Final report

Team Kroket

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Irene van der Blij	ivanderblij	4385691
Jochem Heijltjes	jheijltjes,	1534041
Mayke Kloppenburg	mlkloppenburg	4383265
Alan van Rossum	alanvanrossum	4293932
Harvey van Veltom	hvanveltom	4350073

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1. Introduction

Over the last years the computer game industry has gotten very large. Take for example the video game industry of the United States; this is one of the fastest growing sectors. As can be imagined, the task of creating an appealing game is at the crossroads of creativity and technology, which is why game design and development is such a complex and challenging endeavor.

Team Kroket, a group of five Computer Science students at Delft University of Technology, was ready to take on this challenge. During ten weeks Team Kroket has been designing and building a fully functional game prototype, which smartly uses relatively low-budget technology, in order to smoothly and effectively provide unique gameplay.

It is a very interesting and attractive challenge to devise ways of collectively entertaining a group of colocated people. Team Kroket overcame this challenge by developing a Virtual Reality based game for the Oculus Rift and Android Smartphones, called Escaparade. A more detailed overview of the game can be found in chapter 2.

During the development of Escaparade, Team Kroket was focussed on meeting the end-user's requirements. First of all, in order to meet these requirements, the game should have an intuitive interface. Games without this are often seen as less enjoyable, so it should be clear how to interact with the game. Secondly, the game needs an appealing storyline. This will create a rich space for the players to explore. In addition it is important that the game is challenging. It has been shown that challenging games allow players to be more engaged and immersed in the game. The last end-user's requirement has to do with the realism of the game. The realism is important for the controller naturalness of the player. It also increases the immersion and thereby the enjoyment of the players.

The coming sections of this report will show how the developed product meets these end-user's needs, by describing and reflecting on the software product and process.

2. Overview software product

In this chapter an overview of the developed and implemented software product will be given. First the storyline will be discussed, after which it is discussed how the storyline is realized with the hardware devices. Lastly, a very high-level overview of the software will be given.

2.1 Storyline

Escaparade is played by three players, who are a group of CIA agents. Their current case is the investigation of the disappearance of their fellow agent and colleague. Two of the agents are currently in the CIA headquarters, the other agent is following a lead in the woods… but suddenly he gets knocked unconscious. When he wakes up, he is locked in a dark, scary room. Deadly gas is slowly filling up the room. The gas will completely fill the room in fifteen minutes; a timer starts. Luckily, the locked up agent still has his earpiece, and is able to communicate with the two other players at the CIA headquarters.

2.2 Hardware devices

The agent that is locked up is the player wearing the Oculus Rift. Through the Oculus Rift he sees the room in which he is locked up. This player also has an Xbox controller, with which he can move through the room and interact with the objects present in the room by pressing the A button. The two agents at the headquarters have a mobile phone with an app on which they can play the game. The main idea is that the Oculus Rift player looks for clues by interacting with objects in the room. Specific objects will trigger a minigame for the Oculus Rift player, as well as on the mobile applications. The players have to solve the minigame together, and when it is completed, the game progresses, for example a safe with new clues opens or new objects can be interacted with. When all minigames have been completed successfully, the Oculus Rift player will be able to open the door and escape the room.

2.3 Software

In order to implement the game described above, three separate repositories were used. First of all we have the mobile application, which was developed in Android Studio. This software mainly consists of minigames which the mobile players can play (when triggered). Second of all, we have the software on which the Oculus Rift player runs the game. This software is mainly responsible for showing the scenes in the Oculus Rift as well as the minigames for the Oculus Rift player. The jMonkey Engine framework was used for developing this. Lastly, the systems mentioned above must be able to communicate with each other. For this a server is used. All players, mobile and Rift, can connect to the server and send and receive messages from the server.

3. Reflection product and process

In this chapter there will be reflected upon the product and process of the Escaparade game. The entire team has incorporated the strategies and tricks they learned in software engineering in this project. How and what will be laid out here.

3.1 Product

When reflecting upon the code of the product from a software engineering perspective, there are some parts to be found that could be up for improvement.

3.1.1 Repositories

The first thing that stands out are the multiple repositories used for this project. It was decided tp split the code into three parts which would be stored on three repositories. One for the VR client, one for the android application and one for the host. This was done so that team members could contribute to different parts of the code simultaneously and to make sure different forms of code were on different repositories.
However, the result was that new features would still have to be implemented on each of the three parts, thus requiring a new branch in every repository, rather than just a single branch. This was counterproductive and may not have been the best decision.

3.1.2 Modular Programming

Second of all, more thought should have gone into thinking about the responsibilities of classes before they are written. This would have avoided huge classes that would later have to be refactored multiple times. Programming modularly could have both created separated functionality as well as saved countless hours of refactoring that could be better spent on other parts of the product.

3.1.3 Design Patterns

Furthermore, using design patterns should have been done more naturally. For example, a model-viev-controller pattern would probably have worked well, and would have ensured structure in the code. Discussion for which design patterns to use was started too late into the project, and resulted in just a few patterns being used, like the state pattern for deciding what to do in which state of the game.

3.2 Process

A lightweight, agile methodology called scrum has been used by our team. This means the team has been working in iterations. Typically iterations in scrum are one or two weeks long. It was clear that for a project of only 10 weeks, one-week-scrums would suit the most. This helped the team to continuously adapt its plans to generate as much value as possible in this relatively short timeframe. The process can be broken down to three core activities of software engineering: Specification, development and validation.

3.2.1 Specification

The beauty of scrum lies in its dynamic approach. Initially, the team was given a broad and general game specification, that included the core features the game should have. This included using the Oculus Rift, being a local multiplayer game and using additional technologies like a smartphone or a gamepad. This lead to the initial gameplan which was pitched to the stakeholders after just a week. Feedback was received and lead to big changes in the initial design of the game.
This is just one example of feedback the team has been receiving every week, which resulted in a game that suits most if not all of the stakeholders needs.

3.2.2 Development

Every friday the team has come together for a weekly scrum. A weekly scrum is a meeting with the entire team, in which the team talks about what has been done and what must be done, and the problems that were encountered.
A backlog is written which includes all taks to be done in the following week, and the members responsible for each task. Additionally, the backlog from the last week is reflected upon, and the results of this reflection are noted in a retrospective document along all problems encountered. All tasks that were not completed in the last sprint and are still valid for the product are pushed on to the next backlog.
Proper use of the scrum methodology ensures proper teamwork, high efficiency, structured organization and a beautiful outcome.

3.2.3 Validation

Two manners of validation have been used to guarantee the software meets all of the specified requirements. Firstly, unit tests with mocks and spies have been used to tackle most faults and bugs in the game. Secondly, manually testing of the software every sprint has guaranteed the last working version is actually working the way intented. This manual testing is not only done by the team, but also by users from outside the team. More about this can be found in chapter 5: Interaction Design.

4. Functionalities

In this chapter all major functionalities that are part of Escaparade will be described. The first subsection will be about Oculus Rift virtual reality glasses. The second component of the game is the mobile app. Escaparade is a multiplayer game, how this works is described in the next subsection. In the fourth subsection the networking protocol in this game will be elaborated.

4.1 Oculus Rift support

The Oculus Rift is a virtual reality system giving the user an immersive experience in virtual worlds. Escaparade was designed and built for the Oculus Rift. The Oculus Rift headset should be operated from a Windows powered computer. The Oculus Rift registers the movements of its wearer, allowing him or her to control their character in the virtual world. Using the Rift to look around and a gamepad to move, the player has full control over the vision and movement of the character.

4.2 Mobile App

Escaparade has support for mobile devices running the Android operating system. Currently any Android device running Android 4.0 or later is supported. The Mobile App starts one of the minigames when it is instructed to by the gamehost. The application features six distinct minigames, two of which can be played at all time to obtain bonus time for the player in the room, and 4 of which apply to the main storyline of the game. As the game progresses all these four games will be automatically started sequentially.

4.3 Cooperative multiplayer

Escaparade is a local cooperative multiplayer game, supporting three players. One player should be wearing an Oculus Rift while the other players are using the Mobile App. All players have to communicate and cooperate in order to achieve the final goal of the game: help the player wearing the Oculus Rift headset escape from the room. Communication is done in two ways: through verbal communication, and through receiving commands in the game. Initially interacting with objects in the virtual world will start minigames on the Mobile App. Then, to solve these minigames, players need to converse to obtain a solution to the minigame.

4.4 Networking protocol

The networking protocol of Escaparade is human-readable. This makes it very easy to understand, troubleshoot and expand. As only events are exchanged between the components, the network overhead is limited. TCP is used to send these messages between the server and the clients.

4.5 Gamehost

All clients (the VR client and the Mobile apps) connect to a host. This host is responsible for the course of the game, and decided which messages to send through at which times. It does so by using a state pattern. When receiving a message from any client, such as the command to start a minigame on the mobile application, it decides whether this is a valid command in the current state. This ensures you can’t start the same minigame over and over, and makes sure you need to complete all minigames before you’re able to complete the game as whole.

5. Interaction design

This chapter will discuss the human-computer interaction of the developed software product. First the method used will be discussed, followed by the obtained results. Finally a conclusion will be drawn and a discussion about the product will be given.

5.1 Method

This section will explain what information Team Kroket wanted to obtain from the research, and which procedure and techniques they used to obtain this information. A description of the people who tested the product will also be given.

5.1.1 Research goal

In order to make a successful software product, it is very important to know and understand how users experience the product. As a developer you are often not aware of the difficulties users will encounter when using the software product, and therefore it is very important to collect data on this. In the case of the software developed by Team Kroket, a game for the Oculus Rift and two Android device players, Team Kroket is very interested in how users rate the usability of the game and if the game meets the user's needs on this area. This includes finding out whether users find the interface intuitive, whether they find the storyline appealing and immersive, whether they find the game challenging enough or too hard, and whether they are content with the game's realism. A more detailed explanation of why these aspects are chosen to do research on can be found in appendix A.

5.1.2 Player test procedure

In order to find out how users experience the game, player tests have been done. One player test consists of three players (since the game is played with three players). First of all the roles (Oculus Rift player or Android Phone player) will be divided amongst the three testers. Now the game can just be started and the testers will play the game.

5.1.3 Data collection method

Two methods were used for the collection of data on the player tests. During the player tests all developers in the team were present and actively observing how the test players tackled the game. This was a very appropriate method, because of the multiplayer nature of the game. All players are in the same room and can therefore easily communicate. When players have remarks or do not understand something they just ask their fellow player tests about this. This resembles the think aloud method, and proved to be very useful in finding out where players had difficulties with the game. The second method we used was an interview after the players tested the game. We chose this method because our number of testers is relatively low, and we wanted to be able to go in depth when doing the questioning.

5.1.4 Description testers

For the player tests, we wanted the testers to fall into the target audience of the game. The target audience of Escaparade consists of people from the age of 16 up to 50 years old, who like cooperative games where puzzles have to be solved. A more detailed description of the target audience can be found in appendix B. Most of the test players were friends or siblings of Team Kroket. The average person in this group was aged 25, liked cooperative games and had no specific interest in puzzles (but also no negative attitude towards puzzles).

5.2 Results

The overall attitude towards the game was positive, and all test players said they had fun during the testing of the game. While observing the test players, however, it became visible that at some points the game was not as intuitive as was originally thought. This became most apparent by a minigame for the mobile players where the players were supposed to tilt their phones in order to move a ball in the corresponding direction. Many players had their phone laying on a table, and therefore did not notice the ball moving when the phone moved. Apart from this, the interface and actions that the players had to execute were quite intuitive, and the players were able to play the game from beginning to end. The storyline, which is explained to the players in a small video at the beginning of the game, was clear to all the players. However, during the interviews, we did get a lot of remarks that the mobile players are less in the loop about the progress of the storyline and also that the mobile players are less immersed in the game. The realism for the Oculus Rift player was perceived as very high, the realism for the mobile players was perceived as quite low. Almost all test players were in agreement that the game was challenging; not too hard and not too easy. There were, however, remarks about two minigames which were mentioned by a lot of testers. In the first minigame, the players have to crack a code by matching numbers to the alphabet. Many players said that they would have liked to have paper and pen for this minigame. In the third minigame, the mobile players get shown a color sequence, by colors appearing on their screen after each other (players can restart the sequence as often as they want). One remark that was given many times was that the sequence was shown too fast, and that it was too hard to make out all colors in the sequence.

5.3 Conclusion and discussion

On a whole we can conclude that the usability of the software product is adequate, but can still be improved. The interface is already quite intuitive, and players know what to do in order to win the game. The intuitivity could be improved by adding more information about how to tackle the game in some placed. For example, the minigame described above where players have to tilt their phone should first give information to the player about how to play the game before they can start. The storyline and realism for the Oculus Rift player were already very good according to the test players. These aspects do, however, need improvement for the mobile app players. This can be done by displaying more feedback in the app about the progression of the game. Lastly, we can conclude from the player tests that the game is challenging enough. This aspect could be improved even further by taking

into account the feedback from the testers. This would mean that for the first minigame, which is described in the previous section, a view could be created in the app where players can draw and write. This can then be used as a notepad, which eliminates the need for pen and paper. The third minigame, where the color sequence was shown too fast, can be improved in the following manner. When the sequence is first shown it goes very fast. However, as time passes, the sequence is shown slower and slower, so that in the end everyone can make out all the different colors (but against the cost of using more of your time).

The player tests have shown that the game is fully playable from beginning to end. In addition, the players thought the interface was intuitive and the game was challenging and fun to play. Taking into account all the information given above, the final conclusion is that the software product's usability is adequate, but can be improved by incorporating the feedback of the test players into the game.

6. Product evaluation

This section contains the product evaluation. The goal of the product evaluation is to test if the game satisfies the customer needs. These needs are described in appendix A. First the individual functional modules will be evaluated and then an evaluation of the product as a whole. The section will also contain a failure analysis which describes where the product does not perform as intended.

6.1 Method

The method used to evaluate the functional modules and the product as a whole will be a checklist based on the customer needs described in appendix A. For each module and the product as a whole an evaluation will be made of if the module satisfies the checklist and if not a reasoning for why this wasn't achievable or necessary. The checklist is as follows.

1. Is it clear how the player interacts with the functionality and Is the interface clear?
2. When starting the game does a menu show up with clearly indicated options?
3. Is the hardware used in a for the player intuitive way?
4. Is the story told in such a manner that the players are motivated to complete the game?
5. Are the puzzles challenging enough for the players?
6. Does the game achieve the needed immersion?

6.1.1 Mobile application

1. At the start of the game the mobile player will receive a player which not only describes the story but also the setup of the game and the role the mobile client plays in the game. This ensures that it is clear to the mobile player what he needs to do to complete the game. Also every activity in the mobile application has buttons with a clear description as well as a message that explains the activity. All these elements assures that the mobile player knows how to interact with the mobile application and that the interface is always clear.
2. The startup menu for the android is relatively simple. It only requires the mobile player to fill in their name and ip address they want to connect to. This is all that is required to connect with the game host. The mobile application requires no other options to start the game. These options are clearly defined and easy to use.
3. The mobile application uses layouts that are intuitive to any smartphone user. This is achieved through clear descriptions of what to do and descriptive buttons that are easy to understand. The application also contains a minigame that uses the gyroscope to move a ball across a platform. This is a concept any android user is familiar with so it is intuitive to use.
4. Most of the story is told in the introduction screen this gives more than enough motivation to the mobile players to help the VR player to escape.
5. Judging if a puzzle is challenging enough is difficult to measure. Because every player is different and some players will find certain puzzles easier as others. To

prevent the game from being either too easy or too difficult a wide variety of puzzles are used that test hand eye coordination, problem solving, memory, dexterity and of course communication between the different players. This variety ensures that for every kind of player there exists puzzles that are challenging enough for them.

6. The opening intro will give most of the immersion of what is going on. A key component to the game is that the android players have no way of knowing what exactly is happening in the room. This knowledge is consciously not given to them and can only be gained by communicating with the VR player. So despite nothing being explicitly shown to the mobile players what is going on this lack of information will immerse them more into what is happening to the VR player.

6.1.2 VR client

1. Just like the mobile player the VR player will receive an intro describing the setup of the game and the players role in the game. The intro also describes the controls of the game. During the game the VR player will receive hints and messages of what to do next. These are displayed on the HUD to ensure that no matter where the VR player is looking it sees the messages. So the interface is always clear for the VR player.
2. On startup the VR client will see a menu in which he/she has to fill in their name and an ip address to which they want to connect. These options are clearly defined. Following this the VR client will see a second menu in which the display options are shown. These options aren't meaningful for the VR client themselves however if the game needs to be demoed a second screen is required to showcase what the VR player is seeing. These display options are then useful for the second screen. These options are all clearly defined however for a standard user that has no need for demoing the options are meaningless.
3. The VR client is unique in the fact that it uses two pieces of hardware to interact with the game. An Oculus Rift headset to look around in the virtual scene. This piece is used intuitively because it allows the player to rotate the perspective by moving his head around.The other hardware used is a xbox 360 controller. The player uses the left stick to move forward, backward and strafe through the room and uses the A button to interact with the objects in the scene. Strafing may not seem like an intuitive feature over just using rotation, but since the player uses the Oculus to rotate combining this with a strafe option made moving around in the oculus a lot easier for a player wearing the Oculus headset to move in the scene.
4. Just like the mobile player the story is mostly told in the Introduction cinematic. This gives the VR client enough motivation to attempt to beat the game.
5. Testing if a puzzle is challenging enough is difficult to measure. To solve this a wide range of puzzles were created which tested different skills of the player. Unlike the mobile application the VR client requires an element of exploration of its player.
6. The VR client will use the Oculus Rift to showcase the scene. This is a very powerful tool to achieve immersion because the player is dropped in the scene itself making the scene feel more realistic as opposed to seeing the scene on a screen. Aside from that The VR client also uses audio and visual pop ups to increase the immersion of the player.

6.1.3 The product.

1. All players receive an introduction that explains the different interfaces and how to use them. This ensures that the players can play the game without any external help.
2. All players receive a menu in which they have to fill in their name and ip address they want to connect to. This is necessary to establish a connection with the game host. The VR client will also see a second menu in which he can adjust the display options. But this is only necessary when you want to demonstrate the game on a secondary screen and does not influence regular play. All menu's are descriptive and easy to use.
3. All hardware is designed in a way that is logical and easy to understand for players that are both familiar and unfamiliar with the hardware. The only possible exception to this is that the left stick is used to strafe and not rotate however during play testing Users preferred the strafe ability because they already used the oculus to rotate.
4. All players get to see an introduction which will explain the story to them. This gives them enough motivation to complete the game.
5. To ensure the puzzles are challenging for all players a variety of puzzles are used that all test different skills. These skills are hand eye coordination, problem solving, memory, dexterity, communication and exploration.This ensures that no matter what the players skills are they will encounter a puzzle which will challenge them.
6. The use of an Oculus VR combined with audio and visual effect and the intintual lack of visual representation send to the mobile application assures that all players are engaged and immersed in the game.

6.2 Failure analysis

The failure analysis describes the situations in which the product doesn't work as intended. The failure analysis will for each failure describe in what module it can appear, a description of what causes the failure, the potential effect the failure has, the probability of occurrence and the severity of the failure.

One instance where only the Mobile application will fail is if the user uses a version of android that is older than android 4.0. Team kroket went out of its way to make the mobile application compatible with as many versions of android as possible. This resulted in every version of android between 4.0 and 6.0 to be compatible with the mobile application. There is ofcourse the possibility that someone who uses an older version of android tries to run the mobile application. This will most likely cause an error which shuts down the application because our application uses methods that were only introduced when 4.0 was launched. This is a very severe failure however it is highly unlikely this error will occur because analytics show only 2.1% of android users use a version of android that is older than 4.0. Because of the unlikeliness no action is required to prevent this error from happening.

The other main failure which can happen in any of the modules is when a module will lose its connection to the host for example by an internet outage(or in case of the host lose connection with its clients). This is a severe issue because the Game will fail for all functions because none of the modules will be able to receive messages or send messages. Because the gamehost verifies if the players are allowed to proceed in the game beating the game

when no messages are send becomes impossible to accomplish for the players. The solution would be to restart the game from scratch. The likeliness of this error depends entirely on the stability of the internet connection. This failure however is an inherent problem for every game that uses online multiplayer. So there simply is no action possible from preventing this error from happening.

7. Outlook

This section contains the outlook for the product. There are elements of Escaparade that can be improved; these possible improvements will be considered in this chapter. How these improvements can be achieved will also be elaborated.

7.1 Improvements

At the very beginning of the project, when the idea for the virtual escape room was pitched, someone posed the question “why choose this over a real escape room?”. This question was to be answered by inserting unrealistic elements in the escape room. Currently, the only unrealistic element is toxic gas entering the room. In the future it would be nice to expand this. Some examples of ideas that came up were letting the Oculus Rift player hallucinate, loss of gravity in the room and tilting the room or have the room turn upside down all together.

As described in chapter 2.2, the players play minigames to escape the room. In the current product, three minigames are present. It would make for a more exciting and longer experience if there were more different type of minigames that can be played. To continue on the topic of having essentially more game, it would be desirable to have multiple escape rooms. Although the puzzles can be randomised to a certain extend, the story will always be the same. The games relies in part on mystery, and this will be taken away when one escape room is played multiple times by the same person. Also, players will probably not want to play the same escape room, with the same story and puzzles over and over again.

Escaparade is currently only available for android phones and a computer that runs Windows. Since many people have iPhones, Windows phones and computers that run on Linux or iOS, it would be customer friendly to support these platforms as well.

Lastly, there is some improvement possible in the graphics department. The room could have a more scary feel by adding certain lighting, or other mysterious objects. Objects and textures could be made custom for this game, so they will be a perfect fit. Currently there are no animations, for example if a door is opened. The aforementioned graphic elements would make the experience much more immersive for the Oculus player.

7.2 Improvement strategy

Adding more minigames and unrealistic elements are two things that tie together. The strategy for improving these two elements would be to first write an extended storyline that incorporates more minigames and unrealistic elements. After this a team of developers will need to implement these elements in game for the Oculus Rift, the accompanying app and the server. This team would also be able to implement everything for multiple platforms.

Making more escape rooms could be done in the same way many game makers nowadays release DLC. DLC stands for downloadable content, this is additional content created for a certain game. For this game, it would be possible to add a new escape room once a year, and release it as an extension to the game.

For the improvements for the graphics, it would be beneficial if there was a separate team, whose only job is to make and decorate the room properly.

A Analysis of customer needs

This appendix elaborates in more detail on what the customers want from a game, and in specific what they want from the game developed by Team Kroket.

Escaparade, the game developed by Team Kroket, is meant for entertainment, which means that the customer should have an enjoyable and immersive experience. In order to achieve this, the game should meet as many of the customers' needs as possible. This section will discuss some of the most important needs of customers to enjoy a game, and how these aspects will be incorporated in the game.

Earlier studies have shown that games which have an interface that is not intuitive or even hard to use are often seen as less enjoyable (Amory, Naicker, Vincent, & Adams, 1999). Therefore, to meet the customer's' needs, it should be clear how to interact with the game and the interface has to be intuitive. When starting the game, a menu will appear which shows the available options in a clear manner. The description of the options will also be clear, so that confusion can be avoided. The game will be made further intuitive by using the hardware in the way the players are used to. For example, the thumbstick on the gamepad, that will be used by the Oculus Rift player, will be used to walk around in the environment, as in most games.

The storyline of the game is also an important aspect. One of the genres of the game is adventure, and "in adventure games, narrative is important in order to create a rich space for the player to explore. Often these games rely on intriguing story to propel the player to explore the world" (Information Resources Management Association, 2011). In this game this is also the case and is done by telling the players the story about the murder investigation and the locked up player. This will motivate the locked up player to explore the room and motivate the mobile device players to solve the puzzles as quickly as possible.

Another aspect that customers desire of a game is that the game is challenging. It has been shown that challenging games allow players to be more engaged and immersed in the game (Hamari et al., 2016). In order to incorporate this into the game, the puzzles will have to be of appropriate level with respect to the target audience; the puzzles are not too simple and not too hard, instead they will be challenging to solve. The same goes for the Oculus Rift player, who has to look for hidden objects and clues in the room. The objects and clues will be hidden in such a way that they are not apparent right away. Some intellectual effort is needed to proceed in the game.

A last factor that players also find important is the realism. It has been shown that the higher the game's realism, the higher the controller naturalness of the player (Mcgloin & Krcmar, 2011). Also, "increased immersion facilitates enjoyment" (Mcgloin, Farrar, Krcmar, Park, & Fishlock, 2016). Realism is achieved in the game by creating a storyline that could happen in real life or could be seen on a television show. The Oculus Rift also contributes a lot to this aspect. The purpose of this device is to make the experience as realistic and immersive as possible. Therefore a game with the Oculus Rift will also be perceived as realistic.

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B Analysis of the target audience

This appendix elaborates in more detail who the target audience is of the game developed by Team Kroket and why this is chosen as the target audience.

It would be ideal to produce a game that targets everyone, and that everyone finds fun to play, but this is probably impossible. ”There are some games that fall within more than one genre, however they warn that special care needs to be taken since such games might not be appealing for any of the genre audiences” (Manero, Torrente, Freire, & Fernández-Manjón, 2016). Therefore Escaparade targets a specific group of people, which will now be discussed.

First of all, the target audience ranges from the age of 16 up to 50 years old. This is due to the fact that most people within this range are familiar with modern technology and own a smartphone. Especially older people often lack knowledge about modern technologies (Ellis, Nurden, & Moye, 2010). In addition, the Oculus Rift can cause levels of discomfort in the form of VR-related motion sickness (Allen, Hanley, Rokers, & Green, 2016), which can be of higher severity for people falling outside of this age range. The game is not suitable for most children, since it needs a gentle and careful user. This is due to the fact that many modern technologies, such as the Oculus Rift and smartphones, are still sensitive to incautious actions such as falling on the ground. Children still have to learn that objects and instruments must be used with due care (Worzbyt, 2004), and therefore children are not in the target audience. In addition to this, the puzzles that are to be solved in the game might be too difficult for very young children. This will be because of the nature of the game. The puzzles are designed to be challenging for (young) adults, and thus young children will have a hard time solving these puzzles within the set time limit.

Apart from age, it is also important that the players like the game concept, so that they want to play the game. The Oculus Rift user is mostly busy with searching the environment and communicating his findings to the other players. The other players will be busy with playing minigames, to obtain information and clues for the Oculus Rift player to escape, and communicating with the Oculus Rift player. The target audience will therefore include people that are interested in cooperative games, like to solve problems and play minigames. The next section will discuss how to ensure that the players will like the game.

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