCheck1 = true;
    // startVolume = rainAudio.volume;
}

// Update is called once per frame
void Update()
{
    if (lightsOut.rainStop && audioCheck1)
    {
        StartCoroutine(FadeOut(rainAudio,1f));
        audioCheck1 = false;
    }
}

public static IEnumerator FadeOut(AudioSource audioSource, float FadeTime)
{
    float startVolume = audioSource.volume;
    while (audioSource.volume > 0)
    {
        audioSource.volume -= startVolume * Time.deltaTime / FadeTime;
        yield return null;
    }
    audioSource.Stop();
}

public static IEnumerator FadeIn(AudioSource audioSource, float FadeTime)
{
    audioSource.Play();
    audioSource.volume = 0f;
    while (audioSource.volume < 1)
    {
        audioSource.volume += Time.deltaTime / FadeTime;
        yield return null;
    }
}
}

```

TreeFall.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class TreeFall : MonoBehaviour
{
    public static bool deathScreen;
    GameObject[] playerRenderer;
    // Start is called before the first frame update
    void Start()
    {
        deathScreen = false;
    }

    private void OnTriggerStay(Collider collider)
    {
        if (collider.gameObject.tag == "Player")
        {
            StartCoroutine(DeathByTree());
        }
    }

    IEnumerator DeathByTree()
    {
        yield return new WaitForSecondsRealtime(0.7f);
        if (windEffect.isFallen)
        {

```

```

        deathScreen = true;

        //print("ja, die is dood");
    }
}

```

TruckMove.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class TruckMove : MonoBehaviour
{
    public Vector3 destination;
    public float duration;

    // Start is called before the first frame update
    void Update()
    {
        if (CsvReadWrite.moveTruck == true)
        {
            StartCoroutine(MoveOverSeconds(gameObject, destination, duration));
        }
    }

    public IEnumerator MoveOverSpeed(GameObject objectToMove, Vector3 end, float speed)
    {
        // speed should be 1 unit per second
        while (objectToMove.transform.position != end)
        {
            objectToMove.transform.position = Vector3.MoveTowards(objectToMove.transform.position,
end, speed * Time.deltaTime);
            yield return new WaitForEndOfFrame();
        }
    }
    public IEnumerator MoveOverSeconds(GameObject objectToMove, Vector3 end, float seconds)
    {
        float elapsedTime = 0;
        Vector3 startingPos = objectToMove.transform.position;
        while (elapsedTime < seconds)
        {
            objectToMove.transform.position = Vector3.Lerp(startingPos, end, (elapsedTime / seconds));
            elapsedTime += Time.deltaTime;
            yield return new WaitForEndOfFrame();
        }
        objectToMove.transform.position = end;
        CsvReadWrite.moveTruck = false;
    }
}

```

WindEffect.cs

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class windEffect : MonoBehaviour
{
    public float speed;
    public float maxRotation;
    public float startAngle;

    public static bool fallen;
    public static bool isFallen;
    public float fallDegree;
    //float FallTime;

    private void Start()
    {

```

```

        isFallen = false;
    }

    void Update()
    {
        if (!fallen)
        {
            transform.rotation = Quaternion.Euler(0f, 0f, -startAngle + maxRotation *
Mathf.Sin(Time.time * speed));
        }
        else if (fallen && !isFallen)
        {
            //transform.rotation = Quaternion.Euler(0f, 0f, fallDegree);
            StartCoroutine(FallingTree(Vector3.back * 50,0.7f));
            isFallen = true;
        }
    }

    IEnumerator FallingTree(Vector3 byAngles, float inTime)
    {
        Quaternion fromAngle = transform.rotation;
        Quaternion toAngle = Quaternion.Euler(transform.eulerAngles + byAngles);
        for (float t = 0f; t < 1f; t += Time.deltaTime / inTime)
        {
            transform.rotation = Quaternion.Lerp(fromAngle, toAngle, t);
            yield return null;
        }
    }
}

```

Appendix H: Unity Sources

Fence and alley door:	https://assetstore.unity.com/packages/3d/props/free-hut-pack-130776
Houses:	https://assetstore.unity.com/packages/3d/environments/urban/uk-terraced-houses-pack-free-63481
Roads, street signs, lampposts, bench:	https://assetstore.unity.com/packages/3d/environments/urban/low-poly-street-pack-67475
Rain and rain sounds:	https://assetstore.unity.com/packages/vfx/particles/environment/rain-maker-2d-and-3d-rain-particle-system-for-unity-34938
Furniture:	https://assetstore.unity.com/packages/3d/props/furniture/realistic-furniture-and-interior-props-pack-120379
Foliage:	https://assetstore.unity.com/packages/3d/environments/fantasy/green-forest-22762

Appendix I: End Evaluation Questions and Answers

Participant info: Student x1 / VRT-werknemer x3 / TXchange werknemer x1

Speler ervaring

1. Wat vond je van het spel?

“Ik zie niet wat de consequenties zijn van mijn keuzes. Het zou leuk zijn om iets visueels te zien.”

“Ik vond het leuk om te doen en om te ervaren hoe het voelt als dit je overkomt. De dilemma's voelde ik echt.”

“Het spel is nu nog heel beknopt. Ik kan heb dus ook weinig input, maar de essentie van het spel snap ik.”

“Het ziet er leuk uit. Je hebt het gevoel dat er iets gebeurd en je wordt gedwongen verder te gaan.”

“Ik miste iets van feedback na elke vraag over het gegeven antwoord. Het zou mooi zijn als je de consequenties ook laat zien. Bijvoorbeeld ‘Mijn buurman vond het fijn dat ik langs kwam’ als feedback, of iets dergelijks.”

2. Snapte je hoe je het spel moest spelen, zonder al te veel uitleg?

“Ik wist in eerste instantie niet dat ik kon lopen, en ik snapte niet helemaal waarom ik die data aan het begin moest invullen.”

“Ja.”

“Ja, duidelijke instructies.”

“Ja.”

“Het is nog niet helemaal duidelijk waar je heen moet en wat het doel is. Ik kan ook niet naar buiten, maar ik wilde wel langs de buurman. Je moet ook rekening houden met niet-gamers. Je kan iets simpels als ‘loop gewoon rond, je komt vanzelf dingen tegen’ toevoegen.”

3. Wat vond je leuk aan het spel? En wat niet?

+ :

“Het geluid, daardoor voelt de situatie echter aan. Ik was niet overprikkeld, ik was niet met oninteressante dingen bezig. Ook vind ik het gebruik van een toetsenbord fijn dan de joystick die wij wel eens gebruiken bij testjes. Fijn dat er geen tijdsdruk was.”

“Het gebruik van verschillende media. Vertellen, zien, horen.”

“Hoe het er uit zag was mooi, het geluid ook. Waar andere serious games wat statischer zijn, is dat hier niet zo en is de vormgeving mooi. Ik vond het ook leuk dat je kon rondlopen.”

- :

“Er was een klein technische dingetje waarbij ik niet makkelijk om het huis heen kon lopen.”

“Als iemand die gamet zijn de controls logisch, maar voor iemand van 80 zal het een stuk uitdagender zijn. Je zou het poppetje ook kunnen laten bewegen met een muisklik op de plek waar je heen wil. Een game zou ook echt een spelelement moeten hebben, maar dat heb ik nog niet echt geproefd. Tips aan het eind zouden handig zijn. Je kan je zo als burger voorbereiden. Een mooi doel zou dus ook zijn om de zelfredzaamheid van de speler te stimuleren.”

“De dilemmas zijn wel erg afgesloten. Je kunt geen onbekende reacties vinden zo.”

“Ik vond het jammer dat ik met een mannetje moest spelen, terwijl ik wel had aangegeven vrouw te zijn. Dat zou anders moeten in de uiteindelijke game.”

4. Voelde je je mentaal betrokken bij de situatie van het scenario?

“Ik vond het tekstje aan het begin te lang, dus die heb ik niet gelezen. Daardoor had ik te weinig introductie en was ik dus niet zo betrokken bij de situatie.”

“Ja, maar ik ben het ook wel gewend om scenarios te spelen. Het is wel een reëel scenario.”

“Ja, het is een reëel scenario. Je wordt getriggerd om na te denken.”

“Ja, ik denk het wel door de verschillende media. Ik had trouwens het idee dat het binnen harder regende dan buiten. Het klonkt voller, dus dat zou ik wat zachter zetten.”

“Ja, ik had het gevoel dat ik er in zat.”

5. Voelde het alsof je zelf in de situatie zat, of dat je speelde als iemand anders die het scenario meemaakte?

“Ikzelf, maar het feit dat ik hulpverlener ben speelt daar denk ik wel in mee.”

“Je betreft het snel op jezelf, dus ja.”

“Allebei wel. Het voelde alsof ik in die situatie zat, maar ook alsof ik met een avatar speelde. Het was ook een apart uitziend mannetje, maar dat zou je kunnen veranderen aan de hand van input van de speler.”

“Toch iets meer dat ik iemand bestuurde.”

6. Was je gemotiveerd om het hele spel af te maken? Waarom denk je dat je deze motivatie had? (Nieuwsgierigheid naar wat het verhaal zal brengen? Lag het ergens anders aan?)

“Ja, en ik voelde ook een cliffhanger aan het eind: ik wilde naar buiten, maar dat gebeurde niet. Misschien is het leuk om muziek op de achtergrond te zetten die past bij de sfeer die je wil creëren.”

“Ja, door de echtheid en de tijdsplan die van tevoren bekend was. Het is een reëel, goed te doen spel.”

“Ja, maar het moet wel interessant blijven. Ik vind dit soort onderwerpen interessant, dus nieuwsgierigheid is wel de reden denk ik ja.”

“Ja, ik had het gevoel dat ik invloed, vooral bij het eerste keuzemoment. Zo’n soort van open wereld helpt wel, maar men verwacht meer vrijheid bij die open ruimte, dat je ook daar iets kan doen. Je zou hier meer feedback kunnen geven of zelfs informatie van de speler verzamelen. Op de weg lopen is bijvoorbeeld niet veilig. In de berm kun je uitglijden door het natte gras en er is ook kans op omvallende bomen daar. Waarom lopen mensen daar dan toch? Dit gedrag kan je observeren zonder er een dilemma van te maken. Als men dat doet, is dat dan bewust of onbewust? Hetzelfde zou je kunnen doen bij ramen als je al binnen bent, wegblijven van de ramen is dan misschien verstandig. Daarbij vraag ik me ook af of mensen stekkers er uit trekken als de stroom uitvalt. En wat doen ze dan om te checken of de stroom het weer doet? Je wil in ieder geval de vrijheid en reactie opties uitbreiden. Je zou het ook compleet open kunnen houden. Bijvoorbeeld: Je bent buiten en moet naar huis, maar onderweg is er van alles waarmee je kan interacteren. Wat doet men dan? Je krijgt meer vrijheid zo. Je zou dan bij de stroomuitval een metertje in kunnen bouwen voor honger/dorst. Een optie “anders” zou ook goed zijn. Ook zou je zelfredzaamheid kunnen stimuleren door meer opties mogelijk te maken aan de hand van antwoorden die eerder door andere spelers gegeven zijn: deze data verzamelen en het spel rijker maken en men hun gedrag misschien zo aanpast door te leren van anderen. De vraag is dan natuurlijk of men zelfredzamer wordt door reacties van anderen, of juist niet.”

“Ja, ik vond het jammer dat het zo snel afgelopen was. Dat kwam inderdaad door de nieuwsgierigheid: wat gebeurt er nog meer?”

7. Kon je je relateren aan de dilemma’s, het scenario en/of de game als geheel?

“Ik vond het interessant om te zien wat je in een split second zou doen. Door dit te zien merk ik dat ik beter nadenk over mijn keuzes en zou ik het ook anders aanpakken mocht de situatie zich in het echt voordoen.”

“Ja, want het kan écht gebeuren en ik heb geen moment gedacht dat ik het niet zelf kon zijn.”

“Ja, het zijn realistische scenarios.”

“Ja, ze waren realistisch. Ik zou wel de informatie die gegeven werd aan het begin van de demo behoorlijk inkorten. Dit hoeft ook niet persé met een supermarkt te maken te hebben. Het verhaal zou ook in de supermarkt of daar vlakbij kunnen zijn: Ga je dan de supermarkt in als het weer ineens omslaat of ga je naar huis? Halen mensen ook eten voor hun burens in geval van nood?”

“Ja, al had ik wel 112 willen bellen ná de boom op de auto viel. Dat kan niet. Ik dacht op een bepaald moment ook ‘heb ik daadwerkelijk genoeg spullen in huis?’ Er zit ook wel een stukje bewustwording in.”

8. Heb je het idee dat het verhaal van de game rond is? (rustig begin, spannend in het midden, rustig einde)

“Het zou mooi zijn als je nog een dilemma zou hebben dat zich afspeelt als de stroomstoring al een dag bezig is. Ik kies expres niet voor de telefoon optie, want ik wil zuinig zijn op mijn batterij voor het geval dat ik ‘m echt lang niet kan opladen. Ik zou ook de straat op gaan om te kijken of anderen weten waar noodstroom te halen valt. Dat zou je misschien nog kunnen verwerken in een dilemma.”

“Ik zou het wel interessant vinden als het te zien is wat er met de buurman aan de hand is als je kiest om bij hem langs te gaan. Consequenties van keuzes dus, en andere gevolgen bij andere keuzes om het verhaal uit te breiden.”

“Nog niet helemaal duidelijk, daarom zijn consequenties ook heel belangrijk denk ik.”

9. Zou je het spel spelen als het in-game scenario langer was en het spel online te vinden was?

“Nee, daar ben ik te eigenwijs voor denk ik. Ik vind dat mijn keuzes al goed genoeg zijn en ik hoef daar niet persé de VRT mee te helpen. Uit nieuwsgierigheid zou ik het wel spelen als het ergens aangekondigd werd. Ook ben ik wel benieuwd wat er gebeurt als ik juist de verkeerde keuze maak.”

“Ik ben echt geen gamer, dus nee. Als je het vraagt als vorm van e-learning, dan wel. Het nodigde wel uit om meer te doen, verder te spelen. Ik zou het spel ook spelen als het niet voor mezelf was, maar voor de VRT alleen.”

“Als ik het spel niet aangereikt zou krijgen, zou ik er niet aan beginnen. Dus je zou het moeten promoten met een campagne of een folder door de brievenbus of iets dergelijks. Ik zou er in ieder geval niet naar op zoek gaan. Wil je het gebruiken, dan moet je het actief aanbieden.”

“Hangt af van de communicatie, maar het zegt alleen niks over het spel want die heb ik dan nog niet gezien. De demo is goed genoeg als reaser om het uiteindelijke spel te spelen.”

“Ik zou er wel echt naar streven om twee doelen te hebben. Één voor de VRT en één voor de burgers. Zelfredzaamheid stimuleren en ook nog data daar uit halen. Ik zou het spel niet spelen puur om de VRT te helpen, dus echt actief werven zal wel nodig zijn.”

10. Denk je dat het toevoegen van een “zelfredzaamheidsscore” op basis van je gegeven antwoorden, waarvan je van tevoren zou weten dat je deze score zou ontvangen, je meer motivatie had gegeven om het spel te spelen?

“Ik denk het wel, maar dan zou ik het meeste gewilde antwoord geven en niet persé mijn echte antwoord. Ik zou het spel dan één keer voor het echie spelen, één keer om de perfecte score te behalen en één keer om juist alles fout te doen. Consequenties laten zien zou hier ook bij kunnen helpen misschien.”

“Nee, niet echt. Minimaal. Ik weet van mezelf ook wel dat ik zelfredzaam ben.”

“Als het in kaart brengen van zelfredzaamheid het doel is, dan niet. Als het doel is de burger laten testen hoe zelfredzaam ze zijn, dan wel. Maar als ik dan een score krijg, dan wil ik ook tips en tricks over waarom ik een bepaalde score behaald heb en hoe ik die zou kunnen verbeteren.”

“Ja, maar dan moet je wel oppassen dat ze geen ander gedrag zouden vertonen dan normaal. Dit kan je relateren aan wat het doel en de intentie van de speler is. En je zou kunnen checken of het de eerste keer is dat een speler het spel speelt.”

“Als het doel is dat ik er van leer, dan wel. En dan in combinatie met feedback per vraag. Maar score toevoegen is wel lastig, misschien is alleen feedback wel voldoende. Soms zijn meerdere keuzes ook wel goed, maar heeft het andere gevolgen.”

Dilemma-specifieke vragen

11. Wat vond je van de dilemma's? Denk je dat de antwoorden op de vragen interessant (kunnen) zijn voor de VRT?

“Het zou mooi zijn om te laten zien waarom je moet luisteren naar een NL-alert of iets dergelijks. Dat je bijvoorbeeld hier de consequentie laat zien waardoor ik ga denken ‘was ik maar binnen gebleven’.”

“Ik vond ze interessant en denk ook dat de vragen interessant zijn voor de VRT. Gaan mensen elkaar helpen of niet? Bellen mensen 112 of niet? Erg interessant denk ik.”

“Ja, het is interessant om te weten waarvoor men 112 belt, sommige mensen bellen echt om niks.”

“Ik twijfel een beetje. De situaties zijn realistisch, maar doordat de antwoorden gesloten zijn haal je er geen nieuwe opties/inzichten uit. Je zou gevolg vragen kunnen stellen. In het geval van de boom moest je 112 bellen, maar met sub-vragen en antwoorden kun je beter uitvinden waarom.”

“Het hangt wel af van de vormgeving van de situatie, maar over het algemeen vond ik de dilemma's goed.”

12. Denk je dat deze manier van zelfredzaamheid meten/peilen een manier is die goed kan werken om de gewilde informatie te achterhalen?

“Ik denk dat het een goede manier is, ja. Ik weet niet of het de beste manier is. Je zou eventueel nog de dilemmas onder tijdsdruk kunnen zetten, maar dat was bij deze situaties ook niet reëel geweest, want in het echt zou je bij deze specifieke dilemmas ook wel de tijd hebben.”

“Het maakt het interessanter dan een enquête, dat gevoel dat je in een scenario zit.”

“Ik denk het wel. Data verzamelen die je niet weet is wel lastig, dus ik denk je meer antwoordopties moet geven, waarbij andere input verzamelen zou kunnen helpen.”

“Ja, ik denk van wel.”

13. Wist je van tevoren wat er voorafgegaan is aan de situatie waarmee het spel begon?

“Ja, dat was wel duidelijk.”

“Ja, helder.”

“Ik vond het te veel informatie. Ik ga ervan uit dat er dingen staan die automatisch belangrijk zijn. Zelf zou ik het wat subtieler opschrijven: ‘Je bent onderweg naar de supermarkt, maar je werd overvallen door het weer.’ Zoiets. Dingen over code rood erin zitten verandert niet zo veel, het beeld maakt ook wel duidelijk dat het weer slecht is. Je zou de tekst kunnen gebruiken om het doel beter duidelijk te maken aan de speler.”

“Nee, de intro had te veel tekst, heb het alleen snel gescand zodat ik snel kon beginnen met spelen. Die tekst had korter moeten. Denk dat ik niet de enige zal zijn die snel op play wilde drukken.”

14. Waren de vragen uitdagend om te beantwoorden? Waar lag dit aan?

“Ja, ik moest wel echt goed nadenken.”

“Ja, maar ze moeten ook niet te complex zijn, of over iets gaan waar een groot grijs gebied is. Het zijn nu simpelere, heldere vragen en ik denk dat je dat zo moet laten.”

“Het waren wel dilemmavragen, dus ik moest wel even nadenken. Ik mist soms wel de optie “ik doe niks” voor als je denkt dat het zo wel opgelost zal zijn en je denkt niks te hoeven doen. Ook vond ik het wat te donker voor overdag, waardoor ik NU al licht wilde hebben terwijl de enige optie was om het voor vanavond alvast te pakken.”

“Moest wel even nadenken. Bij de laatste vraag was het logischer geweest om maar twee antwoorden te hebben (thuis blijven/huis verlaten)”

15. Heb je naar eigen inschatting de vragen beantwoord met de reactie die je ook in het echt zou hebben? Of heb je meer sociaal wenselijk geantwoord?

“Ja, ik heb het gespeeld alsof ik het zelf was, dus dan doe ik ook wat ik vind wat ik moet doen.”

“Lastige vraag. Maar het zijn wel reacties die ik echt zou doen ja. Met open antwoorden kom je er sowieso niet. Men kiest het antwoord wat het best bij hun past.”

“Ik zou eerder zelfredzamer handelen dan de opties die ik kreeg. Passief en actief zat erin, maar pro-actief niet. Dat zou ik doen.”

“Ik zou niet twee hele dagen in m’n huis blijven zitten. Ik wil af en toe wel het huis uit.”

16. Heb je iets geleerd van het spelen van de game? Over jezelf, zelfredzaamheid, of iets anders?

“Nee, niet iets dat ik niet al wist, maar ik heb dan ook veel ervaring met crises.”

“Was het een beetje te kort voor. Er waren ook geen tips en tricks.”

“Nee, je zou kunnen terugkoppelen wat anderen hebben gedaan in het spel, ter vergelijking. Ook zou je de wenselijke acties sterker terug kunnen laten komen om het gewenste resultaat bij de speler op te wekken. Je kan duidelijk laten zien dat je keuzes invloed hebben, ook al hebben ze dat misschien niet echt: ‘Oh je helpt hem niet? Hij zal het onthouden!’ Het impliceren geeft al stof tot nadenken.”

“Ik ben al dagelijks met dit onderwerp bezig, dus nee.”

17. Op welk apparaat denk je dat het spel het beste geschikt is, ook kijkende naar bereik en speelgemak?

“Laptop is oké, maar tablet is misschien beter. Of telefoon. Ik doe daar heel veel mee dus dit spel zou daar ook goed voor zijn. Even op de bank zitten, wel zo makkelijk. Maar echt voor gaan zitten is misschien motiverender.”

“iPad of laptop, iets met een groot scherm in ieder geval.”

“iPad of tablet, speelt relaxter en is toegankelijker voor een breder publiek.”

“iPad, telefoon is te klein en ik zit thuis nooit achter de pc. iPadje op de bank, lekker gemakkelijk.”

18. Heb je suggesties voor verbeteringen of aanpassingen van de game?

“Ik miste nog een vraag na de twee dagen zonder stroom. Het wordt koud bijvoorbeeld. Winkels zullen dicht zijn, dus hoe doe je het dan met eten en drinken? Wat doe je als het écht lang duurt?”

“Niet iets wat ik niet al eerder genoemd heb. Gebruiksvriendelijkheid voor mensen die games minder gewend zijn is wel iets om te onthouden.”

“Ik zou beschrijven hoe je het kan koppelen aan social media, dat is goed voor de promotie. Denk na over hoe de VRT de data wil ontvangen, bijvoorbeeld een wekelijks mailtje met de interessante data of een soort dashboard.”

19. Wat voor cijfer zou je het spel geven?

“8.”

“Moeilijk. Ik vind het wat te kort om een cijfer te geven. Ik snap het doel, maar het zou wat mij betreft eerst compleet moeten zijn.”

“8 voor een eerste prototype.”

“8, ziet er goed uit, het is realistisch. Dingen kunnen wel beter, maar het is nog in ontwikkeling. Zoiets als dit hebben we echt nog niet, het is veel echter dan alles wat we nu hebben. ”

20. Heb je nog vragen/opmerkingen of andere dingen over het spel, deze playtest, of dit interview?

“Nee, het is echt wel leuk. Ik denk dat als meer mensen het spelen en dus de vragen invullen je wel echt een inzicht kunt krijgen in zelfredzaamheid. Misschien is het handig om te weten wat het beroep van de speler is. Ik kan namelijk de keuze maken dat ik m’n telefoon gewoon uit zet en alleen aan zet als het nodig is, maar een 19-jarige misschien niet.”

“Ik zou een architectuurtje verwachten van de back-end, wat er met de data gebeurt.”

“Nee, heb weer een beetje motivatie gekregen om weer met zelfredzaamheid bezig te gaan!”