Designing a gamification for promotion and recruitment

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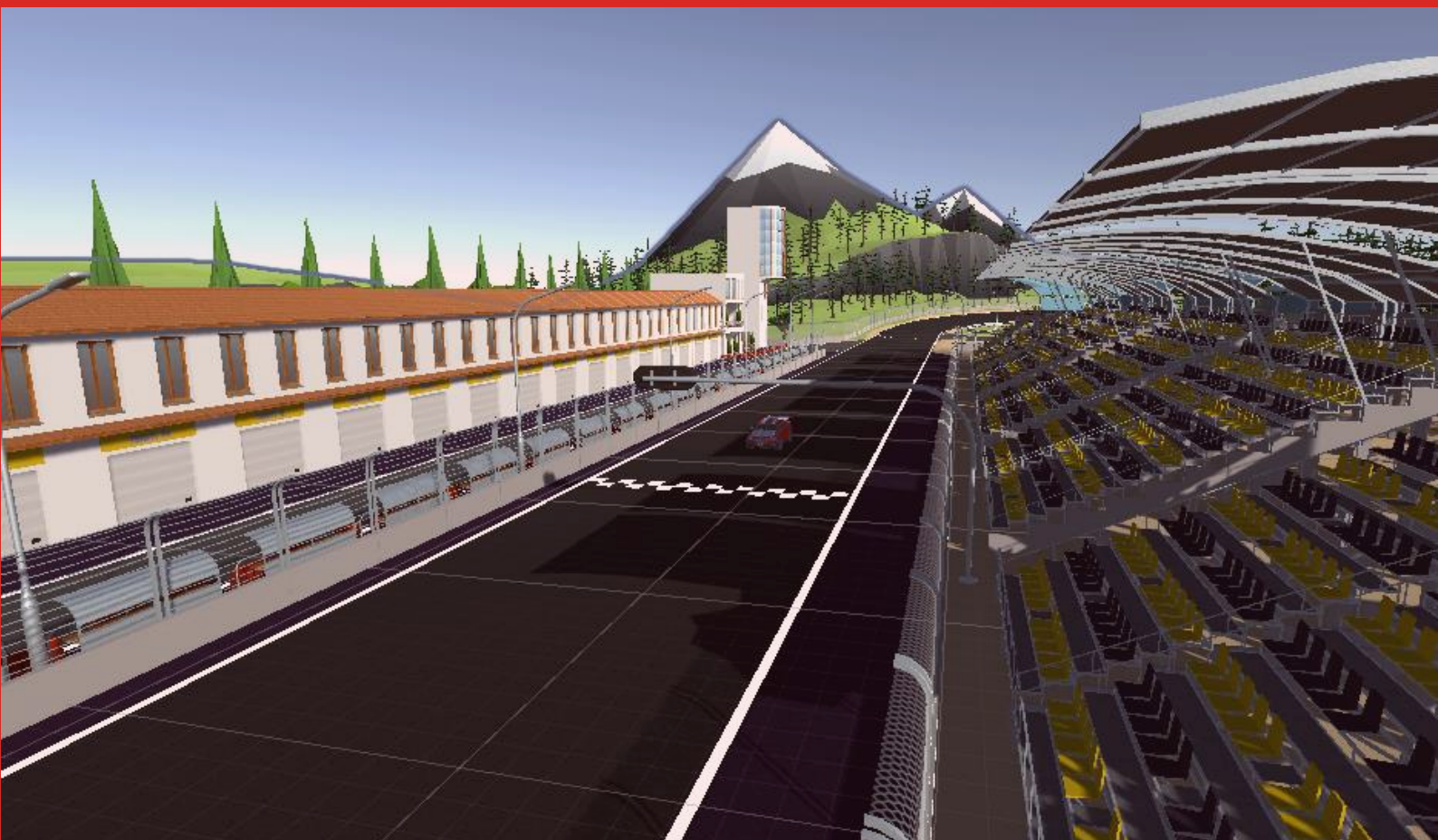

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Abstract

This research aims to find a way to use gamification to promote Solar Team Twente and to be used for recruitment purposes. Based on background research into implementations of gamification and its uses in promotion & marketing, as well as recruitment, a prototype is designed and built through the Creative Technology Design Process. A solar car game is created, offering a simple simulation accessible to a wide audience for experiencing a solar car race. Evaluation of the gamification shows that it was fun to play and some changes need to be made to make it work properly for marketing and promotion. For recruitment a scoring system should be added, so that players can be assessed. Based on the feedback and research, it could prove a useful way to get people more interested in Solar Team Twente.

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1. Introduction

Finding new people to join a student team can be a hard and time-consuming process. There is a lot of work that has to go into promotion and assessing candidates, when the team members change every year. To make such a process easier the team could consider using gamification. Gamification could prove a good way to increase people's interest in a company and can help reach a larger number of people. For example, Chow, et al. [1] propose that gamification of the recruitment process could prove fruitful for capturing the attention of a larger number of potential applicants while simultaneously influencing their attitudes towards the organization/industry. Furthermore, gamification elements can help with people's engagement and can for example strengthen brand love, loyalty and behavioural engagement [2].

A team that changes members every year is Solar Team Twente (STT). It is a team of students that build a solar car and improve it over a two-year time span. The solar car is used to participate in solar car races. Every year STT gets a whole new team of students who work on a Solar Car. Therefore, it is important that they attract a big group of people who might be interested in what they do and that might want to join them. The main goal of this research is to find a way to implement gamification as a tool that can be used to promote STT and that could be used for recruitment purposes. Thus, the following research question was formulated:

"How can Solar Team Twente use gamification to primarily be used for promotion and secondarily recruit potential candidates?"

To answer this question, four sub-questions were formulated:

SQ_1: *How can gamification enhance user experience?*
SQ_2: *What game mechanics can be used to make a gamification interesting to play?*
SQ_3: *How realistic should the simulation be to interest people?*
SQ_4: *How realistic should the simulation be to attract potential candidates?*

These sub-questions will help to answer the main research question and will be answered in different sections of this report.

This report will discuss the design and development process of a gamification for STT. The report is structured in the following way. In chapter 2 the background research is

performed. This will give a better overview of the already existing literature on the topic and will help identify missing implementations of gamification for promotion and the recruitment process. Throughout the process of designing and building a prototype, the Creative Technology Design Process [3] is used. In chapter 3 the development process of the product design and the ideation is discussed and one concept idea is chosen. Then, in chapter 4 requirements for the prototype are researched. A MoSCoW analysis is done and use cases are discussed. Then, in chapter 5 a detailed description is given on the design and mechanics of the game. Furthermore, in chapter 6, the realisation chapter, the developed prototype is described. Then, in chapter 7 two different user tests are discussed and the results from the user tests are described. In chapter 8 outcomes of the user tests are discussed and recommendations for future research are made. Lastly in chapter 9 the conclusion of this research is described.

2. Background Research

Before designing a gamification for promotion and recruitment, it is important to gain insight into gamification and how it could be beneficial to a company, the recruitment process and its different phases, and the use of gamification for promotion, marketing and recruitment. The background research consists of three sections. First a literature analysis is conducted, where the definition of gamification, the enhancement possibilities with gamification, game mechanics for gamification, and phases of the recruitment process will be discussed. Next, some implementations of gamification in marketing and the recruitment process will be discussed in the state of the art. Then, takeaways from the literature research and the state of the art will be discussed.

2.1. Literature Analysis

This literature analysis consists of four parts. First, the definition of gamification will be discussed to get a better idea of what is meant by gamification. Second, the use of gamification and how it can be used to make the recruitment process better will be discussed. Some of the negative sides of gamification will be mentioned, to have a good overview of what to do and what not to do. Third, game mechanics that can be used for gamifications will be discussed. Last, the different phases in the recruitment process will be discussed.

2.1.1. Definition of gamification

Defining gamification does not only help with understanding gamification, but it also helps with thinking critically about it [4]. Therefore, different ways of describing gamification found in literature are discussed. Bina *et al.* and Obaid *et al.* [5], [6] describe it as the use of game design elements in non-gaming contexts. Whilst, Xi and Hamari [7] describe gamification as the phenomenon of transforming services and products to be more game-like. Their way of defining gamification does not describe the impact it has on the users, which most of the other definitions found in the literature do. For example, Kirovska *et al.* [8] describe the concept of gamification as utilizing game theory, mechanics and certain elements of game design in an environment outside of (video) games, with the end goal being to motivate people to achieve their goals. Similarly, Kim [9] defines gamification as incorporating game elements into a non-gaming software application to increase user experience and engagement. Furthermore, Bekk *et al.* [10] states that gamification can be

defined as the enhancement of a non-game entity with game elements, which elicits a gameful experience. The three previous definitions focus on increasing the experience for users of the system that gamification gets applied to. Buil *et al.* [11], also focus on the user experience, but include technology as a part of gamification. They state that gamification has been referred to as 'an approach to performance management that uses technology to create real time access to performance information and make tasks more enjoyable' [11, p. 41]. Contrary to the way users are supposed to experience gamification is the idea that gamification is supposed to influence behaviour. Chow *et al.* [1] describes gamification as the use of game attributes to drive game like behaviour in a non-game context.

From this it can be concluded that there is not just one way to describe gamification. Nonetheless, most of the definitions described are at the core quite similar to each other. Five out of the seven described definitions in some way state that gamification is the use of game attributes/elements in a non-game context/environment. The only ones that diverge from this description are Buil *et al.* [11] and Xi and Hamari [7]. Although Xi and Hamari [7] refer to more game-like products and services, so it could be argued that this definition could also be referring to game attributes and elements. Therefore, gamification in this report will be defined as "The use of game design elements in a non-game context to transform it to be more game-like". This definition is most likely imperfect, but it will help with understanding what is meant when referring to gamification.

2.1.2. Enhancement possibilities with gamification

There are several different ways in which gamification can be used to enhance promotion & marketing and the recruitment process. When done online, implementing gamification in the recruitment process can make the process faster and can reduce the costs that come with the recruitment of new employees [12]. This also ensures that a broader range of people can be reached. As proposed by Woźniak [12, p. 265], gamification is a "more economical way" of influencing Internet users, which makes the process faster, reduces costs and increases reach. Next to that, gamification can also attract more people to an organization. For example, Chow *et al.* [1] states that gamification, such as that used by Marriott, can influence applicant attitudes and thus attraction to an organization/industry. Marriott Hotels has developed a game that simulates the duties of hotel managers for the purpose of introducing potential applicants to the challenges and opportunities of managing a hotel. Besides attracting candidates, giving them the perception that the recruitment process is fair is an important way to increase their satisfaction. Additionally, Georgiou *et al.* [13] states that adding a game element to a

traditional assessment has positive effects on the process satisfaction of applicants and that in turn has an increased effect on the perception of organizational attractiveness and fairness. Besides that, Obaid *et al.* [6] and Buil *et al.* [11] state that the use of gamification can help the organization get a better overview of the way candidates perform during the recruitment phase. It is not only useful for the organization, but it also gives the candidates more space to express their talent and to show off their abilities in a better way. Besides fairness it is important for the gamification to engage the person interacting with it. According to Singh *et al.* [2] gamification elements have widely been acknowledged to elicit high levels of engagement. Various areas of marketing are strengthened by the application including consumer loyalty, online reviews, brand love, behavioural engagement, customer engagement and intrinsic need satisfaction. Similarly, Xi and Hamari [7] state that gamification increases brand awareness and loyalty, and can create engaging customer experiences to improve the way customers interact with a brand or firm. Because gamification is based on game elements, some of the positive effects seen in games could therefore possibly elicit similar positive effects in gamifications. Based on the knowledge on video games, some of the positive effects of gamification might also include: increased perceptions of self-efficacy, competence, relatedness and autonomy [14]. It can also help facilitate social interactions that enhance learning and encourage teaching. Including game elements can also make the audience more motivated. This can be done by using motivational features, like scores, levels, challenges or points [6]. Additionally, the use of gamification can help with giving candidates a clearer idea of what the job will be about and that can help reduce the number of applicants that are not appropriate for the job. Besides that, cheating is more difficult, making the outcome more reliable [11].

The use of gamification does not guarantee success. As stated in [1], the majority of gamification applications are bound to fail. This is due to the lack of research into gamification and just mindlessly using leaderboards, point systems and game graphs when gamifying the process. This is supported by Obaid *et al.* [6], where it is mentioned that these elements though useful for scoring and keeping track of progress for the company does not motivate users to play. Similarly, Hofacker *et al.* [14] state that game elements that create a more game like experience like challenges and narratives, social connections, and visual design are often neglected, because in literature and practice the focus tends to lay on points and awards. Therefore, current implementations of gamification fail to live up to its possibilities. Furthermore, just because individuals might be open to a new experience does not mean that they are in favour of gamified assessment [13]. Some people might not be

familiar with game mechanics and heavy use of these game mechanics can shy people away from partaking in the recruitment process. It might make the process seem unfair towards non-gamers and might give them a bad impression of the company. Besides that, gamification is still in the exploratory phase of its trajectory [2]. This means that a lot of possible implementations of gamification have not been researched.

As discussed above, the implementation of gamification can be very beneficial to organizations when done correctly. For STT it can for example help with reaching a broader range of people and improving brand awareness. Game mechanics that make games fun and engaging could elicit similar effect in gamification, so choice of game mechanics for the gamification is important. Game mechanics like challenges and narratives, social connections, and visual design could be beneficial to gamification. Furthermore, controls should be kept easy to keep the gamification interesting for people that never play games. With this information SQ_1 has been answered. There are a lot of ways gamification can enhance the promotion and marketing, and recruitment processes, but the way these enhancements can be implemented should be researched.

2.1.3. Game mechanics often used for gamification

As mentioned earlier, leaderboards and point systems are often used for gamifications. But there are also other game mechanics that are used. In [7] they are split up in three classifications: immersion, achievement, and social interaction. The immersion -related features include elements such as avatars, storytelling, narrative structures and roleplay mechanics. The achievement -related features include elements such as badges, challenges, missions, goals, leaderboards and progression metrics. Finally, the social interaction related features include elements such as team, group and competition. Even though this list includes a lot of different features, only a few of them are used regularly for gamification. As stated in [14], both the literature and practice tend to focus on points and awards, neglecting other game design elements that can be used to create a more game-like experience. A good tool to use during game design is the lenses that Jesse Schell provides in his book [4]. These lenses help keep the goal of the game in sight and keep its game mechanics balanced. As stated by Hofacker *et al.* [14] rather than pick gamification elements in a vacuum, it is believed that a better way forward would be for researchers to utilize the fundamental elements of game design – the Schell tetrad of story, mechanics, aesthetics, and technology. Instead of just using a point or award system, the lenses can help find the right game mechanics to apply so that the game stays fun. Therefore it could prove a useful tool to apply to gamification.

There are a lot of different game mechanics that can be used for gamification. Based on the type of gamification different game mechanics should be implemented.

2.1.4. Phases in the recruitment process

The recruitment process is an important moment for the company to attract and hire good workers. The recruitment process generally has multiple phases. Varshitha and Sethumadhavan [15] define eight steps in the selection process of recruitment: initial screening, completion of application form, employment tests, job interview, conditional job offer, background investigation, medical/physical examination and final/permanent job offer. Similarly, Breaugh and Starke [16] define four steps in the organizational recruitment process. Candidate attraction, applicant management, pre-selection of candidates and final selection of candidates. These steps follow a similar structure as those from Varshitha and Sethumadhavan [15], but they still are different. As Ślusarczyk and Golnik [17] state, it is difficult to determine which recruitment methods are most effective. That is also the reason why most companies have recruitment processes that work on several levels as shown in [15] and [16].

The recruitment process usually consists of several steps to ensure that the company selects the right employees for their company. Different companies will shape their recruitment process differently but will use a similar structure. For example, STT have steps similar to [15]. These include completion of application form, employment tests and job interview.

2.2. State of the art

The state of the art consists of two parts. First gamifications for promotion and marketing will be discussed. Thereafter gamifications for recruitment will be discussed. Establishing already existing gamifications in both domains can help get a clearer picture on what is needed in each domain.

2.2.1. Gamifications for promotion and marketing

Gamification has been implemented by several companies to market their product or their brand; here six of these implementations are discussed in order from least game like to most game like. The first implementation is called My Starbucks rewards [14], [18]. It is a gamification by Starbucks that uses the reward mechanic to entice customers to visit Starbucks more often and to buy more. When customers buy an item, they gain stars in the

app. There are several goals in the app that lead to different rewards, for example a free drink or sandwich. So the higher the amount of stars the bigger the reward. Similarly, Swisscom and Samsung teamed up to create all eyes on S4 [18]. Here the participant would have to look at a picture of the Samsung S4 for an hour without looking away. Several outrageous distractions were used to challenge the participant. A large crowd would gather around the contestant. After an hour of not looking away the contestant would receive an S4. Furthermore, coca cola offered a branded app for teenagers [18]. The teenagers would download it on their phone and when the coca cola advertisement would play on television the teenagers could open the app and shake their phones. This would allow the users to win discounts and prizes from partners like McDonald's. Similarly, Heineken introduced Heineken's star player game during the Champions League [18]. While watching the game users get to answer predictive questions about the game. If they answered a question right, they would get points for it. The gamification was made to actively engage fans throughout the Champions League and increase awareness of Heineken. Similarly, Bendigo Marketplace held a free smartphone treasure hunt to increase traffic at the shopping centre [14], [19]. In order for people to be willing to participate they used marketing to ensure people would download the app before coming to the shopping centre. Participants could pick up a treasure map and initial clue at the temporary customer experience desk, as well as a sticker sheet and eye patch. Five beacons were set-up across the shopping centre, participants would trigger a new clue when coming within five meters of the beacon. The new clue would lead them to the next beacon with another clue. The people that completed the challenge and handed in a completed map were eligible to win prize packs. Lastly, the most game like implementation is the Magnum Pleasure Hunt [18], [20]. It is a digital online game that is reminiscent of Super Mario. The playing field is integrated throughout pages of the internet. Users collect bon bons throughout their journey through the webpages and accumulate scores and build their rank. Eventually the player ends up back on Magnum's main site, where their bon bons turn into a Magnum Temptation bar.

The methods used for gamification in promotion and marketing all use some type of reward or scoring system to engage users and increase awareness of the brand or a specific product the brand is selling. The gamifications in the promotion and marketing domain range from simply adding a point system, to making a full playable game.

2.2.2. Gamifications for recruitment

Different companies have implemented gamification in their recruitment process; here eight different implementations are discussed. One of these implementations is called My Marriott Hotel by Marriott International. As mentioned in [21] this is a game developed to introduce applicants to the challenges and opportunities of managing a hotel. In [22] it is mentioned that players after playing could click on a "Do it for real" button, which would direct them to the career page of Marriott. The game was developed to attract people who were interested in hospitality jobs, especially the youth in developing countries like India and China. In a similar style, Formaposte launched Jeu Facteur Academy where players live as a mailman all week. This ensures that applicants know what they are getting into. For example; waking up early, delivering shorter deadlines, getting in the work cycle and interacting with other employees. Formaposte had struggled with a high drop-out rate and to combat this Jeu Facteur Academy was created as a mandatory part of their application process [8]. Similarly, Siemens introduced Plantsville where applicants work as plant manager at the company [8]. In a similar fashion PWC Hungary created Multipoly to enhance the process of recruiting and ensure employee retention rate. Multipoly permits candidates to see how ready they are to work at the firm by placing them on teams and it presents them business problems similar to those they would encounter on the job [23], [24]. Marriott Hotel, Formaposte, Plantsville and Multipoly all allow applicants to get acquainted with the type of work they will perform when they become an employee, hereby reducing the amount of people that will stop in the first few months of employment at either of the companies.

Wasabi Waiter by Knack lets candidates assume the role of waiter in a sushi restaurant. They have to align the dish to the mood of the customer and keep the empty dishes in the sink while also attending to new customers. The game scores each player and calculates outstanding employees. Similarly, Google Code Jam was introduced as a way to detect top engineering talent for prospective employment at Google. It is an international programming competition introduced and run by Google. Participants crack a series of algorithmic problems in a limited amount of time [24]. Wasabi Waiter and Google Code Jam both aim to test people's skill under pressure, Google uses time as a pressure method and Wasabi Waiter uses multitasking as a way to see how applicants perform under stress. Whilst also testing relevant skills to the jobs that are being offered by the companies.

Reveal the game by L'Oréal was developed to help candidates challenge themselves in the development of a new product launch using real-life situations. Results can be shared through social media and candidates can play against each other. America's Army on the

other hand uses a game technology platform that they use to design first person shooters (FPS) games. The platform is used by the U.S. Army to entice prospective new recruits [24]. Reveal the game and America's Army both use competitions to make the process interesting and to entice people to do better than other applicants. Although competition is not the main aim of America's Army, as they want to get people interested through the shooters, so the competition although making people want to do better does not necessarily add to the challenge of being recruited.

A lot of the methods used to gamify the recruitment process described above are game versions of tasks that represent the work employees will have to perform at the company. Which is a good way for applicants to get to know the job and also find out if they are interested to even do the job, in turn improving the retention rates of companies. Many of the companies test skills of the candidates to see if they are creative, can perform tasks under pressure, or can work together in a team. Hereby testing if the applicants satisfy the requirements the company has set.

2.3. Takeaways from literature research and state of the art

As found in the literature, most gamifications make use of a score or reward system. But not all limit themselves to just one game element. When gamifications have more game elements, they start to become more game like. This can be observed in the state of the art. For recruitment, there are a lot of game like simulations of jobs that will have to be performed. For promotion and marketing the most game like gamification is reminiscent of an existing game. The gamification for STT, is going to be made up of several game elements and will therefore also lean more in the game like direction.

When comparing the promotion and marketing examples to the recruitment examples, it can be seen that the promotion and marketing gamifications focus on engagement, pulling the user in to play/make use of the offered application. For recruitment there are some examples that attract people to a certain company, but most look at how well the user performs and how well they would work within the company, so engagement is often secondary. The representation of the job that applicants are to perform when they get the job is at the forefront of the gamification. This means that accurate and realistic representation of a company or job to be performed is necessary to make sure that the applicant knows what they are going to face when joining the company. With this information SQ_4 has been answered. The game elements used for the gamifications in both areas are quite similar. Most

companies use rewards, scores and competition elements for their gamifications. Because most gamifications use similar elements, it might be good to look at how these elements could be implemented in the gamification. But it could also help to look at other mechanics often used in games to make the gamification work for STT.

Recruitment phases with active engagement for applicants seem to be the most suitable candidates for gamification. These are the candidate attraction, the initial screening, the employment test, and the job interview phases. Depending on the phase, different forms of gamification should be used to attract and engage applicants. Based on the existing gamifications for recruitment, most companies gamify the candidate attraction and initial screening phase. These two phases are also the phases that the gamification for STT will target. First, gamification for the candidate attraction phase is quite similar to gamification for promotion, because the main goal is to get people interested in the team and what they do. Second, the initial screening phase is often used to see how well someone performs. By implementing some sort of challenge that can test candidate's skills, the gamification could be used for this phase.

3. Ideation

Ideation is split into four sections. The first section is about the concept brainstorm phase, where the first ideas for the product will be discussed. After the brainstorm phase four ideas are worked out further to get an idea of the complexity and feasibility of the ideas. Thirdly, style options for the game will be looked at. Lastly, the final concept will be discussed.

3.1. Concept brainstorm

To develop concepts a brainstorm session was held. At the start of the brainstorm phase a list of card, board, and video games was made and mechanics commonly used in these games were made into a list of game mechanics. This list was made so that each idea during the brainstorm phase could be based on one or multiple game mechanics. Schell [4] identifies seven main categories for game mechanics: space, time, objects (objects, attributes and states), actions, rules, skill and chance. Per category, one idea of the brainstorm phase will be discussed.

1. Space

The space of a game defines the various places that can exist in a game and how those places are related to one another [4].

Example: A player can walk around in an area where they can visit the office (managing or marketing) or the workshop (engineers) and perform tasks that are typical for the role(s) that can be found there.

2. Time

Timing is everything, if a game is too long or too short the experience of the player can easily be spoiled [4].

Example: A race has no fixed time limit, but there is pressure to be faster than the other player, which is why races are part of the time category. The idea is that the player has to beat the rivals to the finish line. To prepare for the race, the player can train to get faster and better. Like in the duck game, where the duck needs to train walking, swimming and flying skills to be able to win the race against the other ducks [25].

3. Objects, attributes and states

Objects have attributes that define for example the position of the object. Each attribute in turn has their own current state, for example if an object can move, the attribute might have two states, one for the current speed and one for the maximum speed.

Example: The player chooses the engine to put in the vehicle, which solar panels to use and when to change drivers. Based on the decisions made by the player, a cutscene will play. This will show the consequences of the made decisions. The player can try to achieve the optimal balance between the different parts/components.

4. Actions

Actions can be basic or strategic, strategic actions can lead to emergent gameplay. Schell [4] states that emergent actions are a hallmark for a good game.

Example: Player races with a solar car. By pressing space, the sun energy in the stamina bar gets used. The weather can change, which can lead to a slower recharge of the energy bar. The player has to be more careful with the energy they use up.

5. Rules

Rules make possible all the mechanics that have been discussed thus far and rules add the crucial thing that makes a game a game – goals [4].

Example: During a race the solar car might run into problems that need to be fixed, to fix the problem at hand, a short task needs to be completed to be able to continue with the race. When the task appears, the mode the game is in changes and therefore different sets of game rules will apply to the task mode and the race mode.

6. Skill

If the skill level of the player is a good match to the difficulty of the game, the player will feel challenged and stay in the flow channel (*Figure 3.1*) [4]. Flow activities must manage to stay in the narrow margin of challenge that lies between boredom and frustration, because both extremes cause the players mind to change its focus to a new activity. This margin between boredom and frustration is called the flow channel.

Example: Quiz, like Keezer's Quest where the player chooses answers and based on the answers gets to see the political party that fits best to their preferences (voting guide game) [26]. The player will have to answer questions that will go deeper into specific roles and

topics that can be found at STT. Based on the players answers they get a suggestion for a more technical or management position.

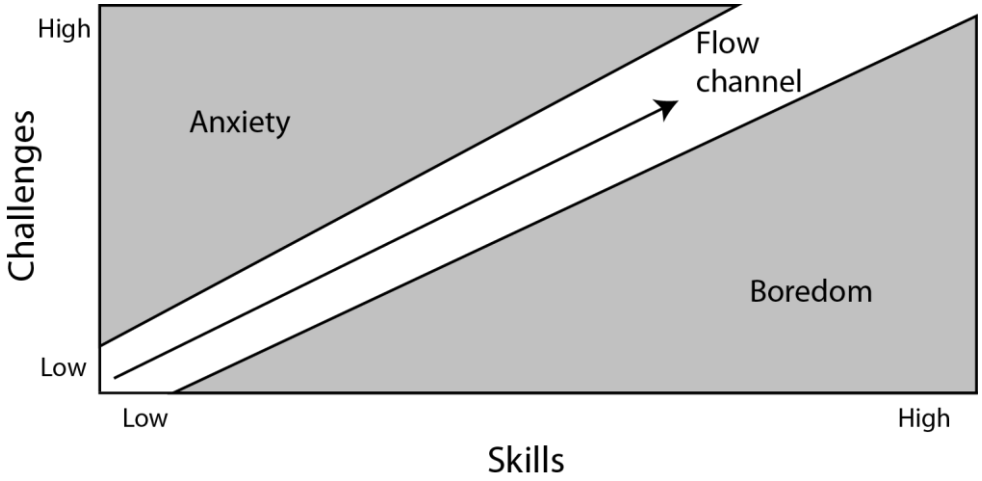

Figure 3.1: Graph of a flow channel [4]

7. Chance

Surprises are an important source of human pleasure and the secret ingredient of fun. Therefore, chance is an essential part of a fun game, because chance means uncertainty, and uncertainty means surprises [4].

Example: Solar storm like game [27], where after every play round weather and faults in the system pop up. These need to be anticipated, so that the whole car does not shut down. If you do not fix something on time you lose.

Having discussed game mechanics implemented in gamifications in the literature analysis subchapter and the game mechanics categories defined by Schell, SQ_2 has been answered.

3.2. Development of concepts

From the ideas in the brainstorm phase, four ideas are worked out and made into concepts. The four concepts discussed are quiz, challenges, car race and area to walk around in.

3.2.1. Quiz

The quiz would consist of multiple choice questions. When moving onto the next question, the background will change to a landscape fitting the theme of the question. To make it look like the character is walking through these scenes to the next scene, the background could be a

continuous picture. This could make it look like the player is walking through the workplace of STT. When the player comes to the workshop, a question they could get could be about what shape the car should have. In *Figure 3.2* sketches of the possible options can be seen. Based on the answers given by the player, the result could show what type of job within the team could fit them. Another option could be to show the player the reason why one option is better than the others, so that they learn something about solar cars and STT along the way.

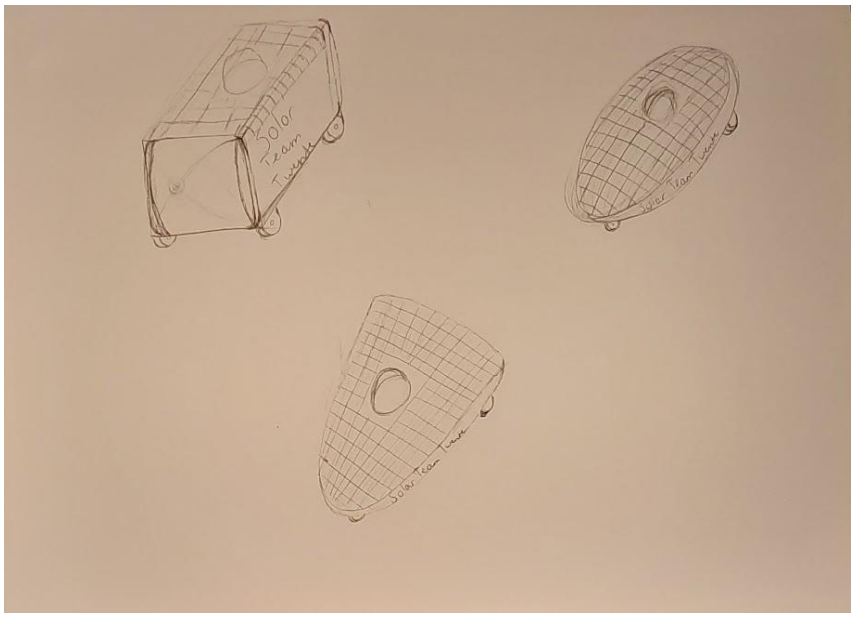

Figure 3.2: Sketches of solar car designs for the quiz

3.2.2. Challenges

The player gets to choose one character. Character options could be: electrical engineer, mechanical engineer, manager, promotion, physics, etc. The character has statistics that need to be kept above a certain level. Based on the chosen character the player gets to do different challenges, for example for promotion the player has to have a conversation with the possible sponsor and pick the best voice lines to be successful. The player gets points for successfully completing challenges. If they fail the challenge, depending on the character, a negative effect will take place. Possible negative effects could include losing sponsor points, losing items, losing car points, etc.

3.2.3. Car race

The car race has a feature that other car racing games do not have. There is a status bar with the collected sun energy, you drive the car by using this energy (inspiration for this mechanic

is from the Wii game derby dash [28], which can be seen in *Figure 3.3*). If the energy bar runs out the car will not move forward anymore, until the battery slowly gets recharged. During the drive the weather will change and based on how cloudy the sky is less energy might be collected. The player's goal is to reach the finish line before the other racers do. During the race, the car might run into other problems that need to be fixed. The player gets to do a small challenge to repair the car. The challenge might be similar in style to the among us tasks, which can be seen in *Figure 3.4.*

Figure 3.3: Wii race game where you have to manage the stamina [28]

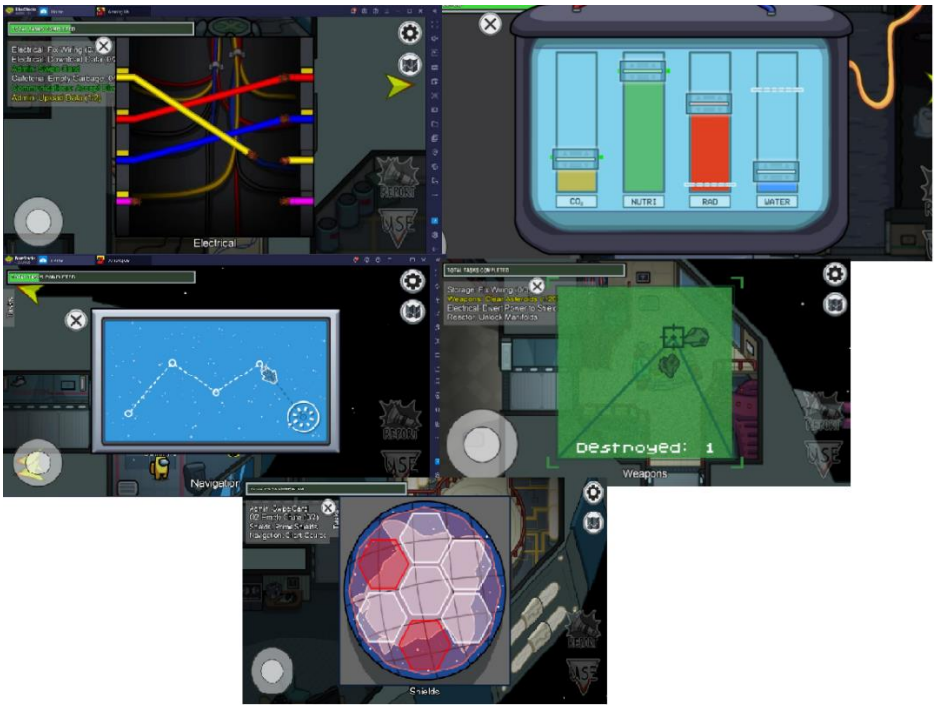

Figure 3.4: Among us tasks [29]

3.2.4. Area to walk around in

An area to walk around in will have three different locations that can be visited. These locations would include a workshop, office and race track. At different locations different tasks can be performed. In the workshop tasks can be performed that are about aerodynamics, physics, sensors, batteries and/or solar panels. In the office the player can for example talk to sponsors, some might already have helped before and are therefore easier to convince, whilst others might need some more convincing. So having a good idea of what STT does is vital for this task. At the race track the player gets to deal with situations where the car has something that needs to be repaired. The car needs to be fixed as fast as possible, but also as good as possible, so that during a race not too much time is lost. This will also give a broad idea on what might go wrong during a race and what the best way is to fix them.

3.3. Style

Depending on the kind of game that is going to be developed different styles will be needed to get the most out of the game. For an open world or race game a 3D plane to play in might be the most interesting, so the style could look similar to *Figure 3.5.*

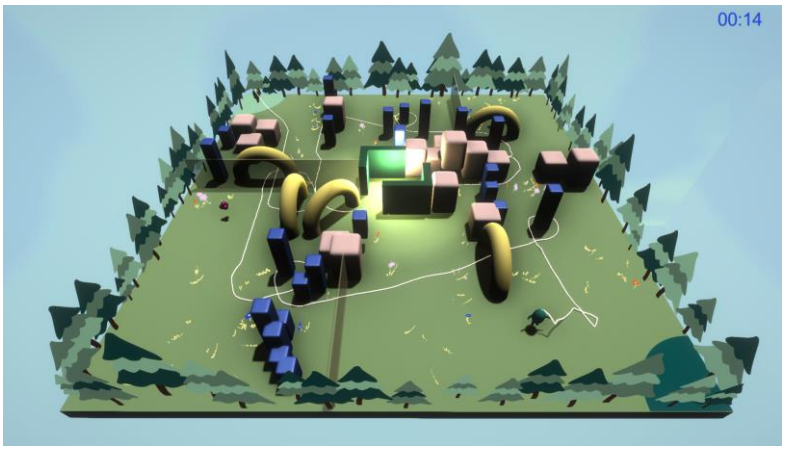

Figure 3.5: Possible style for a 3D game

For the challenge game and the quiz, it would probably look best if the games would be made in 2D. The style could therefore look more like *Figure 3.6* or *Figure 3.7.*

Figure 3.6: Possible style for a 2d game

Figure 3.7: Keezer's quest from Zondag met Lubach [26]

The idea is to have a more cartoon like style, that makes the gamification fun to look at and visually attractive.

3.4. Final concept

The development of concepts was done in cooperation with STT. Once new ideas had been thought up, they were discussed with STT. To make sure that the product would be showing off what STT do and would not be based on ideas of the researcher about the team and the way they work. Early in the ideation process meetings were set up to discuss the ideas, and feasibility of the ideas.

Based on feedback from STT and the feasibility of the project within the given time frame the car race game was chosen. This idea allows the gamification to be adaptable for both promotion and recruitment. Whereas some of the other ideas might only really work for one or the other. Furthermore, out of the four concepts, the car race game has the most engaging mechanics. Which is important if it should be used for promotion and recruitment.

4. Requirements Capture

The requirements capture is split into two sections. In the first section use cases will be discussed. The second section will discuss a MoSCoW analysis on all the things that should be included in the design and things that should not be included in the design.

4.1. Use Cases

To get an idea of who possible users might be, use cases are described. These use cases shortly describe what previous knowledge the person has on solar cars and solar teams and how they found the gamification.

1. Person that wants to get to know more about Solar Team Twente

Thomas (20) is a bachelor student at the university. He has recently found out that there is a student team on campus that builds a Solar Car and partakes in races. He would like to know more about them and starts looking on the website. There he stumbles upon a game where he can drive a solar car. He plays the game and through play finds out that driving with solar panels works a little different then driving with fossil fuels. He decides he wants to find out more about how the car works and how the car is designed.

2. Person that wants to know more about Solar Cars and Solar energy

Jord (29) is working on his doctorate degree. He often thinks about a sustainable future. He has recently gained an interest in solar energy and would like to learn more about how solar energy is used to drive cars. He is looking on the websites of solar teams and on STT's website finds a game where he can control a solar car. He decides to try it out and whilst playing he finds out what the difficulties are with driving a solar car and how changes in weather and wind affect the driving behaviour.

3. Person that is interested in joining a student team

Jenna (23) is working on her master's degree at the university of applied sciences. She is looking to find an interesting thing to do in her gap year. She looks over the student teams that are available near her. While going through the list and writing down pro's and con's she comes across a solar car game. She decides to play it. Whilst playing she realizes that solar cars are a really cool project to work towards a sustainable future. So, she decides that she wants to join the Solar Team during her gap year.

4. Person that found folder/add and is now looking what the team is about

Gwen (18) just started her bachelor at the university. She is bruising the folder stand in one of the university buildings and finds a pamphlet about STT. She decides that she wants to know more about the student team and goes to their website. There she soon spots the game and starts to play. She is intrigued by the game. After playing the game and reading up on STT she decides that she will keep an eye on what they do.

4.2. MoSCoW Analysis

For the de design of the solar car game it is important to stick to how the solar car would behave in real life. But not all elements that influence a car will keep the game entertaining and some elements might make it too complex. To ensure that the gamification is not too simple or complex, the lens of simplicity/complexity is used [4, p. 227]. This helps identify some of the features that the gamification will and will not have. To clearly divide these features, the MoSCoW analysis method is used, which can be seen in *Figure 4.1*. The MoSCoW analysis ranks requirements from most important to least important, which will help with deciding what should and should not be included in the game.

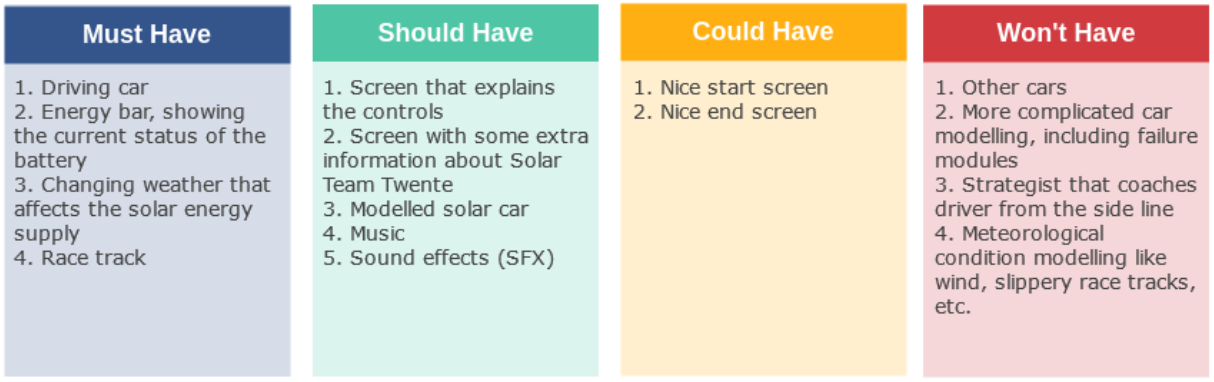

Figure 4.1: MoSCoW analysis

5. Specification

The game must be playable by one person on a standard keyboard.
On the screen a solar car on a racetrack should be visible. When the player presses the W key the car accelerates in a forward direction. When the player presses the S key the car accelerates in a backward direction. To steer the car the A and D keys should be used. To slow the car down significantly the Space bar should be pressed. When driving the car around the racetrack, the car should be affected by physics, so when the car is driving up a hill the speed will reduce and when the car is going downhill it should accelerate. The car should also lose speed after a while if you do not constantly press the W or S key.

The UI should contain weather data it should show the current weather in game with an icon. Besides the current weather the weather forecast should be shown, so that the player is able to anticipate their driving behaviour. The weather will influence how much energy the player will use when driving and how much energy they are getting back from the sun. Three types of weather should be used. Sun, clouds and rain, where sun will use the least amount of energy and gains back the most. When there are clouds the energy usage should be a little higher than when the sun is out, but the gain is lower. When it rains the most amount of energy gets used, but no energy can be gained. An energy bar should be visualized, so that the player knows how much energy they have left. It should contain a slider component, so that when the player is pressing W or S on their keyboard the slider will visibly reduce in height. When the W and S keys are not being pressed and the weather is Sun or clouds, the energy bar will fill up again. Furthermore, in the UI a timer should be visible, so that the player knows how much time they have left. When the time runs out and the player has not reached the finish, they will lose the game. Additionally, a text next to the energy bar displaying the car’s current speed should help the player balance when they should use more or less energy.

To have players know where to go, either barriers should be added to the race track that prevent players from moving of the path or a checkpoint system should be implemented.

6. Realisation

Throughout the realisation of this prototype, when mechanics are not working as expected or the game feels too easy, the lenses of Schell [4] are used to fine tune the mechanics. These lenses help with looking at specific topics and working through them in detail, so that a good idea can be formed on why something might be good or bad to be implemented in a game. The main lenses used are the lens of time, the lens of skill and the lens of the player.

In the following section the building process of the prototype will be described. After all aspects of the prototype have been described, improvements that were made after the first user tests will be discussed. Then, the choice for the implementation tool will shortly be discussed.

6.1. Building the prototype

For the prototype, several assets and mechanics have been used to make a working game. First, the 3D models that were used will be mentioned. Then, the energy bar will shortly be discussed, followed by the weather system. Furthermore, the player interactions and how to play information will be described. Lastly, the guidance system and information for the user will be described.

6.1.1. 3D models

For the 3D models assets were imported from the Unity Asset Store [30]. For the game to resemble one of the areas that Solar Team Twente races in a race track was needed. For the racetrack a Cartoon Race Track *Figure 6.1* was selected. This racetrack was chosen, because it was not simply an oval racetrack, but it had an inner circuit with sharper corners. So it would resemble the track that STT raced on during the iLumen European Solar Challenge [31].

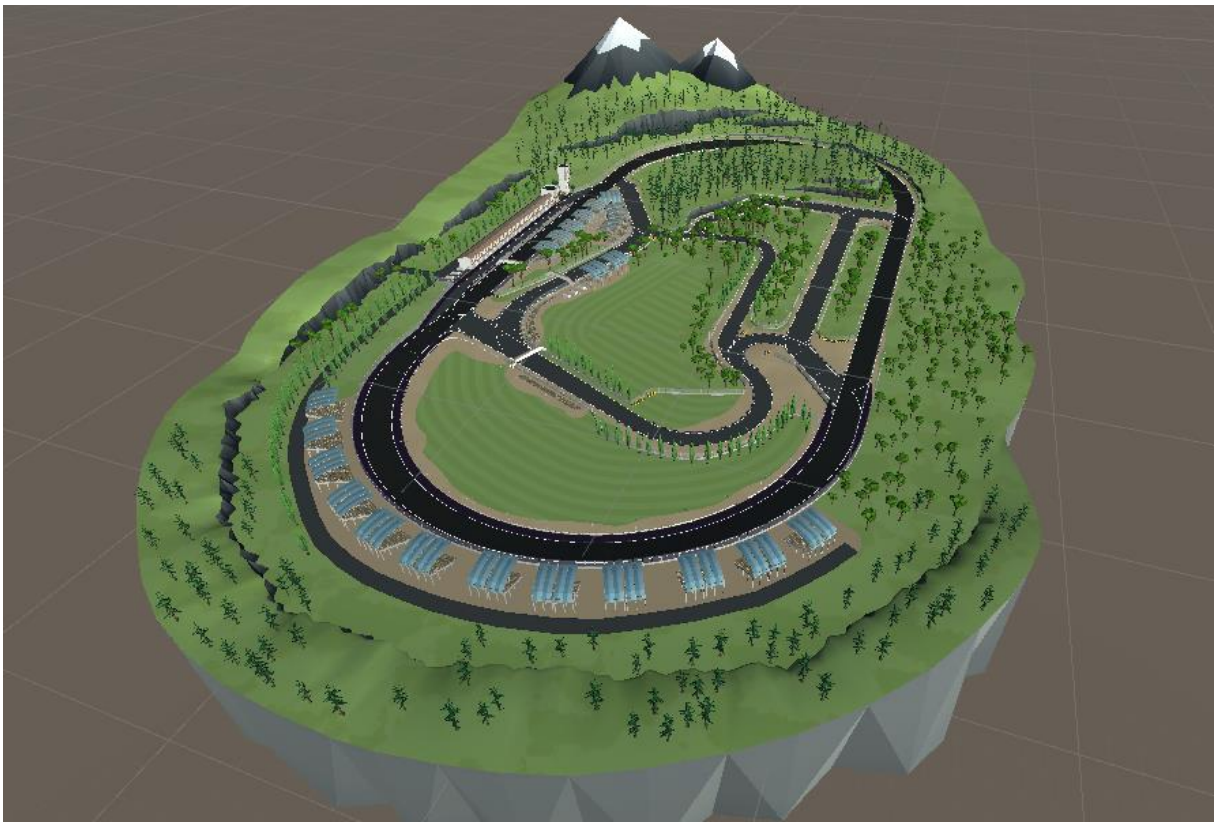

Figure 6.1: Race track from the Unity Asset Store, made by RCC Design [32]

Furthermore, a car was needed, so that it could be driven around the track. For this a race car was selected as placeholder for a solar car. To make it somewhat resemble a solar car two solar panels were placed on top of the car (*Figure 6.2*). The solar panels were also available on the Asset Store. The colour of the car had to resemble STT, so the car was made red.

Figure 6.2: Race car by Ysn Studio [33] *and solar panels by Padia 3D* [34]

To make the 3D objects work in a realistic way rigid body components were added to the game object, which would allow the car to stay on the track and collide with walls and other items along the track.

6.1.2. Energy bar

The energy bar shows the current energy that your car has. Once the player starts driving the meter will start to go down. The meter will fill itself up over time, due to collecting solar energy. If the meter completely runs out the car will start to brake and will come to a full stop. The energy bar with different amounts of energy can be seen in *Figure 6.3.* To make the energy bar a progress bar pack was added to the assets.

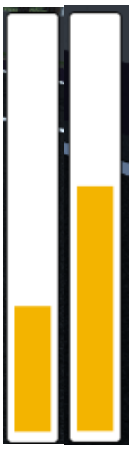

Figure 6.3: Energy bars with different levels of energy; made with an asset by upln [35]

6.1.3. Weather system

Another component that is important for the game to simulate solar car behaviour is the weather system. To make it realistic, the different types of weather that are used would all have to influence the energy bar in a different way. Three different types of weather were used for the simulation: sunny, cloudy and rain. When the weather is sunny the energy bar will fill up and will use up less energy when accelerating. When the weather is cloudy the energy bar will slowly fill up and will use a little bit more energy when accelerating. When it is raining the energy bar will not fill up and the most amount of energy is used when accelerating.

Depending on the current weather the lighting in the scene will change. When the sun is shining the light is quite bright. But when it is cloudy the light will turn more grey and

becomes darker. Similarly, the lighting for rain turns more black/grey and is a little darker then cloudy. When it rains a particle system will be turned on and will start to show rainfall on the screen. The change in lighting and the rain effect will help the player recognise what weather they are currently driving in so that they do not have to constantly look at the weather banner to know what weather it is.

Another important part of the weather system is the weather forecast displayed in the UI (*Figure 6.4*). The weather forecast allows the player to anticipate how to drive. For example, when it is sunny and the forecast is rain it might be smart to make sure to regain energy so that when it starts to rain you have enough energy to not come to a full stop. So in this case you might drive a little slower.

Figure 6.4: Weather and forecast banners

6.1.4. How to play/interaction

To make the game accessible for gamers and non-gamers alike there is a limited number of keys on the keyboard that the user has to interact with. These are the W, A, S, D keys and the Space bar. The car can be moved forward (W) and backward (S). The player can also steer the car left (A) or right (D). The player can use spacebar to slow the car down and come to a full stop.

When the player presses the W or S key the energy bar will start to go down. The longer the player holds down the key the lower the energy bar will get. When the player uses up all the energy the car will come to a stop. Before the player can continue driving, they will have to wait for the energy bar to refill a little bit.

When the player gets stuck or just wants to restart their run, they can click the question mark in the bottom left corner. This way a menu will open over the game where the player can select to look at the controls again, return to main menu or restart the game (*Figure 6.5*).

To finish the game the player has to make it to the end before the time runs out. This is a way to get the player to drive as well as they can, so that they can make it within the given time. The timer was added based on the insights gained from the lens of time [4, p. 165].

Figure 6.5: Overlay menu that can be accessed during the game

6.1.5. Guidance/information for the user

For a race the drivers usually know the route they have to drive, that will not be the case for the players of this game. So to make sure the player does not get lost on the track and knows what route to follow, checkpoints have been placed along the track for the player to follow.

Furthermore, to make sure the player knows how to play and control the car, they can select the controls option in the menu. This will give them the screen that can be seen in *Figure 6.6*. These additions were made with the lens of the player in mind [4, p. 125].

Figure 6.6: Screen with the game controls

6.2. *Prototype improvements*

For the second round of user tests some changes were made to the gamification. A checkpoint counter was added above the stamina bar and under the timer (*Figure 6.7*).

Figure 6.7: Updated game mechanics (checkpoint counter, lightning bolt, speed text) visible in the game UI

A finish line was added where the last checkpoint would appear. These two additions were made, so that it was easier for the players to estimate how far they still need to go to the finish. A page with some information was added that shortly explained what the player had to do (*Figure 6.8*).

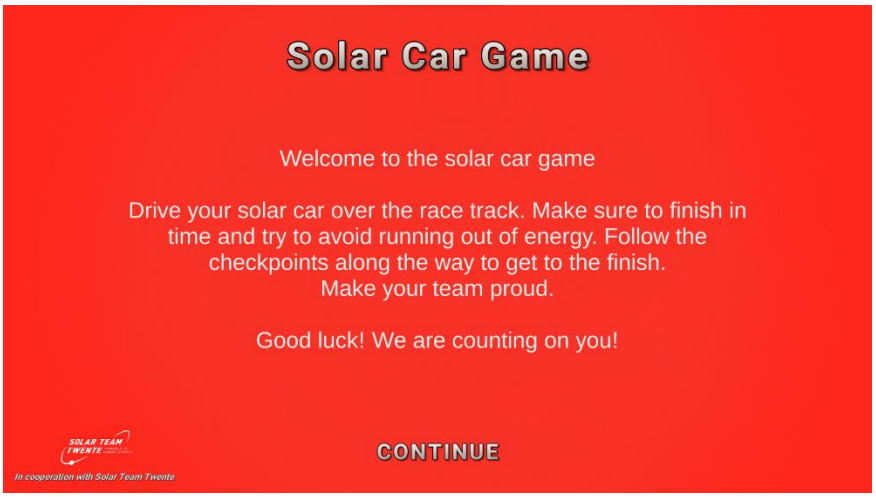

Figure 6.8: information page at the start of the game

This should help payers understand the basic mechanics of the game, whilst not revealing everything the game has to offer and not overloading players with information. A lightning bolt was added to the stamina bar and the speed text was moved a little further left (away from the stamina bar) to make it clearer that the stamina bar is not a speed bar.

6.3. Platform

To build a Solar Car Game a game-engine needs to be used, for this project Unity was chosen. Unity [36] has a wide variety of assets that can be bought and downloaded from their store. Furthermore, they have a lot of tutorials and documentation on all its functionalities that can help when running into problems. Unity has several build functions, so the game can be made for local use or can be made so that it can be accessed online (WebGL).

7. Evaluation

The prototype has been evaluated with potential end-users. In the following section, the procedure for the user tests have been described. Thereafter, the results from the two user tests will be discussed.

7.1. Evaluation procedure

For the evaluation of the solar car game prototype, user tests were conducted with potential end-users. Two rounds of user tests were held. For the user tests, a WebGL build of the game was made, so that it could be hosted on the researchers own website. This way the participants did not have to download a file to their computer and had easy access to the webpage with the game. The first round of playtests was done through semi structured interviews to get feedback on the mechanics and the enjoyment of the gamification. This was also used as point to improve some last minor points in the game. After some improvements to the game, a second round of user tests was held. The second round was done through a form that people could fill in. The form was sent in student WhatsApp groups, so that anyone who was interested could respond.

At the start of the user tests, the participants had to read an information brochure (Appendix A.1.) and had to fill out a consent form (Appendix A.2.). Only if they answered yes to all the questions on the consent form, were they allowed to participate in the user studies. At the start of the first round of user tests a short introduction was given on what the user test would be about. No information on the game or its mechanics were given. The user would start playing the game and learn by doing. After the user had given up or finished the race, they would have to fill in their answers to the questions in a form. Extra questions that were asked by the researchers were recorded in a separate document by the researcher.

7.2. Evaluation results

Before the user tests, the WebGL build was tested out by the researcher. There was found to be quite a long loading time for the game to start up when opening up the webpage. But the performance of the game was quite similar to the pre-build version in Unity.

7.2.1. First round of playtests

The first round of playtests was held with three participants, that all played games somewhat regularly. Two of the three participants made it to the finish line after several tries. The participant that did not make it to the finish got motion sick from the game, so they were not able to finish the race. Furthermore, one participant confused the energy bar for a speed indicator, because the speed is displayed directly next to the stamina bar. Another player commented on the car flipping over weirdly and having to completely restart when the car flipped over. One participant commented on the replayability of the game and that it would be nice to have random weather, they mentioned that they enjoyed the mechanic that there is fuel that recharges differently in different weather conditions.

The players were asked if they would want to play the game again if they got a score, the answers to this were mixed. One participant would not mind a score, but only to improve their own score and not to compare it to others. Another participant mentioned that a score would not make this player want to play again. The third participant might play again if there would be a scoring system.

The players were also asked if they learned something about solar cars and if they would be interested in learning more about them or the teams that make them. One participant stated they learned that solar cars were affected by the weather. Another participant stated that keeping momentum seemed important in the game. Two participants said they would not mind learning more about solar cars. One participant stated they would like to learn more about the team that build the solar car. One participant said they would not mind learning more, but they would not go out of their way to learn more about the solar team.

Overall players liked the game, but would have liked a little bit more information at the start, to know what they could expect of the gamification. Furthermore, they did not know how far they still had to go, so they could not estimate how fast they had to drive to make it to the finish within time. A visible scoring system might make some players want to play more, whilst it might deter others from playing. Some participants were interested in learning more about solar cars and the teams behind them.

During the first round of user tests, one of the members of STT played the game and they enjoyed playing it. Furthermore, for the second round of user tests they allowed their logo to be used on the gamification.

7.2.2. Second round of playtests

For the second round of user tests, some changes were made to the prototype and gameplay related performance was assessed. The gameplay related performance questions are about number of tries it took participants to get to the finish, number of times players ran out of energy, and how often players used the brake.

The second round of user tests resulted in 5 people responding and filling out the form. Three players did not make it to the finish, and one of the people that did not make it to the finish could not do so because of the D key on their keyboard not working (*Figure 7.1*).

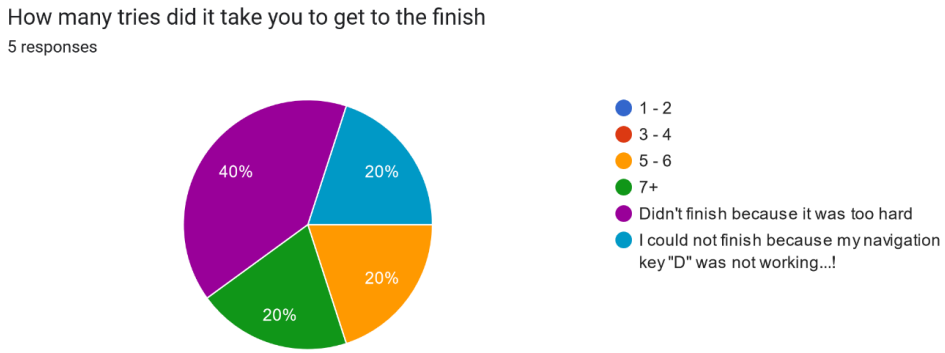

Figure 7.1: Form response how many tries did it take player to get to the finish

So, all in all only two out of five players in the second round of user tests made it to the finish. The least tries it took a player to get to the finish was around 5-6 tries. Furthermore, all of the participants ran out of energy at least once. Most ran out of energy only a few times after that, only one participant ran out of energy very often (*Figure 7.2*). No reason was given for why this participant ran out of energy so often.

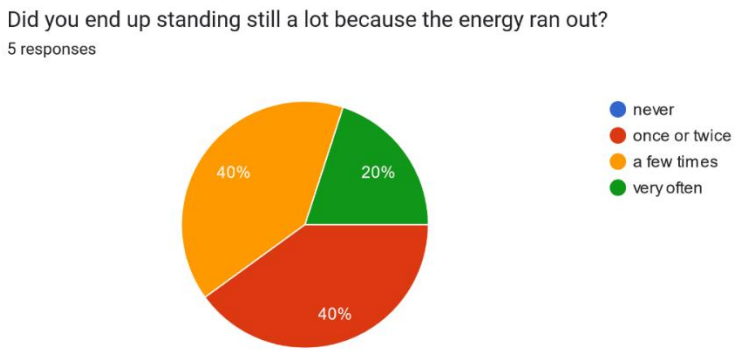

Figure 7.2: Form response how often did players run out of energy

Something that was interesting to see was the low usage of the brake. Only 20% used the brake (*Figure 7.3*).

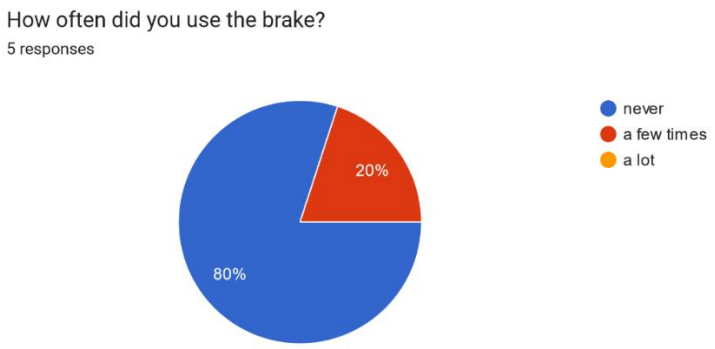

Figure 7.3: Form response how often did players use the brake

Furthermore, most participants answered that they play games every once in a while, or almost every day, only one respondent said they never play games (*Figure 7.4*).

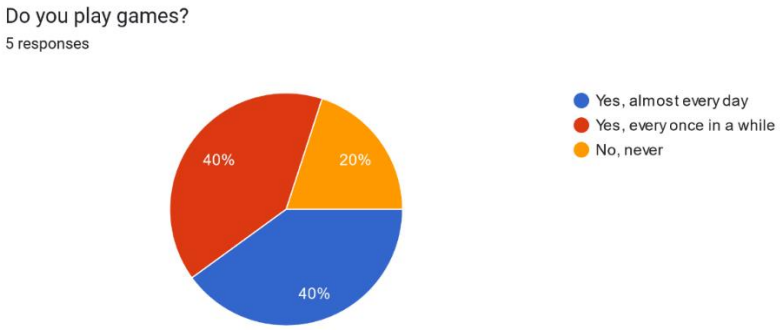

Figure 7.4: Form response how often do players play games

All participants stated that the controls were easy to understand. Some mechanics the participants liked were the challenge of the short timer, the follow up weather forecast, the solar energy as a nice twist to a racing game and how the player needs to think about energy usage. Some mechanics that participants did not like were the car braking when the energy runs out, car falling over pretty easily and no way to get energy apart from the weather.

Similar to the first round of user tests, the participants were asked if they would want to play the game again if they got a score. All participants were interested in a score or

scoreboard, but one participant stated that a scoreboard might be too stressful for a recruitment setting.

The participants were also asked if they learned something about solar cars and if they would be interested in learning more about solar cars or the teams that make them. One participant stated that they learned that when there is no sun the solar car is stranded, which might be a lot in areas where there is little sun. One of the participants also stated that they learned that a solar car brakes when it runs out of energy (which is not a real feature in a solar car). This could be caused by the in-game car braking when the energy bar is empty. This mechanic was added to prevent making the game too easy and was designed based on the lens of challenge [4, p. 209]. Furthermore, two participants were interested in learning more about solar cars and one participant was not opposed to the idea of learning more, but the other two participants were not interested at all. The participants had a similar response when asked if they were interested in learning more about solar teams. Two were interested, one a little and two were not interested at all.

Overall, most participants found it fun to play. Only one participant did not really enjoy the experience, because they did not like the amount of time that it took to load the level and that they had to reload the whole level when toppling over. Furthermore, the braking system after the energy runs out felt quite unnatural to players. Some suggestions for improvement therefore included more subtle braking when the car runs out of energy, toppling over should be game over, when using the brake energy should be regained, and some music and sound could improve ambiance.

8. Discussion

The discussion chapter is split into five sections. First the aims for the prototype will be discussed. Then interpretations of the evaluation will be discussed. Furthermore, some limitations of the research will be mentioned. Then, some recommendations for future research will be given. Lastly, some key takeaways will be discussed.

8.1. Aims for the prototype

The goal for the gamification was to make the game beatable, but not too easy, so that a player could not make it to the finish without putting some effort into it. This was done with the lens of skill in mind [4, p. 183]. If a player plays long enough and learns how to use the energy to the best of their abilities, everyone should technically be able to make it to the finish line. For recruitment this is very useful, so that measurements can be made on how often the player has to retry the game, how often the player runs out of energy, how often the player uses the brakes, and how much time is left over when they finish. With these measurements a threshold can be found that players need to pass to get offered to become part of STT.

To make the gamification accessible to everyone, the controls were deliberately kept easy. During the playtest only one person stated that they never play games, but all participants stated that the controls were easy to understand. Easy controls allow users that normally do not play games the opportunity to also engage with the gamification.

8.2. Interpretations of the evaluation

Most players enjoyed the game; it is important for people to get a good impression of the team, which an enjoyable game can help with. The feedback on the prototype showed that it was already working quite well for what it intended to do, but some improvements will have to be made for a finished working product. One of the main annoyances people ran into was the car actively braking when the energy bar was empty. This mechanic was intentionally added to make running out of energy more punishing. But during the user tests it was noticed that this should be made more subtle. So, when the energy runs out, the car still brakes, but the force it uses to brake might have to be halved. Another thing that came up during the evaluation was the low usage of the brake. This could be due to the controls page not being shown to the player before they start the game and the player already being familiar with basic game controls. They have to navigate to the controls page on their own to see that the

space bar can be used to brake. Another reason could be the S key being used to slow down the car. The S key reduces speed slower than the break, but this might already be enough for most players. Therefore, a feature that could make the gamification more interesting and that could make people want to use the brake more often, is energy that can be regained. So every time someone uses the brake, energy can be regained. However, braking should only regain energy when the car is still moving as a trade-off between speed and energy. So that the energy regained from using the brake button is not infinite. This mechanic would actually make the game more realistic, as the real solar car has two brakes, of which one can be used to regain energy. The braking power of that brake is reduced; therefore, they have another brake that brakes faster. Another change that can be made to the gamification to engage players more, could be random weather, because after a while players get used to the pattern. Although if the players should be tested on performance, it might be hard to actually compare scores. The random weather might make it too easy or too hard to get to the finish. To see it this mechanic should be implemented some user tests should be held with this implementation. Furthermore, one of the mechanics in the game was not working as intended. Based on one player running out of energy very often, the mechanics were looked at to see if there was something that could have caused the player to run out of energy so often. A flaw was found in the energy usage when pressing the W or S key. When the car is accelerating forward and the S key is pressed, even though the car is slowing down and not using energy to accelerate, the energy bar still goes down. Only when the W key is pressed and the car is accelerating forward should energy be used. Similarly, when the car is accelerating backward the S key should use up energy, but the W key should not.

8.3. Limitations

The limited amount of time for the research project affected the user tests. Due to the short time between the prototype being done and the results being needed, there was less time for user tests than was expected. So, for future studies more time should be made available for user testing and feedback, and development of a gamification. Furthermore, the performance of the player in the game, might not give an accurate representation of the performance of the player in real life.

There are some areas that are beyond the scope of this project. One of these areas is the accessibility of the prototype. Where should it be made available or accessible to attract people and give them the chance to enjoy the experience. Furthermore, what effect does the

scoring system have. First, for promotion and marketing, how do people respond to a shared scoreboard or a score for themselves, so that they can focus on their own improvement. Second, for recruitment, what should the score be based on to get an accurate representation of skills and what should the threshold be for allowing people to take part in the recruitment process. Another area that is beyond the scope of this research is the effect of people not making it to the finish. How does the player feel about this and how will it affect their view on STT?

8.4. Recommendations

For future research, it is important to plan more time for each phase of the research. Especially, the user test phase should be longer, so that a good sample size can be reached for significant results. Furthermore, research should be held into where the prototype should be placed or made available to reach the right group of people. For example, an installation could be placed somewhere in a public space. As was done by Swisscom, where they offered a phone after someone had looked at the screen for an hour [18]. The people that were around the participant got pulled into watching. That could help with reaching more people in public. But it might also suffice to have a folder, where people can scan a QR code to lead to the gamification. Another item to be researched is a scoring system or scoreboard. As stated by Chow *et al.* [1] gamifications are bound to fail when leaderboards, point systems and game graphs are used mindlessly. Therefore, before deciding to implement a score into the final product, a prototype should be made that uses a scoring system. This should be thoroughly tested with users to see what benefits a score could have to this gamification and what drawbacks it has. Another adaptation to the game that could be considered is an adaptive system that will reduce the difficulty when a player does not reach the finish in a certain amount of tries. This could be a good way for a promotional gamification to allow all users to get the chance to make it to the finish. To implement such a system, rigorous tests with users will have to be done to figure out when the gamification should become easier and by how much. It should also be looked into how it can be implemented without it being noticed by the players themselves, so that they do not feel bad about having to play it at a lower difficulty.

A helpful tool in the creation of the gamification for STT was the book of Schell [4] which describes game mechanics and the ideas behind them in detail. For future implementations of gamification it might prove useful to not only look at game mechanics that have worked for other gamification, but also look at what game mechanics there are and

what they can add. This can be done by for example using Schell's The Art of Game Design [4]. In this Schell describes the fundamental elements of game design – the Schell tetrad of story, mechanics, aesthetics, and technology. All four elements are essential for game design, but they can also prove useful for gamification. Since a gamification needs to balance all four elements as well.

8.5. Key takeaways

While the game works and the overall responses to it are positive, it does not test the users while playing the game. For the recruitment aspect it would be good to have a score, so that if they pass a certain limit, they can get invited to become a part of solar team (now they only get a link to STT's website if they make it to the finish). The score could consist of the amount of times the player ran out of energy, the number of times the brakes were used and the number of time that was left over when finishing the race. Some of the features like the braking of the car when the energy runs out should be slower and the brake might be used more if it can win back energy.

The solar car game should be realistic enough that it will not give players misconceptions of STT, but it does not have to be fully realistic and have all the features of a real solar car. Therefore, with the suggested changes, the gamification should balance realistic elements and non-realistic elements better. With this information the last SQ (SQ_3) has been answered.

The solar car game can be seen as a basis to be built upon, because it can be used for marketing, but it could also be used for recruitment by having the score measured and depending on the score show a link to sign up to become part of the team.

9. Conclusion

Now that all aspects of the research have been discussed, the research questions can be answered. First the answers to the sub questions will be discussed, followed by the answer to the main research question.

SQ_1: How can gamification enhance user experience?

Gamifications elicit similar effects that games elicit, therefore some of the positive effects might include: increased perceptions of self-efficacy, competence, relatedness and autonomy. For recruitment some positive effects include the process seeming fairer and a clearer idea of the job being offered. Both areas therefore can help enhance the user experience through gamification.

SQ_2: What game mechanics can be used to make a gamification interesting to play?

Most companies use rewards, scores and competition elements for their gamifications, overlooking other game mechanics that can be very useful for a gamification.

Schell identifies seven main categories for game mechanics [4]. These can be used to find the right game mechanics for a companies' gamification. For the Solar Car Game the main categories used are time, skill and actions. To keep the gamification interesting for people that never play games, controls are kept easy. But the game itself is not easy, this is done to balance fun and playability for everyone.

SQ_3: How realistic should the simulation be to interest people?

When the solar car runs out of energy it brakes, the players saw this as a real feature of a solar car. However, this is not the case and should be made more subtle, so that it will not give people the wrong idea. The solar car game should be realistic enough that it will not give players misconceptions of STT, but it does not have to be fully realistic and have all the features of a real solar car. For example, with features like checkpoints, the player knows that that is an in-game mechanic.

SQ_4: How realistic should the simulation be to attract potential candidates?

For recruitment there are some examples that attract people to a certain company, but most look at how well the user performs and how well they would work within the company. The representation of the job that applicants are to perform when they get the job is at the forefront of the gamification. This means that accurate and realistic representation of a company or job to be performed is necessary to make sure that the applicant knows what they are going to face when joining the team.

With the answers to the sub-question, the main research question can be answered.

RQ: How can Solar Team Twente use gamification to primarily be used for promotion and secondarily recruit potential candidates?

The gamification made for STT does not yet work for the initial screening recruitment phase, but it can be used as a nice way to promote their team and have people get to know more about them. Which is also the goal of the candidate attraction phase for recruitment. For the initial screening phase, the gamification could be improved by adding a scoring system. But to see if the performance of the player in game compares to real life, research should be held. To conclude, this gamification is a fun way to promote Solar Team Twente, that can also be used for recruitment purposes with a few changes to the prototype.

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Appendix A: Ethical forms

A.1. Information Brochure

This research is for my BSc thesis. In this research I want to test a prototype to help get a better understanding of the usefulness of the used gamification methods for marketing and recruitment. The prototype that you will be interacting with consists of a web-based game, that can be played in the browser.

The research procedure will consist of a survey/interview with a user test for the developed prototype. The prototype is part of gamification for marketing and recruitment purposes. User skills and interest in the company will be tested. The whole procedure will take between 15-30 minutes to complete. After interacting with the prototype there will be questions about the enjoyment of the prototype and the interest it might have created in a possible company using these methods to recruit people. No sensitive information will be collected and the information that will be collected cannot be linked back to you as a person. You can elect to opt out of the research at any time without giving a reason. Survey/interview questions can be left unanswered. Information gathered with the survey/interview that will be used for the report will be used anonymously and will be used in a way that cannot lead back to a single person partaking in the research. The answers to this survey/interview will be stored temporarily and will be deleted after the research is done.

People qualifying for this user test are people that are interested in solar teams or that are currently studying at the UT or Saxion.

This research project has been reviewed by the Ethics Committee Information and Computer Science.

Researcher:
Rosalie van Elburg
r.s.vanelburg@student.utwente.nl

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than

the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science:
ethicscommittee-CIS@utwente.nl

A.2. Consent Form

Consent Form for Gamification for promotion and Recruitment

YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have read and understood the study information, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	○	○
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	○	○
I understand that taking part in the study involves filling out a survey/doing an interview and testing gamifications.	○	○
Use of the information in the study		
I understand that information I provide will be used for research purposes only.	○	○
I understand that all data collected in this survey will be used anonymously.	○	○

Study contact details for further information:

Researcher:
Rosalie van Elburg

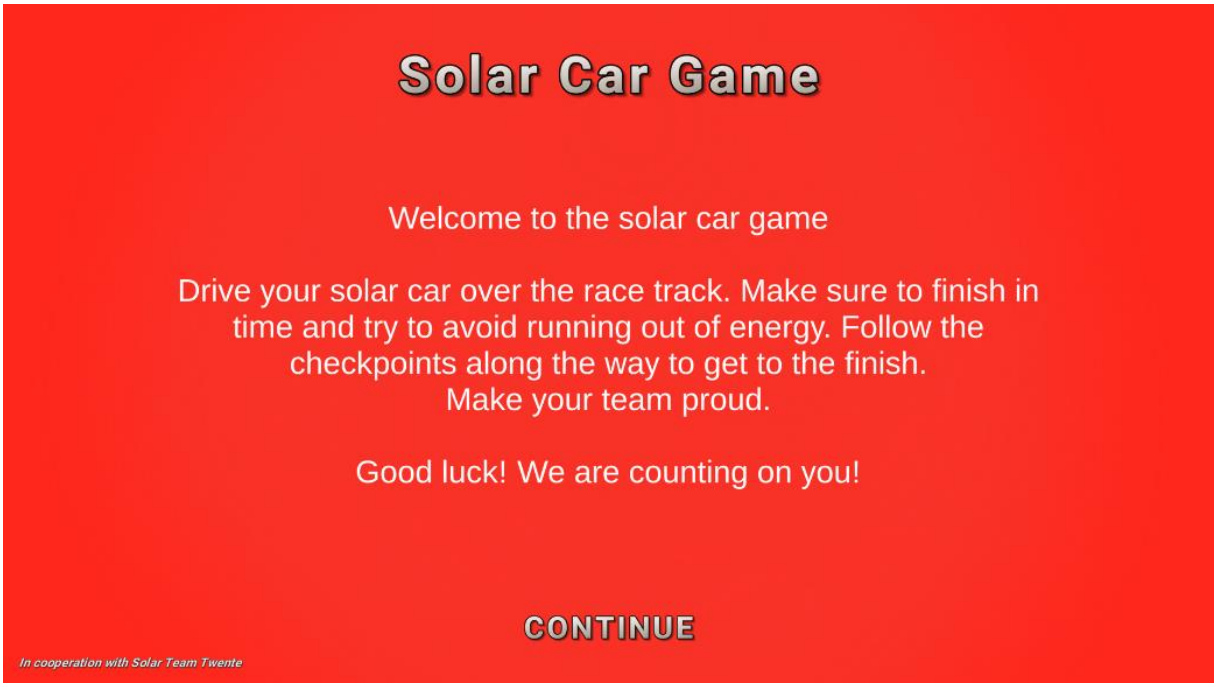
r.s.vanelburg@student.utwente.nl

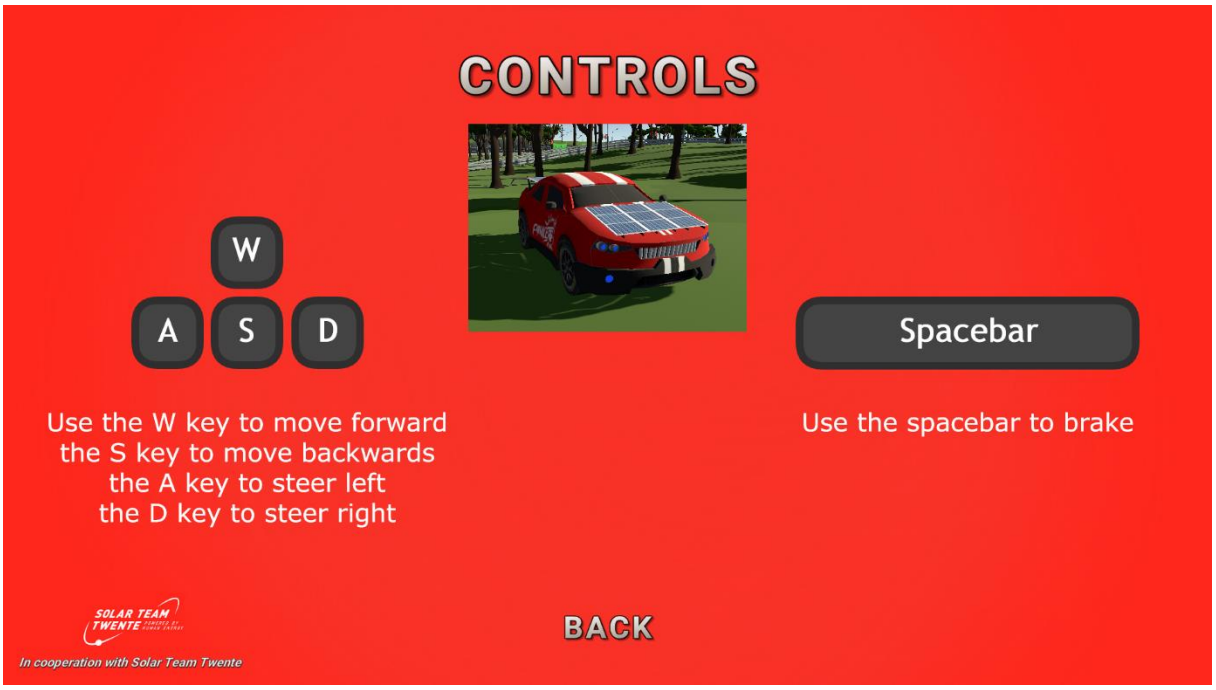
Research supervisor:
Dr. Job Zwiers
j.zwiers@utwente.nl

Contact Information for Questions about Your Rights as a Research Participant

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee Information & Computer Science: ethicscommittee-CIS@utwente.nl

Appendix B: Final prototype

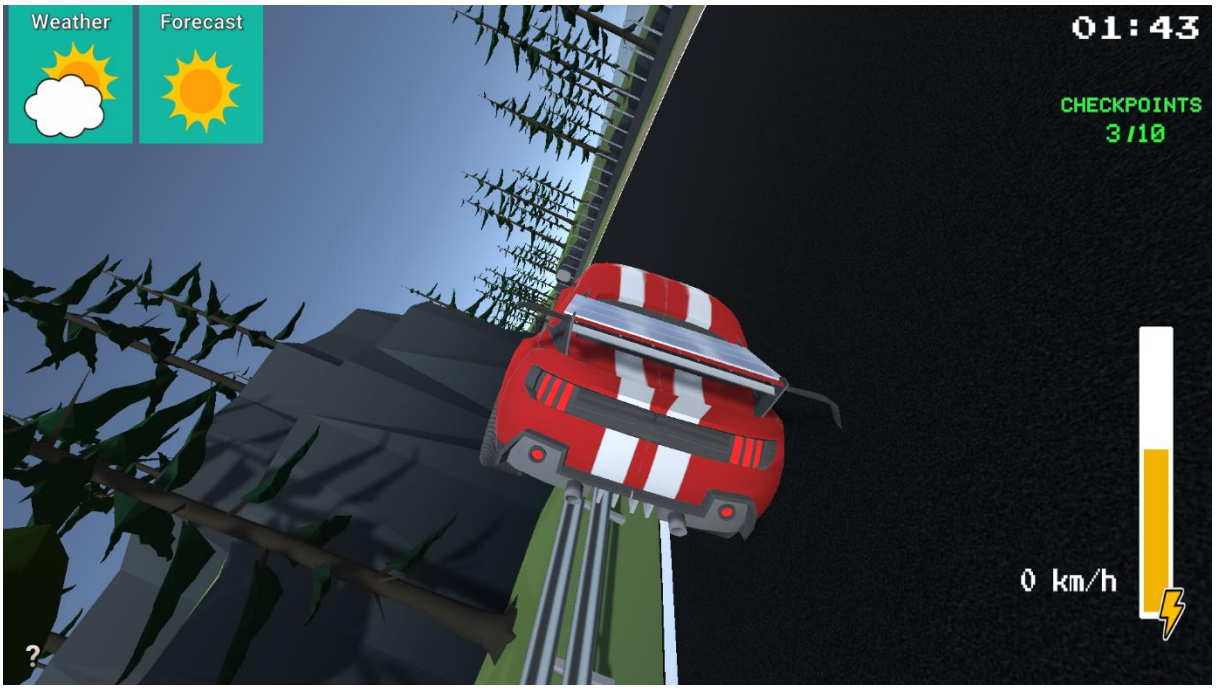



CONTROLS
W
A
S
D
Spacebar
Use the W key to move forward
the S key to move backwards
the A key to steer left
the D key to steer right
Use the spacebar to brake
SOLAR TEAM TWENTE
In cooperation with Solar Team Twente
BACK


Weather
Forecast
02:49
CHECKPOINTS
0/10
0 km/h
?


Weather
Forecast
02:30
CHECKPOINTS
0/10
59 km/h
?


Weather
Forecast
01:56
CHECKPOINTS
2/10
70 km/h
?


Weather
Forecast
01:43
CHECKPOINTS
3/10
0 km/h
?


Weather
Forecast
02:39
CHECKPOINTS
0/10
RESTART
CONTROLS
CONTINUE
40 km/h
RETURN TO MAIN MENU
SOLAR TEAM TWENTE
In cooperation with Solar Team Twente

YOU FINISHED THE RACE!

Visit the website of Solar Team Twente to learn more about their goals!

RETURN TO MAIN MENU

In cooperation with Solar Team Twente

BETTER LUCK NEXT TIME!

Time has run out and you
haven't made it to the finish

RETURN TO MAIN MENU

In cooperation with Solar Team Twente

Appendix C: Questions first user tests

Select your age group:

- 13 and younger
- 14 - 18
- 19– 25
- 26 – 35
- 36 and older

Study/study area (Computer Science, Physics, etc.)

What is your first impression of the game?

What are things you liked in the game?

What are things you disliked in the game?

What would you add or remove to improve the game?

Was it fun to play?

Would you be more interested in playing again if you get a score?

Did you learn something about solar cars?

Are you interested in learning more about solar cars?

Are you interested in learning more about the teams behind the solar cars?

Would you be interested to join a solar team?

Do you have any other observations/feedback you would like to share?

Appendix D: Form second user tests

Impression of the game

To be able to answer the questions a prototype of the game can be played using the link below. After playing the game you can continue on with filling out the questions below.

To play the game click here.

During the game to restart the game or return to the main menu press the question mark in the bottom left corner.

Select your age group

- ◯ 13 and younger
- ◯ 14 - 18
- ◯ 19 - 25
- ◯ 26 - 35
- ◯ 36 and older

Study/study area/work area (Computer Science, Physics, etc.)

Your answer

What is your first impression of the game?

Your answer

What are things you liked in the game?

Your answer

What are things you disliked in the game?

Your answer

What would you do to improve the game?

Your answer

Was the game fun to play? and why was it fun/not fun to play?

Your answer

Would you be more motivated to play again if you get a score that can be compared to other players' scores?

Your answer

Do you play games?

- ◯ Yes, almost every day
- ◯ Yes, every once in a while
- ◯ No, never

Were the controls easy to understand?

Your answer

How often did you use the brake?

- ◯ never
- ◯ a few times
- ◯ a lot

Did you end up standing still a lot because the energy ran out?

- ◯ never
- ◯ once or twice
- ◯ a few times
- ◯ very often

How many tries did it take you to get to the finish

- ◯ 1 - 2
- ◯ 3 - 4
- ◯ 5 - 6
- ◯ 7+
- ◯ Didn't finish because it was too hard
- ◯ Other:

Interest in Solar Cars

Did you learn something about solar cars?

Your answer

Are you interested in learning more about solar cars?

Your answer

Are you interested in learning more about the teams behind the solar cars?

Your answer

Would you be interested to join a solar team?

Your answer

Do you have any other observations/feedback you would like to share?

Your answer