Casual game design guidelines

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Abstract

Casual games have quickly grown into a huge industry that is expected to generate almost $9 billion in 2014. These games are now available on a number of different platforms such as desktop computers, consoles, smartphones or tablets. Some of the newly released games become incredibly popular, however, vast majority of them does not get noticed and quickly fades away.

This dissertation aimed to research successful casual games as well as the research conducted on games in general. It identified a number of aspects that could potentially lead to an enhanced gaming experience and those were then combined in a list of seven guidelines. These were challenge, representation, simplicity, feedback, randomisation, flexibility and social features.

The seven guidelines were then put through a test to see if they do actually make games better and to see if any particular guideline stands out. Five iterations of the popular game Breakout were developed and split tested gathering data from more than 300 participants.

The results showed that even though use of an individual guideline might not directly increase the time users spend playing a game, or the number of times they are willing to restart it, however, a combination of these guidelines does seem to have that effect. People spent 71.5% more time playing a version of the breakout game incorporated with a combination of the ‘challenge’, ‘randomisation and ‘representation’ aspects than they spent playing the very basic version. They also restarted it three times as much then they did the basic version.

The experiment demonstrated that if multiple casual game design guidelines are incorporated in a game, they can significantly improve the gaming experience.

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1 Introduction

1.1 Casual Games

Casual games are games usually providing a very simple gameplay that can be enjoyed in short bursts, while having a break at work or while waiting at a bus stop. They are often designed to appeal to a wide target audience and with the rise of smartphones and tablets they have become easily accessible and widely popular. The International Games Developers' Association defined casual games as "Games that generally involve less complicated game controls and overall complexity in terms of gameplay or investment required to get through game." (Wallace & Robbins, 2006).

Casual games industry is growing very fast and it is expected to become an $8.64 billion industry in 2014 (Evangelho, 2013). Majority of these games are becoming available on more and more platforms, including consoles, computers, smartphones and tables and are available both offline and online. Arguably the most popular casual games to date, Angry Birds (Rovio Entertainment, 2009) and its incarnations have been downloaded 1.7 billion times across devices according to its developer (Rovio, 2013), which is yet another indication of the massive popularity of the casual games genre.

At the time of writing this, there is more than 215 000 games on the Apple App Store and almost 230 more are added each day (148Apps, 2014). Some of these games become really popular and are downloaded millions of times, however, majority of these barely get a hundred downloads. Indeed, big part of that is marketing, however, quality of the game undoubtedly has a great impact on the overall number of downloads.

1.2 Aims

The project aimed to identify a number of design aspects that could help game designers and developers make better casual games. These are represented in a list of guidelines use of which could positively impact the experience of playing a game.

It is important to note that these guidelines are meant to inspire and provide suggestions on the general aspects of a game that should be considered rather than give specific step-by-step tutorial on how to make a good game. They point out what areas should the casual game designers be aware of when designing their games and could provide a simple structure that can be of help.

1.3 Process

Firstly, seven guidelines were identified through an extensive literature review of the existing research conducted on casual games, minimalist game design principles, slot machine gaming but also games in general. The guidelines were as follows:

- Challenge
- Representation
- Simplicity
- Feedback
- Randomisation
- Flexibility
- Social Features

Some of the most successful casual games including Angry Birds (Rovio Entertainment, 2009), Candy Crush Saga (King.com, 2012) and Cut the Rope (ZeptoLab Studios, 2010) then served as case studies. They were analysed in order to confirm whether these guidelines are in fact being used and the different ways they have been applied in these games.

The suggested guidelines were then put through a test. A simple game concept was chosen based on the popular game Breakout (Atari, 1976) and the guidelines were applied on it, creating five different games, each focusing on another aspect that arose from the guidelines. These were:

- The **‘Vanilla’** version, which basically just used the very basic concept of Breakout, using only black and white colours and no sound

- The **‘Challenge’** where the difficulty gradually increased over time and which also included a leaderboard ranking the most successful players

- The **‘Random’** where the level was randomly generated every time the game was restarted

- The **‘Representation’** which included improved colourful graphics, background music and sounds providing the players with feedback

- The **‘Full’** version which combined all of the above

Apart from that, all of the versions had a feature button which allowed them to share the game on Facebook.

These together formed an experiment where people would play them and meanwhile data was gathered about the different ways people played those games. The data gathered was then analysed in order to find out whether some of the versions significantly outperformed the others.

1.4 Summary of the findings

More than 300 people participated in the online experiment that followed and the data gathered from the experiment brought some fairly interesting results.

It would seem that individual guidelines by themselves do not improve the overall gaming experience, some of the ‘upgraded’ versions even performed worse than the ‘Vanilla’ version.

On the other hand, the ‘Full’ version outperformed the other versions in almost all aspects. When compared to the ‘Vanilla’ version, the ‘Full’ had a 71.5% increase in the average time played and it had three times as many restarts. Apart from that it

was also completed more times than the ‘Vanilla’ version, even though its difficulty level was higher.

Data from the experiment suggests that using a single guideline in order to improve the overall gameplay does not work. However, if a multiple casual game design guidelines are applied on a game, people spend more time playing the game and are even willing to restart a level multiple times in order to succeed.

A combination of the casual game design guidelines therefore can, if applied correctly, improve a game by enhancing the experience of playing it.

1.5 Structure of the report

This report consists of eight chapters, first of which is the introduction you are reading now. The other chapters are:

- Literature Review
- Application of the proposed guidelines in existing casual games
- Development
- Experimental design
- Data evaluation
- Critical reflection and Self-appraisal
- Conclusion and Future work

The next chapter will go through a number of publications dealing with casual games and games in general and it will talk about how the seven casual guidelines have been identified.

2 Literature review

There have been many theories and suggestions proposing various game design guidelines and this literature review seeks to find the most commonly mentioned topics and evaluate whether they can be applied on designing casual games. There are seven main topics found within this literature review:

- Challenge
- Representation
- Simplicity
- Feedback
- Randomisation
- Flexibility
- Social Features

These will now be examined in more depth.

2.1 Challenge

Prensky's work on engagement in games (2001) includes a list of 6 main elements that make games engaging. One of them is challenge, but he says we can also refer to it as conflict or competition. He says that challenges include all the problems in a game a player is trying to solve. Solving the problem is playing the game. The player could be competing against an artificial intelligence or against another opponent but challenge could also be a puzzle to solve, anything that stands in the way of progress. Even if games are not competitive, if they are all based around cooperation and teamwork, which just means players are solving the problem together.

Harrigan, Collins, Dixon and Fugelsang (2010) identified competitiveness as one of the major components to be aware of when designing games. Competition can have various forms; players can compete against an artificial intelligence, against other players but also against themselves. Competition is a very important aspect leading to repeat plays, when players try to beat their own score but also the best scores of

their friends. That is why so many games include various forms of leaderboards. They often help players set their long-term goals and thus increase playing time.

Many experts and researchers agree that the balance between the level of difficulty posed by a game and expertise and abilities of a player playing the game is of critical importance. In their article from 2010, Przybylski et al. say that if a game is too challenging, players might experience frustration, while if a game is not challenging enough, they might experience boredom. Both of these could eventually lead to a player giving up and quitting the game. They also talk about the motivation for playing video games and they expect that video games have potential to satisfy basic psychological needs, one of which is the need for competence. The article says that the purpose of challenges in games is so players can continually experience enhanced competence as they progress throughout a game.

A very recent study by Cox, Cairns, Shah and Carroll (2012) examined the role of challenge in a gaming experience. First they tried altering the physical effort required from players in order to succeed in the game. This was achieved by increasing the level of activity (number of actions player needs to make in order to progress in the game) required to play the game, thus changing the relative game 'intensity'. They then used the Immersive Experiences Questionnaire (Jennett, Cox, Cairns, Dhoparee, Epps, Tijs and Walton, 2008) to measure players' levels of immersion in different setups. The results showed that physical effort alone does not significantly impact the level of immersion the players experienced. In another experiment that was part of the same study, the aim was to try manipulating the cognitive challenge within the game and see what effect will it have on the gaming experience. They hypothesised that an increased cognitive challenge could be achieved by addition of time pressure. This hypothesis was later confirmed and the experiment also showed a correlation between expertise and immersion. Skilled players were more immersed under very high time pressure while novices experienced higher immersion with low time pressure. This study concludes that it is the cognitive, not the physical challenge that has a positive impact on immersion.

Many of these papers also talk about the concept of Flow, which Prensky (2001) describes as “a mental state of intense concentration, often to the point where previously difficult tasks become easy and whatever you are doing becomes enormously pleasurable”. This concept comes from a research done by Csikszentmihalyi (1997), and as far as games are concerned, his research suggests that we can achieve this mental state appropriately balancing the game’s perceived level of challenge and the player’s.

To sum up, every game needs to have a challenge, a problem to solve. It is the cognitive, not the physical challenge that can significantly improve the playing experience. Many games also include the element of competition, opponent which could come in form of an artificial intelligence or real players. They could challenge each other or compete to rank higher in leader boards. Game designers should always strive to come up with the right balance between the game’s difficulty and the player’s skills, perhaps by incrementally increasing the difficulty over time. Many designers use time pressure to fully immerse the players in the game.

2.2 Representation

Representation is another one of Prensky’s elements that make games engaging (2001). He says that representation means that a game is about something, be it something abstract or concrete, direct or indirect. It summarises all the narrative or story elements that can be found in the game. It could be some everyday activity that we are all familiar with or basically any type of fantasy.

King, Delfabbro and Griffiths (2010) refer to the representation as to the ‘narrative and identity features’. The game narrative can be presented through various forms - the gameplay itself, in-game cut-scenes, in written form inside the game or many others. King et al. suggest that aesthetic qualities of a game are of high importance and that visual and auditory features can help make a game highly exciting and appealing. They refer to an unpublished study by Griffiths which found that “the music of Tetris significantly increased players excitement and arousal compared to playing the game in silent mode with the music off”. They argue that game’s sound

and visual elements could help boosting player's confidence and arousal and may facilitate the subjective perception of time loss.

In his book titled Casual revolution (2010*a*), Juul talks about 'fiction'. He says that first impression of a game comes from the presentation of what the game is actually about and what is the game's setting. He argues that casual games are almost exclusively set in positive and familiar settings, that in order to attract wider target audience casual games should have positive emotional valence. He explains that valence refers to whether an emotion inclines you to approach something or avoid it and usage of positive valence in game design can encourage positive emotions when playing games.

Kultima makes the same argument in his article (2009), saying that we have to refine the design to make it accessible and suitable for larger target audiences. That is why most casual games provide spaces with familiar and safe environments encouraging positive mechanics like building, creating, collecting instead of destroying and killing. He believes casual games should therefore avoid offensive topics and they should either use abstract topics and game mechanics or already established game designs outside the digital worlds such as chess, solitaire or sports.

Another approach that casual game designers sometimes use is making the representation very abstract, Juul mentions Lumines Live! (Q Entertainment, 2006) which uses a very futuristic style that falls outside the positive/negative fiction scale. In a paper written by Nealen, Saltsman and Boxerman (2011), minimalistic approach to game design is proposed, suggesting to strip away all the unnecessary components. Nealen et al. say that minimalist games should be deliberately abstract, both systematically and visually. Visuals of a minimalist game should be non-photorealistic, independent from visual references coming from the real world. They also compare it to a well-designed infographic. Game designers must carefully balance the number of elements on screen as well as their position in space in order to make them clear to understand, which is even more important on smaller screens, such as the one of iPhone or iPad. Nealen et al. argue that abstract visuals can bring better coherence and contrast thus improving the overall experience by making the

game easier to understand and follow. They also mention the importance of audio in games, which is often designed to reinforce and enhance the main theme.

The literature suggests that casual games should be set in positive, familiar settings and avoid offensive topics in order to attract as wide target audience as possible. In some games, using abstract, perhaps futuristic style can also work quite well, thus creating a visually minimalist environment. Auditory and visual elements should enhance the main theme of the game and make the game appealing to the players. All the game elements should be clearly positioned in space in order to make them clear to understand, mainly if the game is intended to be played on mobile phones, where the screens are much smaller.

2.3 Simplicity

Przybylski, Rigby and Ryan (2010) believe that players must invest lots time and energy to master game's interface, controls and mechanics. Each game has its own learning curve which is basically the process of mastering the game's controls. It is usually more 'steep' in big, complex games, while modern casual games are getting more intuitive and easy to get into.

In their paper about minimalist game design, Nealen et al. (2011) argue that minimalist game should feature only a very small set of mechanics while still being deep enough to allow players explore the game and work on improving their performance. Their idea is that game designers should strip away all unnecessary components and that every element has to have a meaningful contribution to the overall game experience. The controls should be simple and easy to use. They propose the notion of tight coupling of in-game variables. The example they use is from the game Osmos (Hemisphere Games, 2009), where player's size is also his health and fuel and he has to sacrifice some of it in order to move. They argue that even though a game might be very complex, they should have low perceived complexity from the user's perspective. That makes them easier to get into and more inviting. As far as the controls are concerned, there should be a good balance between functionality and simplicity.

Kultima(2009) uses simplicity as one of his four casual game design values. He argues that simplifying the design enables for lighter play experiences. If game designers use minimal elements and user interfaces, they make it much easier for players to get into their games. Simplifying the design alleviates player's cognitive load and can be done through combining in-game functions into smaller number of controls (e.g. one-button interfaces) or by automating some of the in-game activities (e.g. auto-saving).

In summary, research shows that casual games should feature a shallow learning curve when it comes to their controls and mechanics and game designers should try to make them very intuitive and easy to get into. Many casual games could benefit from adapting the minimalist game design principles, using only the necessary mechanics, combining or automating in-game functions and stripping away the elements that do not have a meaningful contribution to the overall gameplay. In addition to that, even though a game's back-end might be very complex, the complexity perceived by the player should be quite low.

2.4 Feedback

Prensky's paper (2001) talks about feedback as one of the essential game design elements. It is how we measure our progress against the game's goals. Winning and losing both have very strong emotional and ego-gratification implications and they are big part of what makes games attractive. When something in a game changes in response to what we do, game immediately lets us know whatever we have done something positive or negative and whether we are getting closer to our final goal or further away.

In his book (2010*a*), Juul refers to excessive positive feedback as juiciness. He says that a 'juicy game' feels alive, responds to everything you do, with tons of response for minimal user input, which makes player feel in control, competent or clever. Through the use of juiciness, the game is informing the players about how well they are doing, basically on a per-interaction basis.

Harrigan et al. (2010) came up with a number of recommendations for casual games based on existing research done on digital slot machines. When playing slot machines, users often get feedback in form of ‘rolling sounds’ and flashing lights, which in many casual games are represented by vibrations, in-game animation and sound effects. These pleasing sounds and animations also serve as rewards to the users.

King et al. (2010) mention the classical conditioning theory, according to which players can form associations with various stimuli within the game and pleasurable feelings, which leads to positive reinforcement. For example players may associate the background music of a particular game with a feeling of winning, which makes them feel excited every time they start the game.

King et al. consider reward and punishment features to be crucial for providing a good game experience. Some games reward players with points, in-game currency that can be exchanged for in-game rewards or with unlocking bonus content, which could come in form of short videos, concept artwork or secret levels. Players can often be playing to obtain a number of rewards at the same time. King et al. believe that in order to establish the contextual worth of in-game rewards, elements of failure and punishment must be present as well. Common forms of punishment could be losing resources of some kind, such as points or lives, having to restart a level or completely failing an objective.

In order to use the elements of reward and punishment properly, timing is of critical importance. Video games can have variable or fixed ratio reinforcement schedules. Players often try to figure out the behaviour that leads them to getting a reward and once they find out the specific ratio, the game becomes more of a job than a game. That is why King et al. recommend using variable ratio schedule, which can better sustain player’s motivation to play a game for a long period of time, thinking they are closing in on yet another reward.

Prensky (2001) states the opposite, his idea is that games should provide frequent rewards but they should not punish their players. He writes: “While early on points

were often subtracted for failure or bad moves, people generally do not like this." However, this is only a subjective opinion since there is no reference to a supporting study.

On the other hand, Juul (2010a) argues that if we make a game too easy, it loses all its essential tension and challenge. He believes that the level of difficulty needs to match the player's skills and abilities but that replaying a difficult level is totally acceptable and could be enjoyable, if the increase in difficulty is reasonable. Juul says that even though in older games punishment used to be more severe (touching an enemy results in losing life), most casual games only really punish the player after accumulating a number of mistakes.

Harrigan et al. (2010) also talk about the notion of 'non-rewards'. Near-miss principle is one of them and it is very common in slot machines design industry. In slot machines it could be that the player needs 3 matching symbols, gets 2 and the third one does not roll down completely, which means he lost. Many players do not perceive this purely as a loss but as an attempt that came very close to winning. In casual games player often has to follow a sequence of events and misses the very last one, such as a long jump manoeuvre in a platform jumping game.

Another of the 'non-rewards' is the notion of losses disguised as wins. In slot machines players often 'win' an amount of money that is less that the amount they actually bet in the game. According to Harrigan et al, research is clear that players physiologically experience these losses disguised as wins the same way they experience regular wins. Harrigan et al. argues that "Casual gamers are often looking for a game that provides rewards without too much time and effort on their part." Many casual games therefore reinforce the players with 'wins' that are not really wins in order to provide just enough enjoyment for even a very short gameplay session.

To conclude, feedback is a crucial element of both casual game design and game design in general. It informs the player about his performance and progress, encourages certain behaviour and eventually leads to winning or losing. Positive feedback can make player feel in control and competent and can have a significant

emotional impact on him. Game designers should ensure that their games produce clear and immediate feedback that could be visual, auditory or even physical (e.g. vibration). All casual games should include some form of reward and punishment features and could also benefit from the addition of 'non-rewards' such as near misses or losses disguised as wins.

2.5 Randomisation

Juul (2010*a*) argues that majority of downloadable casual games feature an element of randomisation, which can make replaying a level more interesting and less punishing. He gives an example of games such as Magic Match or Bejeweled, where every time you start a level, gems are randomly distributed on the screen. In another paper of his (2010*b*) Juul says randomisation does not have to be random in a technical sense, it is meant to prevent the player from performing the same sequence of actions every time he plays a certain level.

According to Harrigan et al (2010), another important technique slot machines are using is illusion of control. Slot machine research brings strong evidence that "gamblers who are given an illusion of control in a gambling game will value their chances higher than those who feel they have no control". Slot machines do this by the addition of stop button, which in reality has absolutely no effect on the outcome of the game, apart from the fact that the reels stop spinning earlier. It increases the perception that the stopping is not random and that result of the game might be based on some form of player's skill.

On the other hand, King et al. (2010) describe that it is important to also involve some degree of chance in games and that events that the players cannot control can significantly increase replayability and enjoyment of a game.

In order to make a game more interesting, increase the playing time and make it more replayable, it is advised to use the element or randomisation. If game designers can prevent the player from performing exactly the same sequence of actions every time he replays a level, the playing experience can be much more enjoyable in long term. Researchers also recommend incorporating a degree of chance which player

does not necessarily need to know about, since game designers can provide him with the illusion of control.

2.6 Flexibility

One of the four casual game design values Kultima suggested (2009) is Flexibility. As mentioned previously, playing a casual game can often be considered a secondary activity. Play may happen in parallel with a number of other activities, such as travelling, eating, watching television, etc. Because of this, Kultima believes that casual game designers should seek solutions for certain limitations and expectations. Players should be able to pop in and out of a game spontaneously, and they should also be able to direct their attention elsewhere at any given time during the play. He also says that casual games should be more error-forgiving than standard PC games, allowing players to make mistakes without severe punishment. He also suggests automated saving feature so players do not lose their progress if they have to leave a game in a hurry. All these suggestions are in line with playability heuristics defined by Korhonen and Koivisto (2006), which say mobile games should be able to reasonably handle interruptions, accommodate the game with its surroundings and enable players to start their game sessions quickly.

Juul (2010) also considers interruptibility to be of high importance when it comes to casual games. Research conducted by Nielsen Games (2008) reported that non-players consider lack of time as a primary reason for not playing games. On the contrary, the same study reported that many casual players also play these games for longer periods of time, often for hours. Therefore casual games should allow player to play in short bursts or to easily interrupt a game, however, they should not prevent them from engaging in longer playing sessions. The addition of automatic saving system is a must in casual games, allowing the player to simply close the game should the need arise, enabling them to leave the game within a few seconds. Juul also recommends including an overview that shows players how many levels it takes to complete the whole game, arguing that perceived ahead-of-time commitment is as important as the actual time commitment. In addition to this, interruptibility should also accommodate for the psychological aspect time, so the

player should feel that it is appropriate to leave the game. Even if a game technically allows the player to quit the game or take a break at any given time, it is appropriate to provide break-facilitating sections when player has no outstanding tasks to solve. This can be solved by simply dividing the game into a number of short levels.

King et al. (2010) also suggest use of a checkpoint system that requires a player to reach a predetermined part of the game in order to save his game progress. It could contribute to longer playing sessions where players might decide not to quit a game until they reach a certain checkpoint.

To sum up, when designing casual games, designers should be constantly aware of the fact that players may consider them a secondary activity, therefore players should be quickly turn them on and off, the game should automatically save player's progress in case the game session gets interrupted. Casual games should accommodate both short and long playing sessions by either designing a number of small levels or having a simple checkpoint system. In addition to that, the player should be informed both about his current progress and the game level/checkpoint structure in order be able to assume how long will it take him to finish a certain part of the game or the game as a whole.

2.7 Social features

According to King et al. (2010), social features refer to how the game enables players to communicate with other players and features that create a cooperative and competitive community of players. Many papers suggest the addition of a multiplayer mode, where players could challenge their friends or have a living opponent selected on random. Apart from enabling players to face other people in multiplayer games, competition can also be encouraged by addition of leaderboards. They give players an overall rank that is usually a position number and should be updated regularly.

Paper by Harrigan et al. (2010) mentions the importance of peer praise when it comes to slot machine gambling. In casinos this is usually achieved by feedback, when the machine starts producing loud sounds and flashing lights, notifying everyone in a close proximity about the player's winnings. That often results in

surrounding people celebrating the winner by hand clapping and cheering. Casual games are typically played on one's own, however, players can still achieve peer praise through competition by using leaderboards or sharing their best performances on various types of social media such as Facebook or Twitter.

Good casual games should allow social interactions between players, whether it is through in-game chat, leaderboards or sharing on social media. This can be directly related to the 'challenge' aspect, where players try to beat the scores of their friends in order to seek peer praise.

2.8 Conclusion

Thanks to the vast research conducted on casual games and games in general this literature review identified seven guidelines that could help casual game designers make better games. These are:

- Challenge
- Representation
- Simplicity
- Feedback
- Randomisation
- Flexibility
- Social Features.

The next chapter will research some of the most successful casual games trying to identify whether some of them did in fact use the guidelines that came from the literature review. It will look at how these guidelines might be used and whether their usage differs from one game to another.

3 Application of the proposed guidelines in existing casual games

In order to demonstrate how these guidelines can be applied on casual games, this section examines some of the most successful casual games from the recent years. The success criterion was that the game must have been downloaded at least 10 million times from the Google Play store (Google Play, 2013) at the time of writing. Five games were picked, including Angry Birds (Rovio Entertainment, 2009), Candy Crush Saga (King.com, 2012), Cut the Rope (ZeptoLab Studios, 2010), Doodle Jump (Lima Sky, 2010), and Fruit Ninja (Halfbrick Studios, 2010). All of these games have had various iterations on a number of different devices, this section will review the Android versions currently available on Google Play. This review will examine whether these games use any of the casual game design guidelines proposed in Chapter 2 and if so, how were then applied.

3.1 Challenge

All of the analysed games pose some kind of a challenge. Angry Birds, Candy Crush Saga and Cut the Rope consist on a huge number of levels and in order for a player to progress, he must first complete the challenge at hand. An example of this is shown in Figure 1, the player has a limited number of moves and the challenge is to reach a certain score within the limit. Angry Birds and Cut the Rope both present very similar type of challenge, only applied on different core mechanics.

On the other hand, Doodle Jump and Fruit Ninja do not include a number of levels; there is only one, however, it is one that only ends if you lose. In Doodle Jump you have to jump up platforms and avoid falling down or hitting an enemy. The game also provides other challenges in form of achievements as shown on Figure 2. These are very specific sets of goals that the player can focus on while also fulfilling the game's primary objective and can significantly prolong the overall play time.

Figure 1. Example of challenge in Candy Crush Saga

Figure 2. Example of challenge in Doodle Jump

Both Doodle Jump and Fruit Ninja are less about the cognitive challenge and more about testing the player's reflexes. Fruit Ninja offers a timed mode, where the player has a very limited time period within which he has to slice as many fruits as possible.

All these games also provide some form of leaderboards. In Angry Birds, Cut the rope and Fruit Ninja they are only local, however, in Doodle Jump you can also compare your score with other players from all over the world. Candy Crush Saga goes even a step further, it allows you to integrate the game with your Facebook account and compare your score to your friends as can be seen on Figure 3.

Figure 3. Comparing your score with your friends in Candy Crush Saga.

3.2 Representation

All of these games have very neat and inviting graphics and most of them include familiar objects or characters. Most of them are set in very friendly settings and had a positive valence, e.g. in Cut the Rope player's objective is essentially to feed a certain creature. Even though the main game objective in Angry Birds is basically to use a slingshot to shoot birds trying to kill pigs, the game still manages to maintain a positive valence. None of the games contains gore or offensive language and therefore all games can be accessible to a very wide target audience.

Angry Birds has had a huge number of incarnations set in different environments, most recently the Angry Birds Star Wars II (Rovio Entertainment, 2013) which can be seen on Figure 4. Here the in-game characters actually represent the characters from the original Star Wars saga, which made the game very popular amongst a number of players.

Figure 4.The second Star Wars incarnation of Angry Birds.

In Cut the Rope, player has access to a number of videos that are constantly being added to the game over time. These are meant to reinforce the main theme and story of the game and encourage players to share them on social media (see Figure 5).

Figure 5. A number of short videos reinforce the story of Cut the Rope.

All of the tested games had very nice graphics and animation effects, only Doodle Jump was slightly more simplistic. Background music and sound effects were also present in all of them and the successfully enhanced the overall gaming experience.

3.3 Simplicity

The examined games are all very intuitive and easy to get into. Most of the games start off with a very simple level that has on-screen instructions on how to control the game. The most difficult one to control was probably Doodle Jump, because apart from touching the screen to shoot, the player also has to tilt the whole device to move left or right, all of that happening very quickly. However, as can be seen on Figure 6 the instructions are very clear and after a few attempts players can easily master the game's controls.

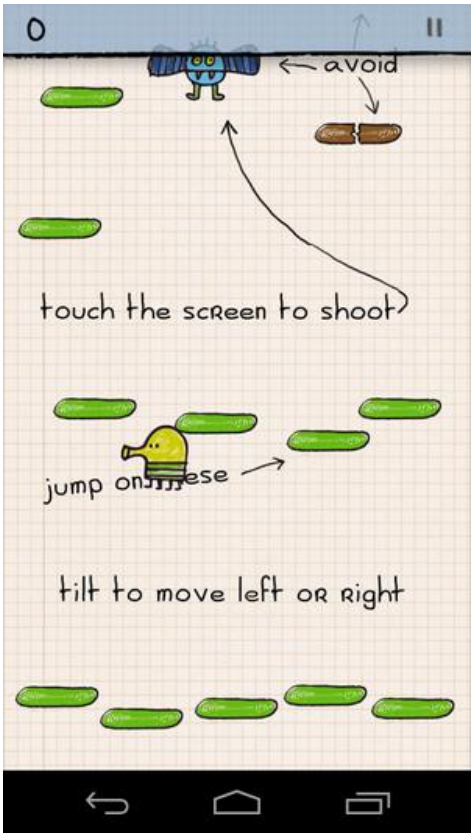

Figure 6. On-screen instructions in Doodle Jump.

Angry Birds do not provide on-screen instructions, however, the controls themselves are very intuitive. Player simply uses his finger to fire the slingshot, controlling the strength and the angle as shown on Figure 7.

Apart from Doodle Jump, which is controlled by touch the screen and tilting the device, all the other games are controlled by swiping the screen. It is not quite as simple as one-button interfaces, however still very intuitive and easy to learn.

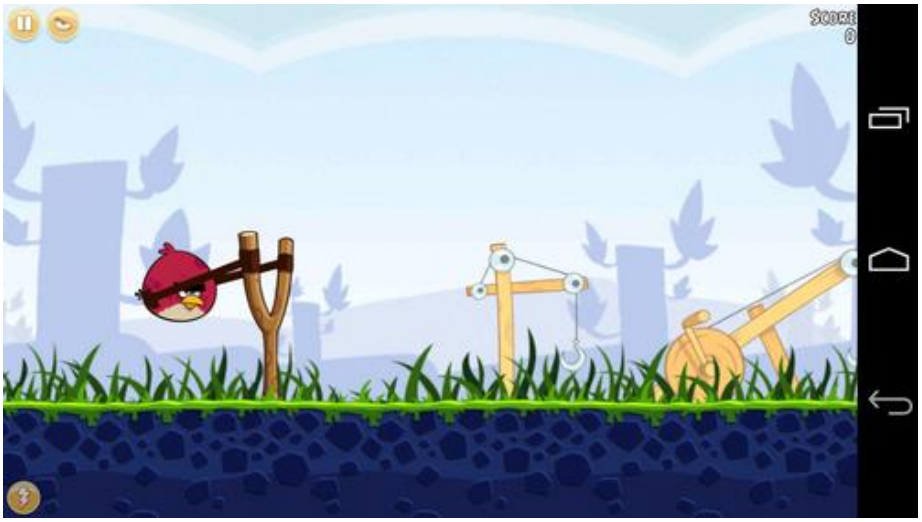

Figure 7. Controlling the slingshot in Angry Birds.

In addition to the easy-to-learn controls, all the games also feature a very shallow learning curve. Players first start with very simple levels and progressively build their way up to the more difficult ones, learning the mechanics on the go.

Many of the tested games are dealing with objects' physics and gravity and therefore their code base is undoubtedly quite complicated, however, the perceived complexity of all these games is quite low, thus users can easily focus on their main goals and objectives and become immersed in the experience.

3.4 Feedback

All of the examined games have various forms of visual and audio feedback, successful actions are followed by positive sounds and neat animations. In Candy Crush Saga, when the player manages to match three candies vertically or horizontally, his action is followed by a smooth animation of the candy disappearing and announcing the amount of point it got him as can be seen on Figure 8.

Figure 8. Successful match in Candy Crush Saga.

When player slices a fruit in Fruit Ninja, the fruit juice splashes on the wall and it is accompanied by a corresponding sound (see Figure 9).

Figure 9. Fruit slicing animation in Fruit Ninja.

In terms of the reward system, all games use a scoring system so player gets a certain number of points for every successful action. Also, unlocking a next level is a reward in itself. In Candy Crush Saga player can also earn a number of boosters that can help him progress in another levels. In Cut the Rope player can find a number of drawing that are later added to his “Om Nom Drawings” gallery as shown on Figure 10.

Figure 10. Reward gallery in Cut the Rope.

All of the analysed games include quite severe punishment systems, in Fruit Ninja if a player slices through a bomb, the game is over, in Cut the Rope if a player cuts the wrong rope, the game is over as well. The levels are quite short though, so restarting level might not be considered too painful. On the other hand, in Doodle Jump, game can take a few or even a dozen minutes if a player is doing good, so losing such a game and having to play again can be quite a negative experience (see Figure 11).

Angry Birds, Doodle Jump and Fruit Ninja are all about precision and often players can experience near-miss situations, when they were really close to succeeding. According to the literature review, this can often be perceived the same way as winning and players are therefore encouraged and eager to try again.

Figure 11. Game over screen in Doodle Jump.

Of the tested games, the 'losses disguised as wins' notion can be found in Angry Birds, Candy Crush Saga and Cut the Rope. All of them use a three star system where players can progress to another level even without being completely successful. For instance, in Cut the Rope, player has to collect stars before feeding the creature, however, even if he does not manage to collect all of them, he will be presented with a winning screen as can be seen on Figure 12.

Figure 12 Loss disguised as a win in Cut the Rope.

3.5 Randomisation

The levels of Angry Birds and Cut the Rope are pre-determined and hard-coded, however, all the other games have the element of randomisation in them. In Doodle Jump, the level is randomly being created as a player progresses, it would be very rare to see the exactly same level generated more than once. The same can be seen in Candy Crush Saga, candies are randomly placed on a grid as can be seen on Figure 13. Apart from the level setup, the type of incoming fruits as soon as player clears some out is random, which means that the game involves a significant amount of chance; even if a player is really good, unlucky candy drop can lead to a lower overall score.

In Fruit Ninja, the fruits are appearing in random forms and angles, however, there is a fixed ratio for the appearance of bombs. Due to the random angles in which the items fall, the sequence of player's actions will rarely be the same and every game will be a totally new experience, which can lead to a prolonged play time.

Figure 13. Randomly generated level in Candy Crush Saga.

3.6 Flexibility

When it comes to flexibility, all of the games can be very easily initiated and closed. They can be easily interrupted by just locking the phone or minimizing the application. They can also be exited but that would lead to a player losing the in-level score. All of these games include very small levels that accommodate short playing sessions, however, players could play the games for hours in order to improve they score or finish all the levels.

None of the games has a checkpoint system, however it might seem unnecessary considering the average time it takes to finish one game. Since Angry Birds, Candy Crush Saga and Cut the rope all consist of a high number of levels, they also incorporated an overview of the level structure, so players can assess the

approximate time commitment it needs to finish a certain chapter or the whole game even before they start playing (see Figure 14).

Figure 14. Level overview in Cut the Rope

3.7 Social Features

None of the reviewed games has an in-game chat system but they all use social media in a number of different ways. For example, as Figure 15 shows, Fruit Ninja encourages you to share your scores on Twitter.

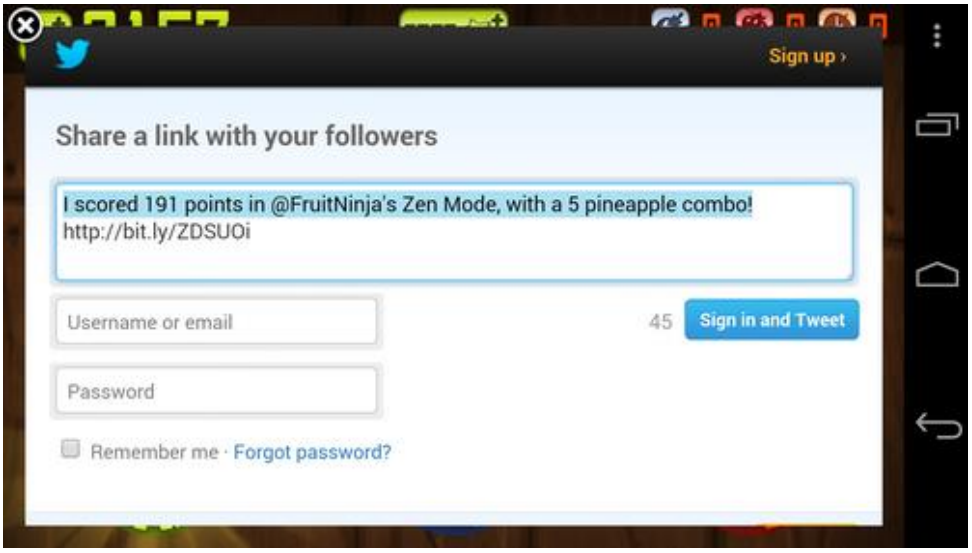

Figure 15. Sharing Fruit Ninja score on Twitter.

All of these games have a Facebook page and they encourage their players to like it and use it to discuss the game with other players from all over the world.

Each one of the reviewed games has a scoring system but only Doodle Jump enables you to compare your score with the best players in the world. In Candy Crush you can connect to the game using Facebook and in response to that, the game shows you scores of all your Facebook friends that played a certain level, encouraging you to beat them. It even uses their Facebook profile pictures, thus making the game slightly more personalised for each player (see Figure 16).

Figure 16. Facebook integration in Candy Crush Saga shows you which ones of your friends did best.

3.8 Conclusion

To conclude, Chapter 3 demonstrated that all seven guidelines proposed in Chapter 2 are in fact being used in successful casual games.

Even though the way these guidelines are used can differ from game to game, the fact that we could identify them in all of the reviewed games determines that they are of very high importance when it comes to designing casual games.

Chapter 4 will document how these guidelines can be applied on an actual game and it will document the most important aspects of developing it.

4 Development

This section will talk about using the proposed guidelines and including them in the development process of an actual game.

4.1 Concept

In order to test the proposed guidelines, it would be a good idea to have a simple game concept to start with. Choosing some concept that many people are already familiar with would make the gameplay more intuitive and it would also save time when it comes to the actual development.

That is why it was decided to use the concept from a very popular game called Breakout (Atari, 1976)or its perhaps even more popular incarnation called Arkanoid (Taito, 1986). In this game, player controls a pad that is meant to prevent a ball from touching the bottom side of the game screen. He also uses this pad to navigate the ball towards a layer of bricks in the upper part of the game screen in order to destroy these, bouncing the ball of the side walls. As soon as the player destroys all of the bricks he wins.

Figure 17. Arkanoid (Taito,1986).

This will stand as the very basis for the game and the individual guidelines will be applied on top of it, each having a separate version of the game. Apart from that, there will also be a version that combines all of the guidelines in one.

Five different game concepts were created:

- The **'Vanilla'** version is the most basic version of Breakout, only using black and white colours. There is no music nor sound effects. The player controls the pad using his mouse or his keyboard and he is trying to destroy all of the 30 bricks that are present in the level by using a ball. The ball bounces off walls and as soon as it gets in contact with one of the bricks, the bricks gets destroyed. When the player destroys all of the bricks, he wins. He is then able to share then presented with a 'win' screen and he can share the game on Facebook.

- The **'Challenge'** version builds upon the 'Vanilla' version by gradually increasing the difficulty according to the number of bricks the player has already destroyed. Every time the player destroys two bricks, the speed of the ball is multiplied by 1.08 (in order to increase the difficulty but still make the

game possible to complete). It also measures and displays player's time. When the player completes the game he is presented with a leaderboard of best players and has the option to submit his own score to see how he stands in comparison to the others. He is also able to share the game on Facebook with his score included.

- The **'Random'** version builds upon the 'Vanilla' version by randomising the layout of bricks in the level. The number of bricks stays the same (30), however, this time they are distributed in an area twice the size. Every time the game is restarted, the bricks get redistributed and this should contribute to creating a slightly different experience each time the game is played. That could potentially improve the overall time spent in game.

- The **'Representation'** version has improved graphics when compared to the 'Vanilla' version, it uses a number colours and has an abstract background created in Adobe Illustrator. The gameplay is accompanied by background music and the bouncing ball presents the player with a feedback in form of various sound effects notifying the player about the ball bouncing of a wall, destroying a brick or the game being lost.

- The **'Full'** version will then combine combination all of the above mentioned versions into a single game. It will include the gradual increase of difficulty, it will measure and display player's time, randomly generate the levels, it will include improved graphics, background music and sounds providing feedback to the player. It will also include a leaderboard where player can compare his score with others and then share it on Facebook. Perhaps, players will use it to seek peer appraisal or to challenge their friends to try and beat their score.

The Facebook sharing functionality included in all of the games is meant to serve as the social aspect to them.

Some of the seven guidelines have not been mentioned due to the fact that these have already been covered in the 'Vanilla' version of the game. The low perceived

complexity of the original Breakout game covers the simplicity aspect and the feedback will be partly represented in the 'Representation' version, as mentioned previously. The flexibility aspect would ideally be included in the mobile version of the game in order to allow users to easily pause the game and swap between apps. However, for testing purposes, using the desktop version will make data gathering much easier and iterating through versions throughout the development process much quicker, that is why it has been decided to leave the flexibility aspect out for the time being.

4.2 Technology

When deciding on the technology that would be the most suitable for this project, the primary objectives were to ease the development and to make the game as accessible for a number different browsers, screen sizes and devices. That is why a combination of HTML5 and JavaScript was chosen as the main development platform. Most of the HTML5 features are now supported by all the major browsers, including Internet Explorer, Mozilla Firefox, Google Chrome, Safari, Opera or their mobile equivalents (Can I use.., 2014).

The game itself is displayed on an HTML5 Canvas and the functionality, including the behaviour of the ball, state of the bricks and player's pad controls are all created by using JavaScript.

One of the bigger challenges was implementing the global leader board system. This was not possible to do on the client-side and therefore a different solution was required. Research pointed at a tool called Scoreoid (Scoreoid, 2012). It allows for very simple implementation and after including only a few lines of code and setting up the web-based interface, it already starts recording the players' times and ranking them in a leader board.

Sublime Text (Jon Skinner, 2008) was the text editor of choice for this project. It is one of the most popular text editors nowadays and it allows for very quick and development.

In order to be able to easily reverse to previously stored versions of the games in case something goes wrong, Git version control system was used. The choice fell on GitHub (2008) which comes with a very user-friendly desktop interface and it also offers a number of project management tools. Furthermore, it also allowed for sharing the codebase of the project online and making it freely available for anyone to see.

4.3 Project Management

As mentioned previously, GitHub served the role of a primary project management tool. Firstly, it was necessary to identify the amount of work that needed to be put into the development process. This was then broken into individual tasks that were divided into various categories such as development of the individual versions, optimisation, bug fixing etc. These were then divided into milestones with specific deadlines, in order to better manage the available time.

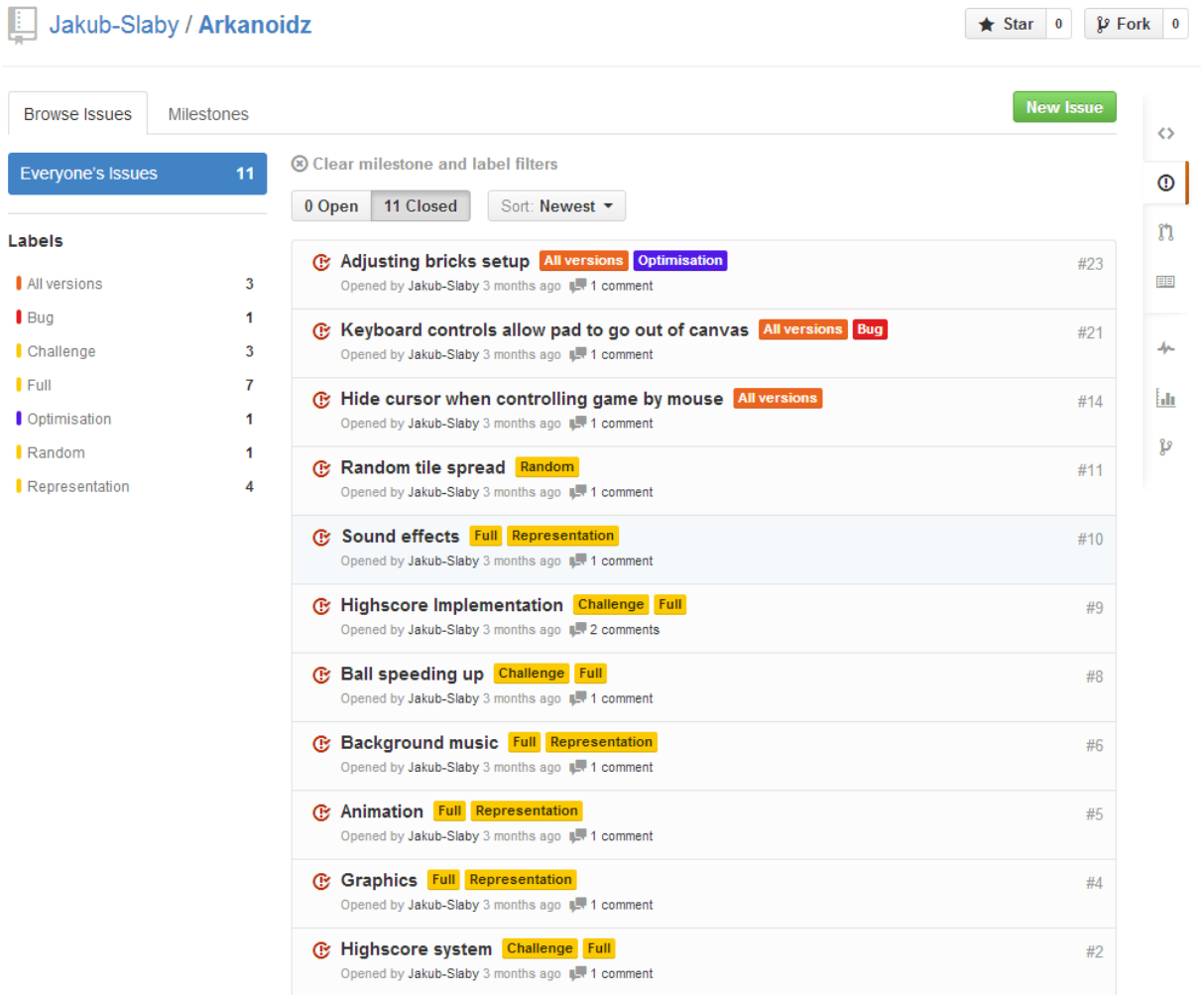

Figure 18.Displaying issues in GitHub.

Each of the tasks, or 'issues' as GitHub calls them, is assigned a specific page where the creator or contributors can comment on them which also proved very useful throughout the development.

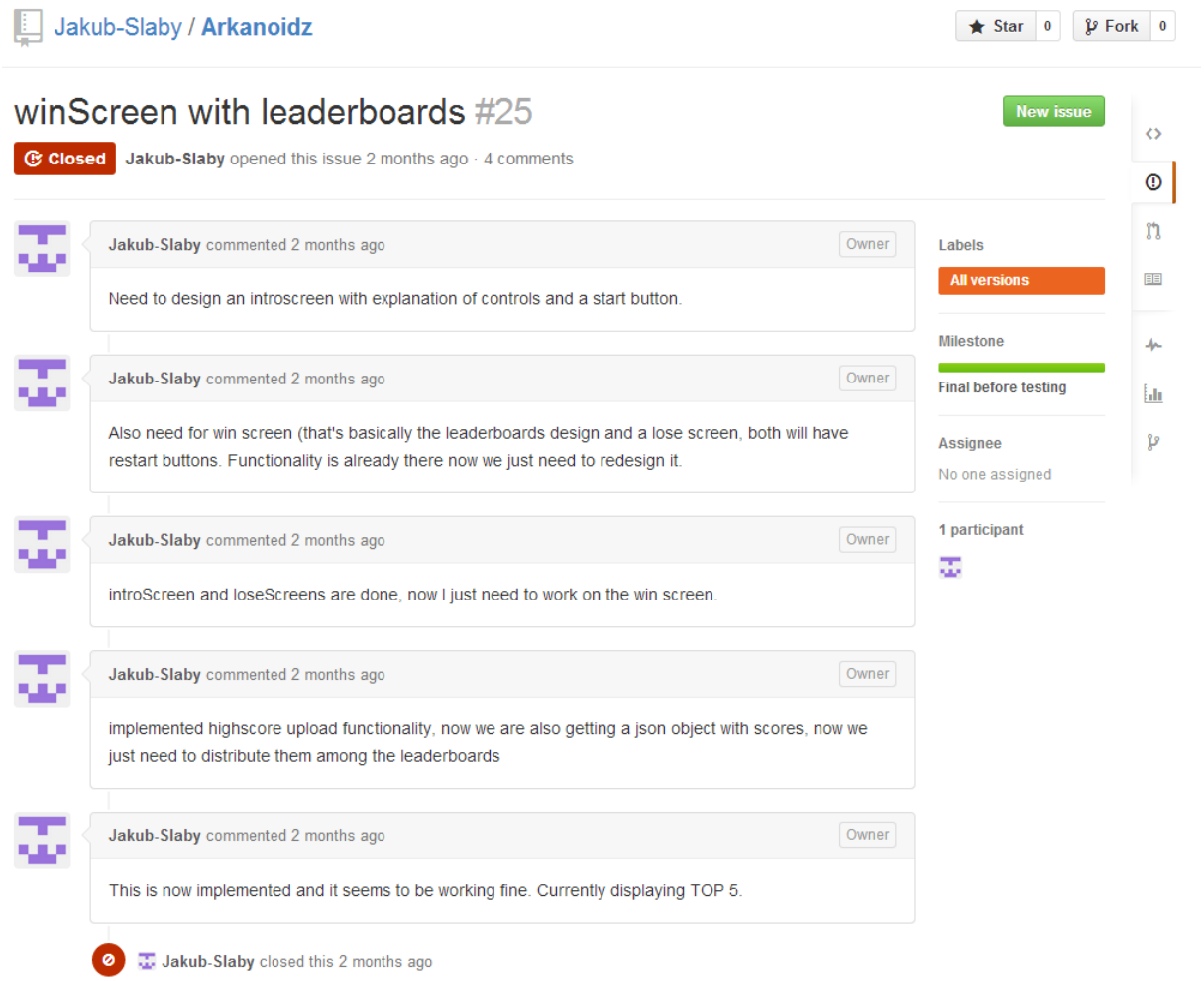

Figure 19.Discussion and commenting functionality on GitHub.

Overall, GitHub was of great help throughout the project, not only because it kept all the game data safe but also because it made the goals so much clearer and easier to follow.

4.4 Limitations

The development process was not without obstacles. Throughout the process, a number of bugs emerged, such as the game stopping before the ball hits the very bottom, player controls not working in Internet Explorer or not being able to control the amount of randomly generated bricks in the ‘Random’ version. Eventually all of these were solved, jQuery provided some help regarding the optimisation of game

controls across browsers and the others required some improvements to be done to the code logic.

On the other hand, due to time constraints, it was not possible to make the games ready for mobile devices. People were able to run the games on mobile devices, however, the controls did not work with touch. In case of future testing this definitely needs to be added or perhaps altered for a different control mechanism.

These games are not currently usable on mobile devices and tablets, mainly because the desktop version allowed for much quicker development and iteration process. However, in the future it is definitely necessary to also test these on mobile devices, providing they cover majority of the casual games market.

4.5 Conclusion

Five different games have been created, now it is important to come up with a way of testing them. The next section will talk about experimental design and methods that can be used in order to test these five different versions of the game.

5 Experimental Design

5.1 Methods

After creating five different games it was important to come up with an experiment that can assess how each of them performs in comparison to the others. Furthermore, it is assumed that the versions that use the casual game design guidelines would perform better than the ‘Vanilla’ version. The two options to do this were either via qualitative or quantitative testing.

Qualitative user-testing done through a form of an interview or observing a player while playing could bring very detailed information about the way he plays and his attitude towards a particular version of the game. However, having him play five versions of what is essentially the same game could affect the results, the player could easily get bored and not give the latter games enough attention. Multiple in-person experiments would also be quite time consuming.

Quantitative user-testing could provide data from a large number of players if done correctly. In order to do that, players would need to get into a state where they are playing a game rather than participating in an experiment. The idea was to create an online experiment where a single link is shared and its traffic is evenly distributed throughout the five different game versions. Having at least 100 people take part in the experiment would result in 20 players per game which could be considered a credible sample. Each of the games would be implemented with a tracking code which stores data from the particular playing session.

The type of data that could provide some insight into performance of these five game versions is as follows:

- Time spent in game
- Number of restarts

- Number of times completed
- Number of times the game was shared on Facebook

This way people would not have to fill any questionnaires and they could treat the games as they would any other game rather than an experiment. They will not be given any information about the experiment itself or the data that is being stored, the only thing they will be told is that there is a game they should try out.

5.2 Tools

Google Analytics (Google, 2005) was chosen as the main tool for the experiment. It is free to use and can be set up very easily and quickly. The important thing is that it comes with an 'Experiment' feature which automatically distributes traffic between different versions of a website. Usually this is used by e-shops trying to design a new homepage or product page and see which one of them performs better and which one results in an increased number of sales.

Since the game is shared on an online server and it behaves as any other website would, this suits the experiment just fine. The experiment can be set up using the web interface, it is necessary to provide a name and hyperlink for each of the versions and then use the provided tracking code in the game's sourcecode. The web interface also makes it possible to easily set a specific start and end date for the experiment and only gather data for that specific period.

It was decided the experiment will take place between 1st of March and 15 of March, thus providing 15 days of data in total. JavaScript was used to store the desired data in a variable within the game itself and that variable would afterwards be sent to Google Analytics through a form of an event. Every time a game is completed, restarted or shared on Facebook, Google Analytics will get notified about the event and update the numbers accordingly. Furthermore, it also automatically stores the time a user spends in game for every single session.

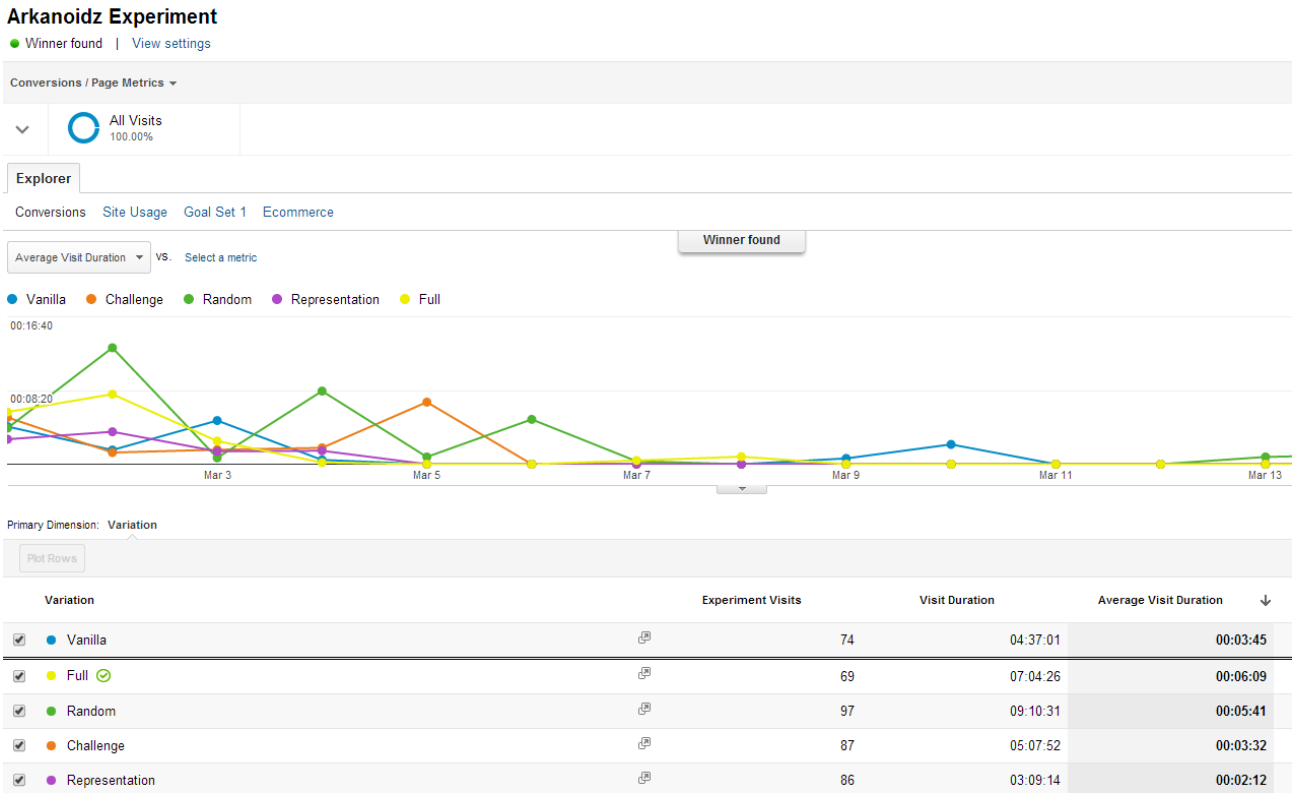

Figure 20.An experiment in Google Analytics.

Google Analytics then displays the data it has gathered in form of various graphs. The individual events that Google Analytics has registered can also be displayed in slightly more detail:

	Event Label	Total Events	% Total Events
1.	Full.Restart	872	40.11%
2.	Challenge.Restart	355	16.33%
3.	Vanilla.Restart	290	13.34%
4.	Representation.Restart	284	13.06%
5.	Random.Restart	210	9.66%
6.	Random.Completed	47	2.16%
7.	Representation.Completed	43	1.98%
8.	Full.Completed	29	1.33%

Figure 21.Events display in Google Analytics.

5.3 Hypotheses

Average time spent in game (H1)

The assumption is that each of the game versions ‘empowered’ by some of the casual game design guidelines will outperform the ‘Vanilla’ version. Also, the full version will have the highest average time spent in game.

Number of times completed (H2)

The hypothesis is that the increased difficulty in ‘Challenge’ and ‘Full’ versions will decrease the number of times these are completed. The ‘random’ version should provide a certain level of game variability for players and therefore this version should be completed the highest number of times.

Number of restarts (H3)

The assumption is that the increase of difficulty in ‘Challenge’ and ‘Full’ versions will result in a higher average number of restarts in these versions when compared to the others. This should signify that even though in these versions the participants will fail more, they are willing to restart the game and try again. This should also directly influence the overall time spent in game.

Number of Facebook shares (H4)

The hypothesis is that the ‘Full’ versions will be shared on Facebook the most, followed by the ‘challenge’ version. The assumption comes from the increase of difficulty and the fact that users are able to include their score in when sharing the link to the game on Facebook.

5.4 Audience

In order to get at least one hundred people to take part in these experiments, the link will be shared on various forms of social media, namely Facebook, Reddit (Reddit, 2014) and Twitter. Link to the experiment will also be shared on a popular Czech game forum called Score Phorum (Score Phorum, 2014).

5.5 Limitations

One of the major limitations of Google Analytics is that it does not provide raw data for individual game sessions. It is possible to get the overall and average numbers for different stats and categories, however, not being able the get the raw data from Google Analytics makes recognising outliers slightly more difficult.

Another limitation comes from the fact that the ‘time spent in game’ category is recording the amount of time the game window stays open rather than the actual time the user spends playing the game. This will have to be addressed when analysing the data and the outliers should be taken out of the sample.

Furthermore, the way Google Analytics distributes the visitors across the different versions is not always exactly even, it does get quite close but this must also be taken into consideration when analysing the data.

One hour after the experiment started it became obvious that the Facebook sharing button was broken. This was immediately fixed, however, almost a 100 people who took part in the experiment were not able to us the sharing functionality. This will as well have a certain effect on the final results.

6 Data evaluation

The goal of the experiment was to get at least a 100 people to take part, thus each of those games was meant to be played at least 20 times. The results far exceeded the expectations and experiment page was visited by 416 unique visitors.

6.1 Number of participants

The next important thing was to identify the outliers and exclude them from the experiment sample. Due to the fact that the tracking mechanism tracks the amount of time people spend on the page rather than the time they spend playing, finding people who spend less than 10 seconds on the site can help identify people who did not actually take part in the experiment. Excluding these from the sample resulted in reducing the number of participants from 416 to 328.

Furthermore, it became obvious that some of the averages were incredibly high due to the fact that many people left their windows with the game open. In order to overcome this, all sessions that lasted longer than one hour were excluded. This reduced the number of eligible participants from 328 to 323.

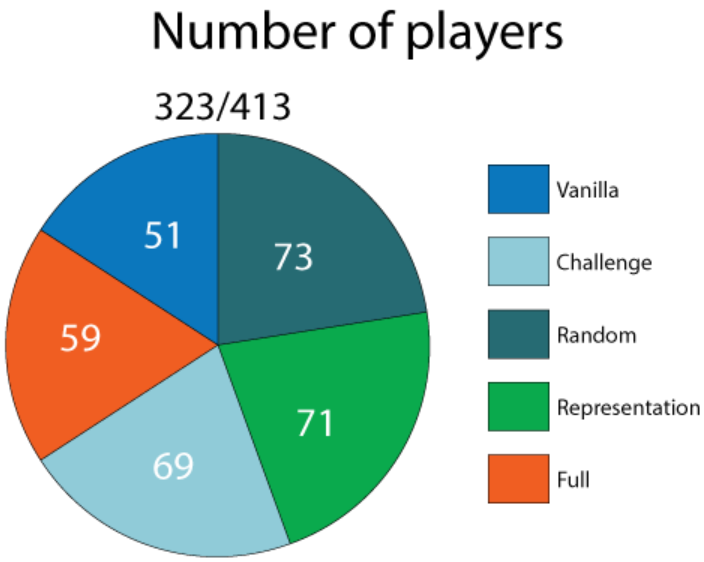

Figure 22.Number of players per game version.

As shown on the graph above, the division of participants throughout the five different versions was not exactly even. Each of the game versions had at least 50 people play it, with 'Vanilla' having the least players (51) and 'Representation' having the most (71). That is why the latter graphs will contain averages rather than overall numbers.

6.2 Average time spent in game

Throughout the experiment, people spent almost 20 hours playing the five different versions of the game. On average, each of the participants spent around 3 minutes and 40 seconds playing the game, however, the average time varies widely across individual versions:

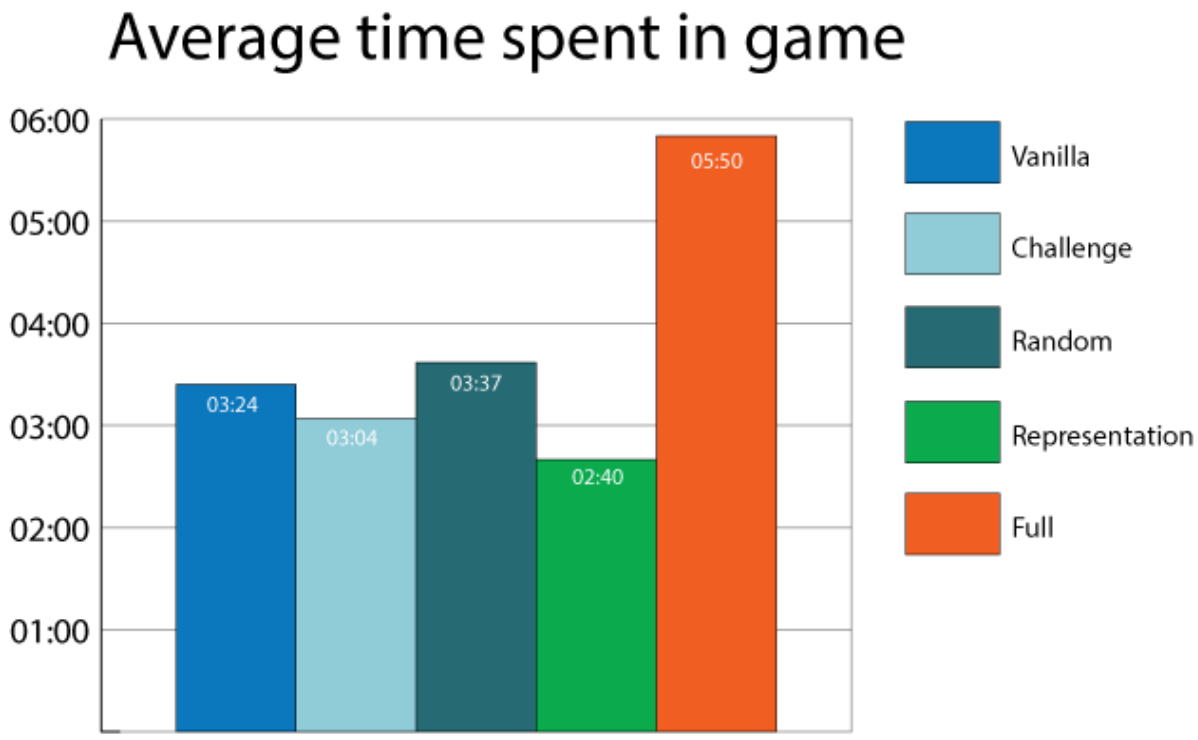

Figure 23.Average time spent in game per game version.

Only two of the versions using casual game design guidelines outperformed the 'Vanilla' version (03:24) in this category. These are 'Random' (03:37) and 'Full' version (05:50). The 'Challenge' version came close (03:04) but still did worse than the 'Vanilla' version. The 'Representation' version had the lowest average time and was the only one which did not go above three minutes (02:40).

The two main important things to note are:

- All of the game versions that applied a single casual game design guideline failed to significantly outperform the 'Vanilla' version, some of them even underperforming it.
- The 'Full' version was a huge improvement over the 'Vanilla' version and it managed to increase the average playing time by 71.5%. None of the other versions came even close to such number.

6.3 Average number of restarts

All of the game versions were implemented with a tracking system that would track the number of times a user restarted the game throughout an experiment. Between

the five different versions, the restart event occurred 2011 times. Most of it was from the ‘Full’ version which had 872 restarts overall. The other versions had between 200-400 restarts, the ‘Random’ version scoring the least (210).

The more important statistic is the average number of restarts per session. Between the five versions the average number of restarts was 4.83. This is how the number of restarts was divided across the versions:

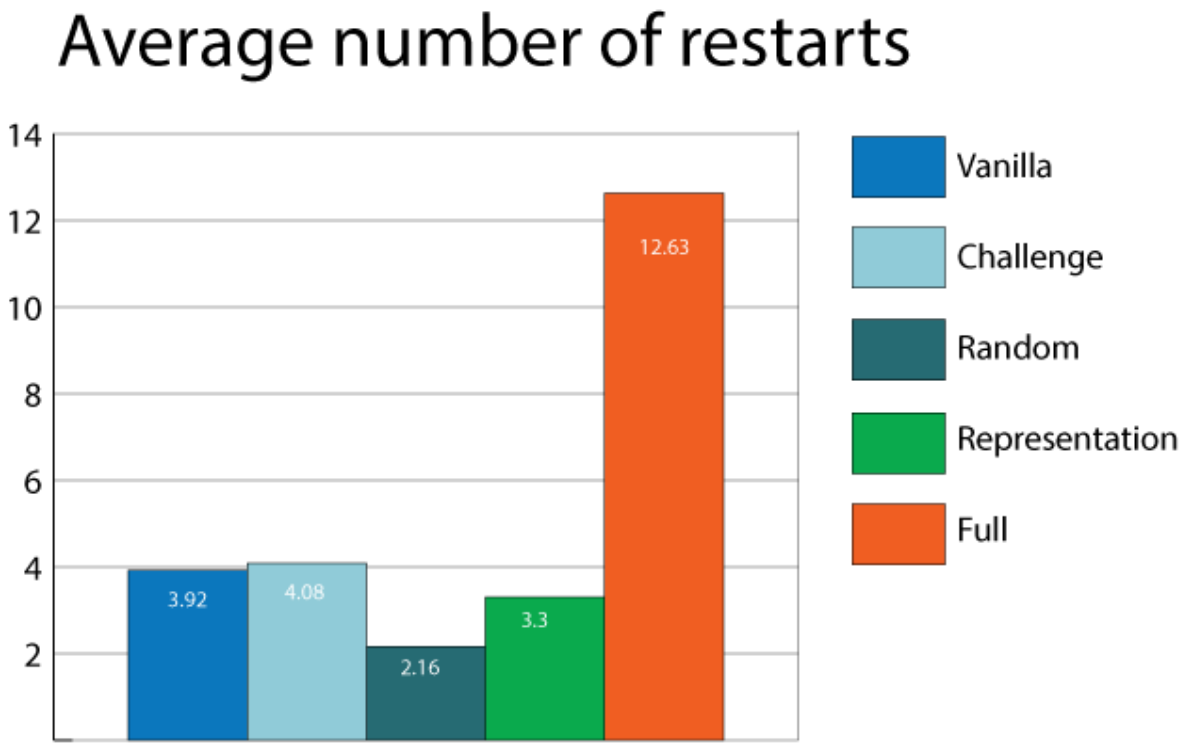

Figure 24.Average number of restarts per game version.

Once again, there were only two versions that outperformed the ‘Vanilla’ version which was on average restarted 3.92 times per session. This time it was the ‘Challenge’ version (4.08) and the ‘Full’ version (12.63). Surprisingly, the ‘Random’ version came as the very last this time, being restarted only 2.16 times on average.

The main findings in this category are as follows:

- All of the game versions that applied a single causal game design guideline failed to significantly outperform the ‘Vanilla’ version in this category.

- The ‘Random’ version shockingly scored 45.6% less restarts per session when compared to the ‘Vanilla’ version
- The ‘Full’ version was a huge improvement over the ‘Vanilla’ version in this category and the average number of restarts was more than tripled.

6.4 Games completed

Overall, 135 participants (41.8%) successfully completed the game while taking part in the experiment. The division across different versions can be seen below:

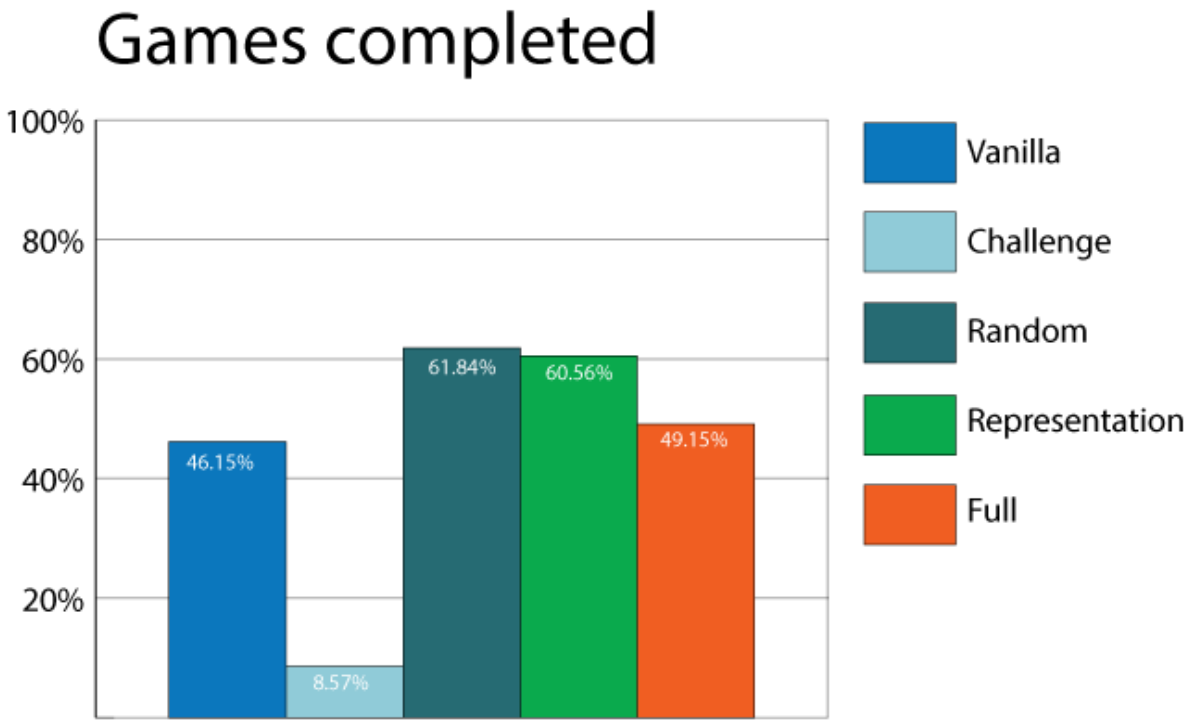

Figure 25.Percentage of players completing the game per game version.

The ‘Random’ and the ‘Representation’ versions had the highest percentage of completion (61.8% and 60.6% respectively). They were followed by the ‘Full’ version (49.2%) and the ‘Vanilla version with 46.15%. The Challenge version was surprisingly completed only in 8.6% of the sessions. Further testing showed that this was most likely due to the increase in of difficulty. Even though the one would expect similar results from the ‘Full’ version, because the increase in ball speed works the same way in that one, the ‘Random’ element supposedly made the game easier on multiple occasions, where it created sort of a path between the bricks and players

could destroy large amount of them in a very short amount of time. Further testing would be required to further research this.

These were the main findings in this category:

- Apart from the ‘Challenge’ version, all the other versions managed to outperform the ‘Vanilla’ version.
- Both the ‘Random’ and ‘Representation’ versions were completed by more than 60% of the participants.
- The ‘Challenge’ version had a very low completion rate, being successfully finished only by only 8.6% of the participants.

The ‘Full’ version was a huge improvement over the ‘Vanilla’ version in this category and the average number of restarts more than tripled.

6.5 Games shared on Facebook

Firstly, it is important to note that as previously mentioned in the Experiment Design section, the Facebook sharing function was broken in the first hour of the experiment, thus not allowing about the first 100 of the participants to use the sharing feature. Another important thing to note is that in order to share the game on Facebook using the Facebook share button, the participant must first complete the game. This significantly reduced the number of people able to share it.

Taking that into consideration, between the 5 different versions the game was only shared on Facebook 14 times. The graph below displays the percentage of people who both completed the game and shared it on Facebook:

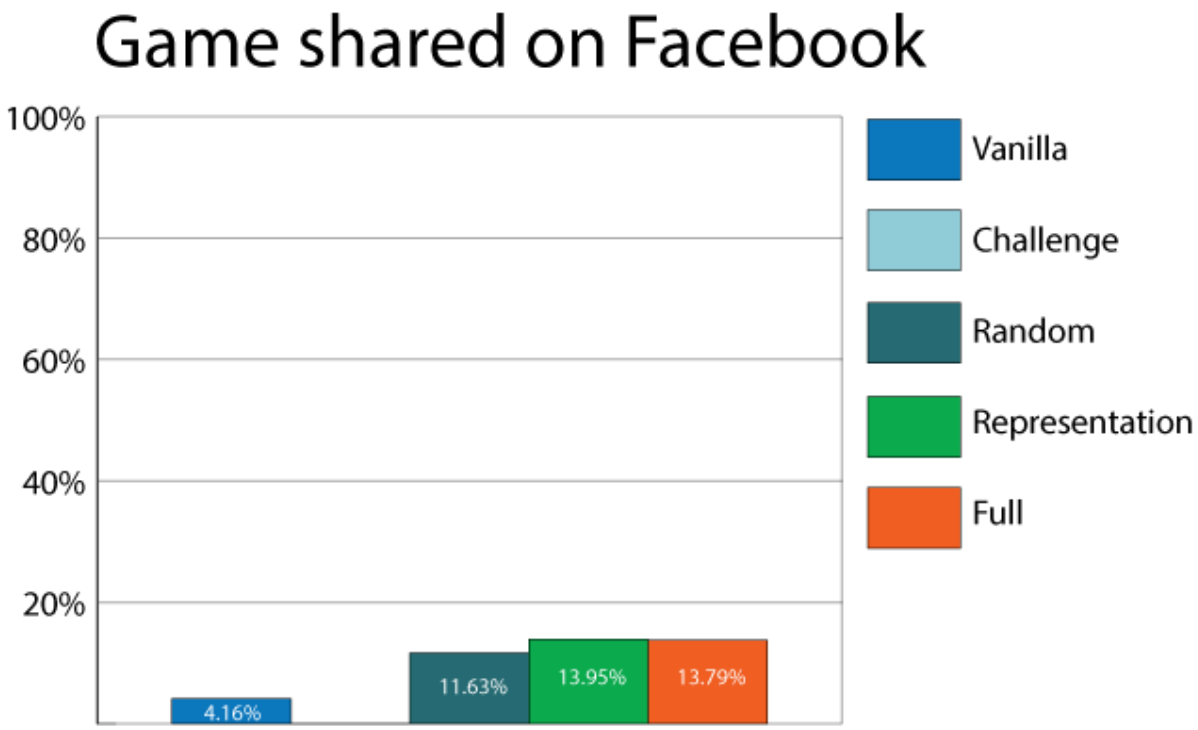

Figure 26.Pecentage of eligible players sharing the game on Facebook.

The ‘Random’, ‘Representation’ and ‘Full’ versions were all shared on Facebook in more than 10% of the time. The fact that the ‘Challenge’ version was not shared on Facebook could be related to the very low number of participants that completed that version of the game. Surprisingly, the ‘Vanilla’ version was only shared 4.2% of the time. It is not very safe to compare the versions between each other, if the numbers are so low.

The main findings when it comes to the social features are as follows:

- Even though the low numbers are partly caused by only enabling the sharing feature for people who complete the game, the % of participants who actually used it is surprisingly low
- With such a low number of overall shares, it might be unsafe to compare the statistics about individual versions. Further testing is necessary.

6.6 Analysis of results

The experiment has been a success. Having more than 300 people take part provided us with a huge amount of data to work with and the data itself brought some interesting results.

Firstly, the assumption that each of the games using some of the casual game design guidelines would outperform the ‘Vanilla’ version (H1) turned out to be incorrect. In some cases the opposite was true and the Vanilla version often ranked somewhere in the middle of the scale. Reasons for this are yet unknown and further testing would be required to analyse this phenomena.

Secondly, the assumption about the ‘Random’ version being completed the most time was correct (H2), however, the difference between the one that ranked as second (‘Representation’) was very small. That is why it cannot be considered a sure evidence that adding the randomisation element can have a direct impact on the number of times players complete the game. The assumption about the ‘Challenge’ version being completed less than the others (H2) was correct, however, the ‘Full’ version was surprisingly completed more times than the ‘Vanilla’ version. This might be because the randomisation aspect made this game slightly easier to complete in some occasions.

Furthermore, the fact that each of the game versions had a very low number of Facebook shares could mean that the social feature was not implemented very well. Players should have the option to share the game on Facebook even if they have not yet finished the game, which proved to be even more important in the ‘Challenge’ version. It is therefore hard to prove or disprove the assumption (H4), further testing is required.

Last but not least, the assumption about the ‘Full’ version having the highest average time spent in game and highest number of restarts (H1, H3) turned out to be correct. This version marginally outperformed the other versions and in many cases it provided numbers that could signify an improvement of the overall gameplay. The data suggests that using the casual game design guidelines one by one does not

bring much improvement to the gameplay, however, combining these guidelines in a single game has definitely impacted the overall gameplay and the response has been very positive.

Further research could look at various combinations of these guidelines in order to analyse the individual contributions towards the overall experience. It is also necessary to test the remaining guidelines to see what effect they could bring towards the gameplay and whether using them can make the game even better. Apart from that, it would also be interesting to make the game available on smartphones and tablets and see if the experiment data from those devices would be any different.

7 Critical reflection and Self-appraisal

This section includes both the critical reflection and the self-appraisal. The critical reflection will first sum up everything that worked well and then talk about the areas that could have been covered better and provide space for improvement. The readers will then be provided with a short overall reflection of the whole project.

The self-appraisal section will then sum up the author's thoughts and opinions about the finished project and work done.

7.1 Critical reflection

7.1.1 The good parts

There are many areas of the project that turned out extraordinarily well. The research provided a huge amount of useful data that was later used for creating the seven casual game design guidelines. The literature review managed to balance a good ratio of in-depth study while staying in the general topic of game design and game development.

It was possible to identify the casual game design guidelines in the games chosen as the case studies, even though their overall game concepts varied vastly in comparison to each other. The case studies demonstrated that these guidelines are in fact being used in popular games, even though the ways they are used differs from one game to another.

The games for the experiment were developed fairly quickly and the testing method proved successful providing gameplay data from more than 300 participants.

7.1.2 Space for improvement

The main area that could be improved is definitely the data gathering process when it comes to user-testing. Google Analytics is a very useful tool and experiments within it can be designer fairly quickly, however, having the raw data to work with would make for slightly more precise results. Also, relying on a free-to-use online tool is always slightly risky, since the user has no control over it.

Even though the games used in the experiment were tested a number of times, it did not avoid the problem that occurred when the experiment was launched. Participants who visited the site in the first hour were not able to use the Facebook sharing function and it had a visible impact on the gathered data. In the future, similar mistakes should be avoided.

7.1.3 Overall reflection

All in all, the research did manage to answer the questions asked in the beginning of the project, even though the answers might not be as detailed as originally anticipated. It soon became obvious that the results will not provide a list of rules that can guarantee success for a game but rather a list of guidelines that can inspire designers and developers and provide them with advice on improvements.

The experiment demonstrated that these guidelines can in fact improve the overall gameplay if used correctly and that means that the project has been a success.

7.2 Self-appraisal

I have just finished what has most definitely been the biggest project I have ever worked on. I have definitely learned a lot throughout the last year and the project has greatly improved both my research and development skills.

The project allowed me to pursue my interests in cognitive psychology, games and web development all at the same time which also provided my work with lots of variability and helped me to maintain my interest and focus throughout the way.

Working on a one-man project has been greatly beneficial in terms of my personal development, however, I must admit that in the future I would prefer to work in collaboration with other people. In a team of people everyone is specialised in a particular area and thus can bring more to the table and the individuals are allowed to more into detail in the areas they are dedicated to. Such project could go a lot further and more into depth, while also reducing the chance of an error or cognitive bias.

I believe I managed the project fairly well, I was able to meet the deadlines I set for myself and the weekly meetings with my supervisor helped me to stay on track. Even though the extent of this research topic is incredibly wide, I managed to stay within the lines of an honours project and cover all the necessary areas.

Overall, I must say I really enjoyed working on the project and the area of research I chose worked really well for me. Even though there are a few things that could have been done better, I believe I have done a good job and I am satisfied with the extent of my work.

Furthermore, in my free time I would like to pursue my interest in game development and perhaps build upon my research in order to try and make my games better than the competition. I would also like to attend game development conferences, where I could meet with people who share a common interest in the area and discuss this with them. Who knows, perhaps my research on the design and development of casual games is not yet over.

8 Conclusion and Future work

The aim of this project was to identify a list of guidelines that can help designers and developers of casual games create better overall experiences.

This section summarises the findings from the research, development and testing and it also suggests future work that could build upon this project.

8.1 Research summary

The literature review examined a number of publications dealing with casual games, minimalist game design principles, slot machine gaming but also games in general. It successfully identified a number of game design elements that could contribute to creating an enjoyable gaming experience in casual games. These were merged into seven main casual game design guidelines:

- Challenge
- Representation
- Simplicity
- Feedback
- Randomisation
- Flexibility
- Social Features

Case study researching some of the most successful casual games was able to identify the proposed guidelines in these games even though the particular use scenario differs from one game to another. That is why we assumed that the proposed casual game design guidelines could play a valuable role in designing a good casual game.

The research also stated that these guidelines are meant to be of general help, they are descriptive rather than prescriptive and can be used and applied in a number of different ways depending on context. They point out what areas should the casual

game designers be aware of when designing their games and could provide a simple structure that can be of help.

8.2 Development and testing summary

Five iterations of the popular casual game Breakout (Atari, 1976) were created, one creating a raw ‘vanilla’ version which was basically a copy of the original, three other versions that were implemented different casual game design guidelines (‘challenge’, ‘random’ and ‘representation’) and finally a version that would combine all of the aforementioned ones (‘full’). As these games were being created, a number of hypotheses arose, based mainly on the information gathered from the literature review and the case studies.

These games were then shared online as a part of an experiment where people would play these games and data about the way they play would be automatically stored. More than 300 people took part in the experiment and the data was then thoroughly analysed and the results were as follows:

- There was no evidence to confirm that usage of the individual guidelines can lead to an improved gaming experience. The ‘challenge’, ‘random’ and ‘representation’ versions showed very little improvement over the ‘Vanilla’ versions and in many cases even underperformed the ‘Vanilla’ version.

- On the other hand, the ‘full’ version outperformed all of the other versions. When compared to the ‘Vanilla’ version, the ‘full’ version increased the average playing time by 71.5%, it more than tripled the number of restarts and even though its difficulty level was increased, it was still completed more times than the ‘Vanilla’ version.

- The amount of data gathered on the social aspect of the games (the amount of Facebook shares) was very low and therefore it was not possible to certainly identify which of the game versions did better than others. Further testing would be required in this aspect.

The experiment demonstrated that even though the individual guidelines might not directly enhance the time users spend playing a game, when used in combination with others, they definitely do. That means that using a combination of the casual game design guidelines can positively impact the experience of playing a game.

8.3 Future work

In order to make these guidelines ready to be published, more testing is required. It is necessary to test the remaining guidelines including feedback, simplicity flexibility and also the social features. It is also important to conduct experiments with different combinations of these guidelines to identify the ones that seem to affect the gaming experience the most. It is important not to make the players feel like they are a part of an experiment. In order to get the most realistic data, they must think of these games as they would of any other game and play them in all kind of different places and situations.

The literature review and case studies identified smartphones and tablets as the main publishing platforms for casual games and that is why further experiments using these platforms have to be conducted as well. It might be interesting to see whether the way players use these platforms differs between the two but also to compare it to the way players play casual games on desktop computers. Furthermore, we should not forget the modern consoles, where casual gaming is growing more and more popular as the consoles are starting to support the community of indie developers.

Now that the list of seven guidelines has been created, it is also important to start creating more detailed descriptions of how these guidelines can be applied in games and help game designers and developers throughout the game development cycle. The usage will most likely depend on the game genre and the particular device, each of them comes with a slightly different set of requirements. It would be interesting to actually work in cooperation with people from the game development industry in order to get their insights and speak about the things that did or did not work from them. After all, they are going to be the consumers of these guidelines, involving them and hearing what they have to say could be of great help.

8.4 Closing words

Nowadays, technology progresses at an incredible rate and the devices people use to play games are constantly changing. Players can now control their game using a keyboard, mouse, touch or even gestures. Games require stronger hardware, they are becoming more portable and there is has also been a huge push towards the free-to-play model where people get a game for free and pay for various updates or downloadable content.

The one thing that does not change is the basic concept of a game. People still want their games to be challenging, they want to easily grasp the basic concept and get into the game as quickly and as easily as possible. They want to have a great experience while playing the game. The seven guidelines proposed in this work are trying to improve the overall experience for players and they can be applied on games that are popular nowadays but also those that were popular 20 years ago.

With some additional work, hopefully these guidelines will help both the current and future game designers and developers to make better casual games and thus improve the gaming experience for players all around the world.

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Appendix 1 Learning contract

Nature of the project

Casual games are games usually providing a very simple gameplay that can be enjoyed in short bursts, while having a break at work or while waiting at a bus stop. They can be very easily initiated and also very easy to drop. They are often designed to appeal to a wide target audience and with the rise of smartphones and tablets they have become easily accessible and widely popular. The Apple App Store and Google Play Store nowadays provide instant access to hundreds of thousands of games, however, their individual quality varies widely.

In this project I intend to study successful casual games and create a list of guidelines that will include individual design elements that casual game designers can use in order to improve user-engagement in their games.

Aims

- Research previous publications relevant to casual games, mobile games, engagement in games and game design as such
- Research successful casual games and use them as case studies
- Based on the research create a list of guidelines that could help game designers improve user-engagement in casual games
- Implement the proposed game design principles in a game prototype
- Evaluate the quality of individual guidelines by conducting user-testing

Contextualisation

Probably the biggest inspiration for my project has been the Game Design Canvas published on thegameprodigy.com. Unfortunately it’s not on the site anymore, however, I was able to find it through the wayback machine. It was a framework meant to help game designers analyse games and also give them a set of guidelines for making games. The 4 main principles were about Base Mechanics, Punishment and Rewards System, Aesthetic Layout and Long Term Incentive, and they all together make up the Core Experience:

http://web.archive.org/web/20110511211248/http://thegameprodigy.com/the-game-design-canvas-an-introduction/

In my contextualisation I would also like to show examples of successful casual games such as:

Angry Birds (Rovio, 2009-2013)
Temple Run (Imangi Studios, 2011-2013)
Cut the Rope (ZeptoLab, 2010-2013)
Words with Friends (Zynga, 2009-2013)
Bejeweled (PopCap, 2001-2013)
Candy Crush (King, 2011-2013)

There is quite a lot of research done that is very relevant to my project. Here I would like to list the papers and books that are the most relevant and inspiring:

Kultima, A. (2009) "Casual game design values.", paper presented at I13th International MindTrek Conference: Everyday Life in the Ubiquitous Era, ACM, pp. 58-68.

This article looks at the phenomenon of casual games, the transformation of the type of video games we play and the effect it has on expansion of video game player basis. Kultima proposes a framework for designing casual games.

Harrigan, Kevin A., et al. (2010) "Addictive gameplay: what casual game designers can learn from slot machine research." Proceedings of the International Academic Conference on the Future of Game Design and Technology. ACM, pp. 127-133

This paper discusses similarities between slot machine games and casual games. It proposes that casual game designers could use existing slot machine research in order to improve the design of casual games and it also introduces particular game design ideas.

Prensky, M. (2001). Fun, play and games: What makes games engaging. Digital game-based learning, pp. 1-31.

Prensky talks about the particular elements of video and computer games that support engagement and proposes how these elements can be applied on creating game-based learning.

Juul, J. 2010. A casual revolution. Cambridge, Mass.: MIT Press.

This book talks about the casual games and how they are nowadays reinventing the game industry. It describes the history of casual games from games like Pac-man and Pong to modern downloadable games that are now so popular.

Process/methodology

1) Project management

In order to manage my project, I have created a general project plan that covers tasks I plan to do in particular weeks. Every Sunday I will revisit my Project plan to divide the tasks into individual days, thus creating 7-days long sprints, similar to Scrum Development methods. I will also use a timesheet the document the number of hours I spent on specific tasks. All my project files will be stored on Google Drive, in order to make them accessible from any computer at any given time.

2) Literature Review/Case study

Analysing literature including research papers and books related to casual games, mobile games, game design guidelines and engagement in games. Also analysing successful casual games and using them as case studies, showing how the proposed guidelines were used in existing games.

3) Game Design Guidelines

Summarize the research findings from literature review and case studies and propose a certain number of casual game design guidelines/principles Based on the research create a certain number of guidelines/principles that will together serve as a resource that helps casual game designers to improve the user-engagement in their games and thus create a better overall user-experience.

4) Game Concept

Use brainstorming and sketching to come up with ideas for a casual game. This game will include some or all of the proposed guidelines and will serve as a prototype. After creating the core concept, work on level design and UI design.

5) Prototype

Use rapid prototyping method to develop a game based on the created concept. This will include game logic development, level development, UI development and some work with graphics and sound.

5) User-testing

In order to get some qualitative data, a number of user-tests will be conducted, where people would test the game prototype. The way they interact with the game will be tracked and potentially there might be an interview/questionnaire afterwards.

6) Data evaluation

All the data gathered during the user-testing will be evaluated and this will help assess which of the proposed casual game design guidelines work, which do not and why do I think that is.

7) Critical Evaluation

Risk analysis

Because of the size of my project, I could end up not having enough time to have all the deliverables ready for the deadline. In order to avoid that, the project planning has to be very thorough and done well.

Limitations have to be really detailed in order for me to avoid having too wide reach or getting away from the desired path. The focus is on engagement and therefore I should avoid topics such as marketing, accessibility, high quality graphics and sound. Some of these might still be to some extent present in the final version of the project though.

My coding proficiency should not affect the creation of the guidelines, the focus should be on the guidelines themselves, not their implementation.

I have to really think the user-testing through and it must be done well in order to get results or data that I can actually use, and to avoid biased or skewed results.

The hardest phase is going to be the implementation of the proposed guidelines into a working prototype, it will be a real challenge to create a prototype that will allow me to test the individual guidelines and at the same time work well as a single unit.

Throughout any of the phases I might find out that the process or methods I am following are not the best way to work on such a project, however, they might not be enough time to change that. For instance, the testing environment for the games might be too artificial or I might not be able to properly test the individual game design guidelines. In this case I must document this and mention it in the critical evaluation, including arguments for why I think that happened and how could it be improved.

Deliverables

Interim Deliverable

1) Literature Review and Case study
2) Casual Game Design Guidelines

Final Deliverable

1) Casual Game Prototype
2) User Testing Analysis
3) Final Report

Assessment criteria

This is a researched project and therefore it will be marked on

- Quality of the research and literature review
- Application of methods

- Quality of implementation of the proposed guidelines
- Quality of evaluation (user-testing and data evaluation)

Appendix 2 Interim review feedback sheet

Interim Meeting: Jakub Slaby

Present: Tom Flint, Jakub Slaby and Michael Smyth
Date: Tuesday 3rd Dec

Topic: What makes a casual game popular - design perspective.
Goal of the Research: Identification of design guidelines

General Advice

Include tables or visualisations to help the reader understand the framing of the large volume of information contained in your Literature Review.

1. Need to Focus on the Creation of "The Game"

Game is vehicle to test principles on real users. What 'game' will be developed during the project?

Choose a simple game - get the ball in the hole - then add complexity (time challenge…)

2. How to Evaluate

Question is how to measure engagement - how to evaluate?

On-line v In-person
Could you measure who returns to the game, how long they play etc?

On-line game - questionnaire - more players but maybe less detailed.

Use the games students or online questionnaire.

Think about who is the audience for the research and shape evaluation accordingly: developers of casual games

Aim is to raise awareness of design factors

3. Need to refine literature review

This can be done after you have designed, developed and evaluated your game and the argument you wish to make is clearer - this can then inform your selection and emphasis of literature included in your review.

Appendix 3 Electronic resources

Blog

http://casual-gaming.tumblr.com/

Development management through GitHub

https://github.com/Jakub-Slaby/Arkanoidz/

Experiment

- 'Vanilla' version:
  http://jakubs.eu/test/vanilla/
- 'Challenge' version:
  http://jakubs.eu/test/challenge/
- 'Random' version:
  http://jakubs.eu/test/random/
- 'Representation' version:
  http://jakubs.eu/test/representation/
- 'Full' version:
  http://jakubs.eu/test/full/

CD

Apart from a .pdf version of the poster and the report itself, the CD also includes an Experiment folder. In this folder you will find all five of the developed games. The Google Analytics tracking code and the Facebook sharing functionality have been removed from these so they can be run locally. Just open the 'index.html' file using your favourite browser.