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QUALITY IN VIDEOGAMES: GOOD DESIGN PRACTICES

JYVÄSKYLÄN YLIOPISTO

INFORMAATIOTEKNOLOGIAN TIEDEKUNTA

2019

TIIVISTELMÄ

Pylkkönen, Taneli
Laatu videopeleissä: hyvät käytänteet
Jyväskylä: Jyväskylän yliopisto, 2019, 31 s.
Tietojärjestelmätiede, kandidaatin tutkielma
Ohjaaja: Rousi Rebekah

Tämä tutkimus on keskittynyt löytämään kvalitatiivisia tekijöitä videopeli toteutuksista. Tutkimus on toteutettu tutkimalla olemassa olevia heuristisia arviointimalleja, joiden kivijalkana toimivat hyvät suunnittelukäytänteet. Hyvällä käytänteellä tarkoitetaan tämän tutkimuksen yhteydessä ratkaisuja, jotka johtavat positiiviseen käyttäjäkokemukseen. Malleja verrataan keskenään tutkimuksen edetessä toisiinsa ja yhteisiä nimittäjiä malleissa on valittu esittämään erinäisiä laadullisia tekijöitä, jotka ilmenevät videopeleissä, jotka ovat viehättäviä, viihdyttäviä, käytettäviä, pelattavia ja muut vastaavat tekijät, jotka kielivät hyvistä suunnittelu käytänteistä. Nämä käytänteet kategorisoidaan uuden määritelmän alle, joka antaa keskitetymmän kuvan moniulotteisesta videopelien rakenteesta.

Asiasanat: videopelit, pelattavuus, käytettävyys, laatu, heuristiikat

ABSTRACT

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Quality in videogames: good design practices
University of Jyväskylä, 2019, 31 p.
Information Systems, Bachelor's Thesis
Supervisor: Rousi, Rebekah

This research is focused on qualitative factors in video games. The research is conducted by looking into existing heuristic models that present good design practices as their foundation. In the context of this research good design practices mean implementations that lead to positive user experience. These models are compared between each other and common nominators are picked to present different qualities in video game that are engaging, entertaining, usable, playable and overall done with good design choices. These qualities are categorized under new categorical perspective that offers more solid basis for understanding the dimensional structure of video games.

Keywords: videogames, playability, usability, quality, heuristics

CONTENT

1   Introduction

In the recent few decades videogames have moved from arcades to our living rooms due to the rise of personal computers. This has turned it in to acceptable mainstream form of entertainment. That change has allowed production values of the games to rise in to something that can be compared to the production values of the Hollywood movies. These games are called 'triple A games', but the definition does little justification to the content in any manner. This might reflect the possible outcomes to audio-visual excellence or detailed story, as the input working hours are higher. Yet there are multiple productions that fail in the eyes of the consumer and critics despite their deflated budgets and hours spent on them. In order to avoid situations like this, there must be an extended look on what are the qualitative factors that constitute to a successful and thus well designed game. The main purpose of the game is to entertain the player and keep them playing as long as possible. The aim of this research is to identify the content and design related factors that can be seen to build engaging and enjoyable experience that constitutes as a quality product in the eyes of the consumers and critics alike. This study excludes videogames with different set of purpose, such as educational games, simulators and multiplayer games, as they exist in their own domain and would extend the scope too far from the original purpose. This does not automatically mean that the principles mentioned in this paper does not apply to some extend to the experience they offer as the aim is to find elements that are applicable in video games in general sense. There is scarcely research based on purely qualitative factors of games, but fortunately there is extensive research on heuristic evaluation on game domain.

Heuristic evaluation is a model developed originally by Nielsen & Molich (1990) for evaluating user interfaces to ensure usability of them. Usability is not applicable for evaluating games as it is for regular software, but there is multiple models for gaming domain for evaluating usability, playability, engagement and fun of the games. The problem with these models is that each have different definitions of the mentioned video game related concepts and thus the literature is fragmented in to a scarce variety of definitions that might share attributes but have different ontological basis. This is one aspect that this research tries to address by arranging the definitions under a unified view of what they are. As it is

in original model, the criteria is based on heuristic principles, which are good design practices that should be used when designing the software in order to avoid unusable or in this context unplayable experience (Omar & Jaafar, 2010). This research will offer a critical take on the possible downfalls of these heuristic models in order to understand how applicable they are in their domain. These good design practices that have been listed in the game heuristics contain factors that can be extracted, compared and compiled in to comprehensive set of qualitative attributes that game should contain in order to achieve its main directive. In order to do this, research offers a detailed look on why these models can be seen as holders of qualitative attributes of elements and what quality means in context of video games by building it from definitions of quality in other software as the literature on the subject itself is scarce. Based on this I will compile a comprehensive analysis of the qualitative attributes that can be found across the models with categorization that allows more comprehensible view of video game elements.

2   Good Design Practices

In the context of the video games, there are multiple views that constitute to good design practices. Video game is, in the end, piece of software and therefor it can be judged from perspective of software. It holds same values in requirements that software does; performance is stable without crashes or bugs (Ruuska, 2015). Yet from perspective of the intended purpose of use, there is huge difference between traditional software and a game. Traditional software is created and purchased to complete certain intended task as a game is acquired for entertainment purpose solely (Federoff, 2002). Usability therefore, is also viewed from different perspectives in the context of games. The effectiveness and efficiency mentioned in ISO 9241-11 definition stay in the background as the satisfaction takes the stage. Usability itself has wide range of definitions in gaming context. Pinelle et al. (2008) see usability as structural excellence of the game and put their focus on UI (user interface) and mechanical factors. Others such as Korhonen & Koivisto (2006) and Desuvire et al. (2004) use the term playability as an extension of usability with the view that it focuses more holistically on factors such as game play, mechanics, story and usability.

This view is supported by Sanchez et al. (2009), who point out that usability and functionality are not the only things to consider when evaluating a videogame. There is vast amount of content related factors with artistic values that should be taken into account as well. These models are built in the spirit of heuristic models which are a set of principles for usable software which constitutes to the positive user experience. The source for these principles were in existing literature (Desuvire et al, 2008; Federoff et al., 2002; Korhonen & Koivisto, 2006) or in professional reviews (Zhu & Fang, 2004; Pinelle et al., 2008). These open the definition of good by offering set of principles that have been studied or evaluated to be effective and useful for creating a good experience for the player. This goes along with the primary directive of a video game that is creating satisfaction to the player (Sanchez et al., 2009). So in conclusion, good design practices can be considered as features of entertainment software product that ensure good user experience by enabling product to be usable, playable and overall enjoyable.

3 Heuristic models

3.1 Usability of Games

Usability defined by ISO 9241 is effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments. Effectiveness means accuracy and completeness of with the goal is achieved. Efficiency requires extra resources that you need to use to complete the goal. Satisfaction is comfort and acceptability for the user of the system. This is expanded by Nielsen (Erola, 2012) with attributes such as learnability, memorability and low amount of errors. Federoff (2002) argues that compared to satisfaction, effectiveness and efficiency in their original form are clearly a secondary goals in usability of the games. These two factors are applicable when looking at UI, but when you reach the core of the game, these factors turn against the main purpose of the game, which is satisfaction. In example if the game gives you a mission and if completing it is done in effective and efficient manner, the challenge aspect of the game suffers and it can be argued that with it the satisfaction withers. The extension attributes of usability can be seen throughout the usability/playability models of the games where they constitute to the good user experience in significant manner (Federoff, 2002; Zhu & Fang, 2004; Korhonen & Koivisto, 2006).

Heuristic evaluation was created by Nielsen and Molich (1990) to be a lightweight and effective evaluation method for detecting usability problems in interface of a software product. The method is recommended to be used by a team of evaluators, as the validation of the method has shown that to find all usability problems it is required to have multiple evaluators. According to Nielsen (1990) the number should be between five and fifteen, but maximum number of evaluators is not set in stone if the more detailed evaluation is required. One benefit of the method is that it can be used by a team of novices to detect issues. The heuristic evaluation is conducted in a free manner, where evaluator interacts with the interface looking for instances where heuristic principles does not actualize. In addition to evaluating products it can be seen as useful tool for design phase of the development (Omar & Jaafar, 2010).

Usability can be seen from multiple perspectives, it is not just an attribute. According to Erola (2012), it can be viewed as a combination of product, user, the goals of the user and the running environment combined that affects achieving a certain goal. Its main directive lies in enhancing the quality of use by ensuring functional, pleasant to use and effective in its dimension of a software.

In the context of gaming, usability is defined by Erola (2012) with two views. In the first view it is necessary technical feature of element. He views it as a quality attribute that allows user to complete tasks with ease of use and with efficiency. Therefor issues can be seen as design flaws of the system in use and this

is the main view that this research tries to address, which features can be viewed as necessary in the context of quality game. The second view is heavily related to the user experience and the issues which are related to negative emotions that they stir. This is also vital part of the research as this goes into the research question of presented models, in which the engagement and enjoyment are central parts of the models. These elements do answer the question how instead of the question in first part which is what.

3.1.1 Usability according to Pinelle, Wong and Stach (2008)

In the gaming context the usability can be seen according Pinelle et al. (2008) as something that does not rely on game aspects such as engaging or entertaining aspects, but more of mechanical excellence that counts factors such as intuitive control-mapping or use of proper camera angle and distance for certain type of game. This was raised above other studies for its own block as it was the only one with solely usability basis on mind and thus it serves as great example of differences between two definitions. Other studies will also be presented as they take much narrower stance on game usability. Their work aims for universal applicability by default as it is built on game reviews of over hundred games, and all the 6 major game genres are represented. This allows to see the problems that videogames have across the genre lines and based on those problems they build a categorization of the problems. It contains 12 different categories which were cultured in to 10 different heuristic principles and 8 of these principles were applicable to all of the genre's which is in line with aim to create a model that is applicable disregarding the genre of the game being evaluated. They also validated the practical use of the model by testing a demo version of the game with five expert evaluators with background in gaming. All the heuristic principles on the list, without skipping the non-playable content, as the demo had none, were found violated during the evaluation. The critique towards the model was that it can drive evaluators in to narrow mindset set by the heuristic framework which makes it harder to detect issues outside of that mindset. Other issue mentioned was overlap in violated principles in detected issue. Overall the model was perceived as useful, effective and easy to use.

The 10 heuristic principles in Pinelle et al.'s (2008) work were: consistency to user actions, customization of settings, understandable AI, functional views, skipping non-playing content, functional and customizable control system (6 & 7), informative UI (8 & 10), effective training system. Consistency to user's actions means that the game reacts to user inputs effectively and gives user sense of control over actions and customization of settings, is allowing to player select difficulty, and through this the pace he wish to experience the game. The customization of audio and video settings allow player to match the best option for output

(speakers & display). It is important that the player understands how the AI functions that the player can plan his actions against it. The view is about camera angles that should be functional and fitting to the action that the game offers. In addition to this I see that in some environments there should be freedom of control of the view especially in third person game. Also they point out that multiple angles should be taken in to the view if the games setting such as environment changes. Skipping unplayable content is straightforward, for example before boss battle cinematics should be able be skipped if boss battle fails. It can be seen as positive feature that it takes more than one try to down a boss and benefits of skipping can be seen clearly based on that as it is in favor of the core element of usability, enjoyment.

Customizable controls are bit simplifications of important control mapping. It should be always possibility for players to change mapping of controls, but as default the control mapping should be done with care that allows players intuitively and logically. Other side of the controls are the actual events that they cause in the game world. They should be responsive in realistic manner; the action comes as you expect it to come in the game world. This allows player to connect the real world actions that are simulated in the game in sensible manner. I.e. if player swings a sword in a game, the action should be imminent which creates sense or responsiveness to controls. In addition it should happen in expected manner; the sword animation should move in game in a manner that represent the actual time it takes to do such task. Instructions are important in the games and it should be done in interactive manner, in a way where playing the game teaches the player.

The UI is the instance where player get most of the important information about the play. This should cover all the information that is relevant to the gameplay experience and it can vary greatly depending on the genre. It is something that should enable players to base decisions in game. The UI should be done in a manner that it is understandable and they elements should always be places with purpose to communicate valid information about game. It should allow user to trim needless actions off.

3.1.2 Other views on usability

Pinelle et al.'s (2008) view on usability is different as through its main motive to strive for mechanical excellence crosses with other definitions, such as subcategorizations of playability and narrows it all under one term of usability. These categorizations, amongst of them Desuvire et al.'s (2004) is criticized by Pinelle et al. for not offering detailed enough view on purely usability issues of the games. I will compare these differences between the definitions and strive to show how categorizations crosses each other later on this paper. Next part though is reserved for showcase of alternative looks on usability.

According to Korhonen & Koivisto's (2006) in their mobile game heuristic model, usability of games is focused on controls and interface which players use

to affect the game state. Their 12 evaluation criteria consist of: audio-visual representation supporting the game(1), screen layout is efficient and visually pleasant(2), separation of device and game UI (3), clear indicators(4), understandable terminology(5), consistent minimalistic and logical navigation(6), convenient and flexible controls that are consistent(7 & 8), proper feedback(9), player cannot make irreversible errors(10), no unnecessary memorizing(11) and game provides help(12). The scent of mobile environment is strongly in phrasing of the heuristic principles, yet most of the principles are detected in other models as well.

Desuvire et al. see game usability as something that addresses interface and other means that are meant for interaction with game state, their 12 usability heuristics are as follows: immediate feedback (1), control over game shell (2), consistent, non-intrusive UI & varying content(3 & 9), embedded well organized intuitive menu (4 & 10), initially enough information to play(5 & 8), game trains user (6 & 11), sounds should be done with intention (7) and art should be recognizable and speak its function (12). There are few parts that can be questioned as if they are part of the usability of the game, such as design related questions about art and sounds.

3.1.3 Differences and similarities of models

The biggest similarity between these three models of usability is the criteria for help and instructions. The narrowest view is in Korhonen and Koivisto (2006) model where they just state that help should be available, as Desuvire et al. (2004) puts their main emphasis on player (heuristics 8, 5 & 11) being able to play game without external instructions or manuals, but by intuitive game design and in game tutorials. This view is supported in more detailed description of Pinelle et al.'s (2008) usability heuristic 9 where interactive training is central, but they notify unlike Desuvire et al. that player should have the access to documentation if the need arises.

The audio-visual heuristics are questionable as they offer much room for interpretation. Such heuristics as Korhonen Kandoivisto (2006) usability heuristic 1 can be understood as something that ties the thematic elements in game together. Heuristics 7 and 12 from Desuvire et al. ask for meaningful audio usage and recognizable art. Recognizable art can be seen from multitude of perspectives. Is it the style that sets the game apart or is it about creating art that has representation that are familiar to the player and allow them to map actions to the real-world counter parts as in Pinelle et al.'s heuristic 7 on control suggest? Desuvire et al. does not take any stance on the artistic design of the game and only suggest that on settings player should be able to modify the experience for the display properly.

The stance on UI differences quite a lot between the models. Pinelle et al.'s (2008) stance is on information delivery and minimizing workload. Desuvire et al. (2004) goes to more detail of what it should be in form, heuristic 3 asks for consistency, 4 for embedding menu's in the game, 9 for non-intrusiveness and 10

for well organized, minimalistic with intuitive options. Korhonen and Koivisto (2006) want to separate the device and game UI with screen layout being efficient and visually pleasing. This opens very much the perception on the usability of the authors. It is clear that Desuvire et al.'s model is closer to the original though on usability measuring the effectiveness, efficiency and satisfaction of the UI elements of the game as Pinelle et al. view usability more through game elements and mechanics. Korhonen and Koivisto deliver the information delivery aspect through the heuristics 4 and 5 and takes stance on menus through navigation perspective.

Controls are something that Desuvire et al. (2004) do not take stance at all on as in their model they are categorized under mechanics. Korhonen and Koivisto (2006) and Pinelle et al. (2008) views basically are unified in asking intuitivism, customization and following conventions. With controls come feed-back or responsiveness of the system, which is noted in all three models. In all the models it is expected that it is immediate, but Pinelle et al. goes most in to the detail with feedback. In addition to the character and the world reacting to user actions in correct manner, they take stance on how responsiveness of the system should be done. They present idea that if there is action that can be mirrored to real world it should be done that way i.e. steering a car should remind steering a car in real world.

There are lot of overlap between terminologies as for example Pinelle et al. talks about AI being understandable in her usability model, but for Desuvire et al. it is categorized under game mechanics. Still there is unique views among these such as Pinelle et al.'s 4th heuristic that describes importance of the view. By this it means that player should have visibility of all the important action. These days players are given some control over the camera, but yet there is the questions of distance of the view and how the camera acts when player isn't controlling it. These are major factors in game experience and something that other models should recognize on some level. There is of course room for argument if the camera angles are more of a question of game mechanics or usability, but yet it falls down to the semantics; how to define what is what. Overall the usability can be defined as ease of use of the game UI, game shell and overall functionality that ensures pleasant user experience with little to no view on gameplay, mechanics of the game or any artistic dimensions with exception of directions that they should be representing the action in a manner that is understandable for the user.

In conclusion, the usable game allows players to learn the game by offering ease of use design with possibility to get help. It is visually meaningful and relatable to its counter parts in real world. The user interface brings forth meaningful information in the same time being minimalistic, non-intrusive and overall pleasant for the user. This includes that game have sensible views on action. Game controls should follow conventions and the game system is responsive with sufficient feedback for the player.

3.2 Playability

According to Korhonen (2011) playability builds on two aspects: game usability and gameplay. The first one consists of a functional and intuitive interface that allows interaction with the game world. The second one consists of game mechanics and the content of the game. Zhu and Fang (2014) used an approach where they defined playability with adjectives associated to it from professional reviews of the games. Other factors they found from their material were creativity, usability, action, sensation and strategy. Playability was the one to cause most variance in the results. They do not have other summarization of each group in their heuristic model other than the adjective group the heuristic set belongs to and therefor their core areas of the playability are hard to pin under a term. My interpretation of the adjective groups are: appeal, challenge, sensibility, variety, engagement and novelty. Desuvire et al. (2004) define playability with four core areas: game play, game story, game mechanics, and game usability. Game play is the challenge of the game, story is the development in characters and plot, mechanics is the underlying rules how objects act in the game world, and usability is how player interact with the mechanics. Federoff (2002) builds playability from game mechanics, game play and game interface. To compare these very similar outlooks in the game, it is clear that a playable game can be viewed from multiple points and next in this paper I will review these different views and form a unified outlook what is the quality factors on each viewpoint.

The most ambitious effort to define playability comes from Sanchez et al. (2009). Their definition is "a set of properties that describe the player experience using a specific game system whose main objective is provide enjoyment and entertainment, by being credible and satisfying". There is emphasis according to them to satisfaction and credibility, and they use attributes known in usability literature, but their definitions differ from their original source. They have formed based on these original attributes set of 7 playability attributes: Satisfaction, Learnability, Effectiveness, Immersion, Motivation, Emotion and Socialization. These are excellent guidelines for designing a playable game even though they do not go to practical level as the heuristic models do, but they recognize that playability is affected greatly by factors such as quality of narrative, game play elements and game mechanics. They also recognize multiple facets of playability that allow to take factor-related viewpoint on playability. These facets are: artistic, intrapersonal, interactive, mechanical, intrinsic, interpersonal.

Later in this paper I will base the qualitative factors based on these facets of playability excluding interpersonal facet as it broadens the scope to dimensions of the play that does not fit to the research problem presented.

3.2.1 Gameplay

Federoff (2002) compresses the idea of the gameplay in following manner: it is all the cognitive effort that player must encounter during the gameplay. This includes decisions that players must make and challenges and problems player must face. Her heuristic model reflects this by taking a stance on challenge, engagement, mastery, AI functionality, narrative, interaction with world, audio-visual style and advancement and pace in the game world. Desuvire et al. (2004) separate narrative from game play in their heuristic model. Their 16 gameplay elements in the model are concerned with variety(1), consistency between game elements and narrative (2), goals (3), engaging tutorials (4, 7, 13) , replayability (5), challenge and advancement (6, 15, 16), focus on experience (8, 9, 10), non-penalization on reoccurring mistakes (11), sense of control and impact on the world (12) and immersive rewards (14). Fabricatore (2007) points out in his paper that gameplay forms from challenges within the simulated environment. So it is about how the player is able to act to the world and how the world reacts back or acts on its own. Korhonen & Koivisto (2006) argue that game play and mechanics are intertwined and thus in their model, they are not separated from each other. Arguments in favor of this can be seen in Federoff's (2002) work where distinguishable lines between mechanics and game play is minimal. There is clear distinguish between game mechanics and game play and it is acknowledged by Korhonen & Koivisto (2006) but they argue that the jointed nature is justifiable as gameplay forms when player interacts with game state through mechanics. In addition to this they add story to the game play as it is done in Federoff's (2002) model. Their view is based that everything playable in the game is considered game play, which might sound reasonable, but yet it overlooks multiple instances of the structure of the game and narrows the evaluating factors to much fewer number than other models do. Their heuristic model consists of: Clear goals and goal creating (1), clear indicators of progress (2), game rewards player (3), sense of control (4), game progresses gradually (5 & 11), first-time experience is encouraging (6), story is meaningful and supports the gameplay (7), no repetition (8 & 11), encouragement in self-expression (9 & 10), consistency (12), orthogonal unit differentiation (13), no penalization on possessions (14).
Even though it can be argued that there are ontological difficulties in Korhonen & Koivisto definitions as they mix up the mechanics being built by the rules of the game as it is argued in Sicart (2008) paper about game mechanics that rules only create possibility space for mechanics to happen. They give possibility to interaction to happen, but they are not direct cause of the interaction as mechanics are and thus they should be treated separately.

3.2.2   Game mechanics

Desuvire et al. (2004) see game mechanics as the structure which provides foundation on how it is possible to interact within the game world. For Federoff (2002) it is a marriage of animation, programming and design that allows players

to interact with the world. Her work overall on the subject is fairly narrow in her heuristic model. Sicart (2008) gives the most fulfilling definition to the question: methods invoked by the agents, designed for interaction with the game state. To understand the term methods better Sicart proposes that methods should always described by the verbs of the game i.e. in race car game methods would be turning, speeding, breaking and such actions that allow agents to change the game state. Agents can be anything that is able to invoke methods, from player to AI of the game, in a manner of previous example: the other cars you race have control over their speed and maneuvers. Game state is self-explanatory, it is the current state the game is in without interaction. There is also discussion about relation of the rules to the mechanics, but they are seen by Sicart as a possibility space for mechanics to happen, in other words they do not interact with game state, they simply create a framework where interaction is possible by regulating the transition. They apply after the action has been taken, as mechanics apply for when the action is taken. In example, mechanics is that player can jump, but rules are how high player can jump. This is why they should be separated when addressed as the mechanics are not rules even though they are closely related.

In Desuvire et al.'s (2004) heuristic set mechanics consist: responsiveness (1), transparency of AI (2), informative UI (3), effective and modifiable controls (4, 6 & 7), follow the genre related trends (5). Federoff's (2002) narrow and even some parts vague list contains: appropriateness of mechanic (feeling natural), instant feedback and engaging tutorials. These can be considered similar to Desuvire et al.'s list of mechanics as instant feedback can be related to responsiveness (1), appropriateness of mechanics relate at least to heuristic number 5 and possibly number 3. The engaging tutorials was categorized as game play and mechanics, and by the very definition of gameplay they tend to fall more to that category than mechanics. Zhu & Fang's (2014) model has similarities such as effective controls with addition them being done by the trends of the genre. There is dispute of categorization of the problem, as it is seen by Desuvire et al. as a mechanics issue as it is seen by Korhonen & Koivisto (2006) as a usability issue. The reasons for doing things by trend can be found in heuristic model of Desuvire et al. where it is pointed out that it shortens the time for the player to get in way of his mastery of the game, by allowing the game to be understandable right away. Yet in Zhu & Fang model they point out that the mechanics should not be mundane, which leaves designers to balance between these two values. Responsiveness of the system is similar in both models: it should make sense, be exciting, consistent and challenging. Challenge is something widely considered as a core part of the game play, but in this mechanical view, my interpretation is that mechanics offer variety of possibilities to game world to react to the player's actions.

3.2.3 Other variables of playability

Games have evolved from the years where the challenge was the only vital part of the experience. Nowadays, so called "triple A games" (games with highest production value and marketing effort) loan a good bit from the movie industry. Their narrative now has directors, actors and writers who put great effort to make the experience one of a kind and get players to be emotionally invested in what happens in the game world. I found it bit surprising that there were so little of heuristic criteria considering the area, even most of them are focused on engagement and fun. Yet it might be one of those areas where one's personal taste can intervene with objective evaluation. The Desuvire's set of story heuristics is following: story is single consistent vision (1), story is interesting (2 & 3), world feels alive (4), sense of control over character (5), fairness of outcomes (6), engaging on personal level (7), player should be interested in character and its development (8). Zhu & Fang (2014) approach is narrative with guidelines such as: npc (non-playable character) behavior being in line with story and setting, and appealing character and environment design. These two rules are fairly similar to Desuvire's heuristics 2, 3, 4, 7 and 8. They present unity that reflects unity between the models.

Korhonen & Koivisto in their mobile game heuristics rated mobility, it is something worth looking into even though it is bit off-scope of this research. Their heuristic has only three criteria: game and play session can be started quickly (1), the game accommodates with the surroundings (2), interrupts are handled reasonably (3). I think there should be some sort of clarification especially for second of the heuristics as by definition of mobility the surroundings can be anywhere, so how designer can prepare for this. There is also the question of multiplayer heuristics, which are too broad of subject to go in to during this research.

3.3   GameFlow theory

As it has been stated earlier in this research, one of the main reasons why people play is the fact that it is fun. There are multiple views of what makes experiences enjoyable, but Flow theory presented by Csikszentmihalyi (1990), takes an holistic approach to the subject. His extensive research lead him to conclude that people do challenging tasks with no external reward or motivation in order to experience the flow state. He found 8 elements that build these self-rewarding activities These are: "*1) a task that can be completed; (2) the ability to concentrate on the task; (3) that concentration is possible because the task has clear goals; (4) that concentration is possible because the task provides immediate feedback; (5) the ability to exercise a sense of control over actions; (6) a deep but effortless involvement that removes awareness of the frustrations of everyday life; (7) concern for self disappears, but sense of self emerges stronger afterwards; and (8) the sense of the duration of time is altered*." The essential autotelic component, which means a sense of purpose in activity itself, fulfills in

games with other components such as high-workload and challenge, which are mentioned to build the flow experience. (Sweetser & Wyeth, 2005)

In their research, Sweetser & Wyeth (2005) applied the 8 core elements of Flow in to the gaming domain and thus created the GameFlow –model. The model is designed to work as a heuristic evaluation tool for a holistic approach to the game itself. By holistic it is meant that it is built on several other heuristic evaluation models and takes account the fun and playability aspect of the game and through this the structural quality in it. As an evaluation model it has set of criteria for each of the elements. The task that can be completed is left out of the elements and replaced by the more domain appropriate social interaction, since the game by its definition is meant to be completed.

The concentration element by its name is about grabbing player's attention in a way that leaves little to no possibility to focus on other tasks. This is done by creating a detailed world that offers challenge in terms of human cognitive limits, with design that offers players a vision in to the main game events by minimizing unimportant or secondary tasks out of field of focus.

The challenge element is one of the key elements in a good game. The key in this element is sufficient challenge. This can be done by offering different difficulty settings. The game should invite players to it, so challenge should increase gradually as the game goes further. Also, there should be a variety in challenge through distinct game elements such as variety in opponents in game i.e. boss – battles. Player skills are majorly related to the challenge as it can be seen in table1. The mentioned criteria applies to the skills as well. In addition to this there should be sense of reward in challenging events during the play, such as loot from the boss battle. This increases the involvement and investment into the game. The game inviting the players into itself, in context of skills, should include functional tutorials, where players experience the mechanics instead of reading them. The controls must be understandable and relatable to the world we live in. By offering controls that are intuitively understandable the game controller loses its value as an object of control and becomes extension of the player that does not draw any focus from the game itself.

Sense of control is a multi-dimensional element. It relates to the direct controls that should offer possibility to mastery, but also to the world that the game presents. The experience that player's choices make impact in the world and by this, that they matter, is essential to create emotional immersion and involvement. Also, there should be effort to disguise linearity in sense of control of player being the one calling the shots. This extends to the characters abilities and is enhanced by at least offering seemingly multiple paths to success. On mechanical level game shouldn't have any elements that break the game by player choices. Other errors such as faulty gameplay can be prevented by messages, i.e. "you are driving in wrong direction" –in a racecar game. You should be also able to pause, save and load the game at any time the desire and by this offering sense of control over the game in real world.

Clear goals are self-explanatory, game should give objects to reach for completion. These should vary during the experience. Briefings should give a hint

what the object is about and what type of challenge the mission will offer. The presented thought about role of open cinematic being one to set the overriding goals is in my opinion false, because working standard is that cinematic establishes the world, but the goal should be revealed during the narrative as the character progresses in the world. It is vital part of the immersion and control as elements, to create sense of development in characters motives as he affects the world.

Feedback is crucial element of games. It is important that game rewards player for correct actions and punishes them for incorrect ones, thus allowing player to achieve mastery in the mechanics and contribute to the control element of the game. The understanding of where player is and where he should be heading in the world are important factors for flow experience to form. Also, the status of character and changes should be communicated through UI, sounds and visual effects i.e. gravely wounded character turns the screen blood red, is limping and informing that he needs healing.

One of the main reasons to play besides fun, and according to flow theory, one of the contributors to it, is immersion. Immersion is described as a state where whole focus of the subject is on the task at hand, which fades yourself, everyday troubles and even sense of time. In order to create such state the UI and controls should become an extension of the player and the world he is in should be the world that draws all focus from reality. This is achieved with detailed world that offers variety of stimulus, a narrative that makes people to emphaticize with the characters and the story. The key element is to get the players emotionally invested in to the experience, make it matter to them.

The addition to the original flow –theory in the gameflow- theory is the social component. Playing has always been social event and it is vital part to the measurement in the heuristic criteria of model because its primary directive is to holistically measure enjoyment in games even if it is not a factor in flow experience. They see that in quality games, game should encourage players to interact socially; compete, co-operate and communicate. Communities and other social mediums in the game world create engagement and commitment to the game.

Sweetser and Wyeth (2005) propose that evaluation should be done with 5-point scale (not at all, below average, average, above average and well done) with addition of zero (criteria not applicable) per criteria. They evaluate and compare two real-time strategy games, other welcomed by critics, other not. Between critic reviews and evaluation there were clear correlation that proved that model is competent in its use. The issues with model that very identified were that some of the criteria does not apply to all games or apply better to different type of games. Also measuring things like how suitable game is for different skill levels would require multiple evaluators from different backgrounds in gaming. Also, they criticize the self-evaluation of immersion being moot when done by individual itself, which I disagree with strongly since who would be better aware of the immersive qualities than subject experiencing the possible flow. Testing it with creating external distractions that subject would need to pass during the play is questionable since immersion is made by not only the physical drop in awareness

of surroundings, but mainly it is mental state where escapistic nature of games allow you to absorb yourself into the game world with subjective experience that cannot being measured by reactions to bells and whistles. Overall, they see their model as a starting point for academic view on the enjoyment factor. I would argue that the enjoyment measuring is just one component building a bigger factor: quality in games.

3.4 Validation & critique of the models

The models presented are a web of categorization, with possible overlaps of the issues between categories and models. In this part of the paper the critical touch is obtained and possible downfalls of the models are presented. Some of the models are validated in their presenting papers and therefor their possible short comes are evaluated through usage. The review of the models presented in this paper can be found from Paavilainen's (2010) paper where he presents his heuristics for social games based on the other models.

First noteworthy criticism on the Pinelle et al. (2008) and arguably Zhu & Fang (2004) papers is the formation of the heuristics. Paavilainen points out that usability and professional reviews does not go hand in hand, as game reviewers are not usability experts and they strive for reviewing the game. It can be argued that this is not a problem as the reviews are used as a baseline to detect usability problems that reoccur in reviews by the team who understand and form usability problems based on that. In this light, the much popular claim of game reviewers being in developers pockets does not really matter, as such situation would affect what is said (positive either negative) but not by which structure, which is what models is based on. If we consider this critique to be valid, then validation in GameFlow theory by Sweetser & Wyeth (2005) can be as well questioned, as it is validated by applying the evaluation model to two similar games (theme, mechanics etc.) and comparing the results to professional reviews. In addition, that test validation of the model with one PC game with comparison with other heuristic model, is not suffice to give generalization worthy results. Other criticism of similar nature is directed towards Federoff (2002) & Desuvire (2004), on the formation of the model. In Desuvire's case there is little to none information on how the heuristics were developed, so the claims of high applicability cannot be confirmed. The case study of one development team, that is used to drive the development of Federoff's the model further from its literature roots, is said not be applicable for general use. The only paper that did not have major issue with validation and development of the model itself is one by Korhonen & Koivisto (2006), where literature sources as practical evaluations of multiple games were used. Still it was noted that to get objective view it should be compared against other evaluation methods.

Second noteworthy criticism by Paavilainen (2010) is the subjective content of the heuristics, which makes them challenging to apply and naturally questions their validity. He argues that the underlying motive with these is not really to develop a tool for evaluators to use, but as a guidelines of requirements for developers to use. There is also question of proper categorization, multiple instances of same criteria, low ratio on usability problems found per game. Issues in categorization can make evaluators look such clues in wrong elements of the game or misunderstood the criteria if there are multiple instances of same criteria in different categories.

Third important criticism of the studies come from the researchers themselves. Federoff's (2002) lists as limitation of the study time not spent with quality assurance, as it would have gained insight what are the qualitative factors that relate to game development and evaluation. Pinelle et al's (2008) research was based on the critic over other models not being focused on usability of the games but instead on fun and engagement. The suitability for all game types was concern with multiple of models (Sweetser & Wyeth; Pinelle et al.,) as they were tested on one platform and with one game, that was a prototype in most of the cases. This continues the generalizability issue that was introduced by Paavilainen. Only model of the reviewed that was developed for domain specific use was Korhonen & Koivisto (2006) model for mobile games. Most of the models singled out aspects of gaming out of their models, such as multiplayer, to keep their criteria applicable.

Fourth field of criticism is the cognitive load of the heuristic models. Lists as long as 40 criteria are hard to remember, even though categorization of the lists help to identify which category the violated heuristic might be part of. Yet it is nearly impossible for evaluator to keep in working memory such vast amount of criteria due to the Miller's golden rule. (Korhonen et. al, 2009).

4 Quality in Games

Research on quality factors in games has been highly neglected and therefore in order to define the quality in games we must understand how it perceived in other software. It is clear that same metrics do not apply as the function and purpose of the entertainment software such as game is different from traditional software. Yet it offers valuable insight how we can perceive quality and allow us to form our own view based on that. The simplest definition for quality in software is as follows: "*the totality of features and characteristics of a product or service that bears on its ability to satisfy given needs*" (Buckley & Poston, 1984). Kitchenham & Pfeelger (1996) present Garvin's multiple views on quality as follows: Transcendental view - quality is something that can be recognized but not defined; user view - quality is fitness for purpose; manufacturing view - going according the specifications; product view - inherent characteristics of product; and value based view - the amount that customer is willing to pay for it.

The purpose of this paper was to introduce quality factors based on heuristic evaluation models of games to game designers. To serve this purpose the dimensions of quality that apply are transcendental, user, product and bit manufacturing. The transcendental view is applied, since it is the ultimate goal of the game, is to be something that is generally recognized as quality product. The user view is bit different with games as we are not talking about a tool but entertainment product, therefor what user needs is entertaining, engaging and fun experience. This also serves as basis why quality factors can be derived from heuristic models as they are used to evaluate (or design as they were criticized) these very values. The product view is taken to recognize what are the attributes of the product that deliver quality. Manufacturing view is presented by Kitchenham & Pfeelger as something that examines that the product "was build right in the first place", this goes along with the goal of this study to extract design principles that allow to create products that are more likely to lead into qualitative outcomes. Definitions on quality such as ISO 9126 are not applicable in good scale for games. Factors such as efficiency and usability, can be somehow transformed to the entertainment domain. Views on usability have been addressed before in this document, and to understand efficiency, the best model is offered by Sanchez et al. (2009) who transforms it in his playability model into learnability and immersion. Factors such as maintainability, reliability and portability are something that can be seen as support systems of the game, rather than attributes of the game itself, even though in these values contribute to the quality as well. In example it is expected in technical sense that game doesn't have game crashing bugs and is reliable in that sense, but that is structural quality and not content wise quality that this research is aiming to pin point. These values sit much better on service producer side, such as on multiplayer games the host instead of the client. It af-

fects the client and is important factor in perceived quality of the gaming experience, but yet it is something that has nothing to do with the game itself. Functionality is a quality that can't be applied in its software development definition directly as video games purpose isn't to complete a real life task, but complete series of enjoyable challenges set by the game itself. Functionality can be seen as something that presents sets of effective game mechanics to the series of challenges, as it is defined in ISO 9126 as "those that satisfy stated or implied needs": the main difference is that the needs are fabricated by the software itself. Functionality is also one of the main focuses of the quality assurance. It can be viewed from the perspective of developer as a way the game functions as it is intended. From that point of view it contains every part of the game from the game shell to the AI. (Ruuskanen, 2015.)

These factors have a lot of common with criteria presented in heuristic models as with dimensions of playability presented by Sanchez et al. (2009). They thus, work as validators for the authentication of criteria for these models being actually qualitative attributes of the games.

The one big question is applicability of the criteria to all types of genres. Limitations of the heuristic models have been acknowledged by the authors themselves (i.e. Pinelle et al., 2008) for all gaming genres and Bevan (1995) brings fourth thought about quality being related to intended purpose of product. Simulator- and entertainment games have different standard of quality naturally. Still the main value of the game is to entertain and these heuristic models are striving to ensure with their principles that the game does that. The question that remains, is, does this difference of purpose extend to different genres of the games? Is it even possible to create model of quality implementations that can be generalized over the genre lines? I think it is on some level possible. Bevan points out that quality can be part of the perception of evaluator and needs of users vary by the type of usage. Because of this games need to appeal to different audiences as an example so called "hard core gamers" and "casuals" that have different standards for the quality. He sees this as problem, but presents that even though the differentiation of the needs, they still share a great deal of attributes that are shared in perception of quality. These attributes are the ones that this research aims to point out.

To achieve this I looked into the presented heuristic models and compare them to find similar practices across them. These practices are based on the research based on extensive literature and validation tests with the purpose to find elements that constitute to usability, fun and engagement by product dissection. The categorizations were done by Sanchez et al.'s six facets of playability excluding interpersonal facet as it broadens the scope beyond the restrictions of this research. I took the liberty to rearrange the definitions so that they fit better to other models of playability and usability. Also, only the facets are used for categorization purpose only, they do not contain the model for analyzing player experience. These facets are: artistic, intrapersonal, interactive, mechanical, intrinsic. Artistic facet contains all the audio-visual and narrative related elements that can be considered as artistic choices. Intrapersonal relates to the elements that are

aimed to create an internal states such as immersion. Interactive facet relates to the UI and how the player interacts with the game and how the game interacts back. Mechanical facet focuses on the mechanics of the game. Intrinsic facet is focused on the gameplay of the game which contains content and how the game present itself.

4.1   Intrinsic dimension

The best way to describe the intrinsic dimension is related to how game is presented to the player or with the definition that has been covered earlier in this paper, gameplay. Unlike in original model this does not contain elements from game mechanics. By far intrinsic dimension is the largest dimension to consider. I start this section logically from the start of the game, which should be tutorial. Tutorial should be conducted within the game at start where the basic mechanics are covered. It should be conducted in interesting, absorbing, interactive and encouraging way. This means that manuals and other external help shouldn't be the primary source of learning, but they should be available if the need arises. In addition to this, game should retrain player when new mechanics arise during the gameplay (Federoff, 2002; Sweetser, 2005; Desuvire, 2004; Pinelle, 2008).

Challenge is the main reasons why players play games. The main rule here is easy to learn, difficult to master (Federoff, 2002; Zhu & Fang, 2004). Which is in line with recommended quick and absorbing nature of tutorials. The thumb of the rule here is that learning the game should be fun and part of the reward (Korhonen, 2006). As the game progresses the challenges should become harder to overcome and should require skillful use of previous techniques taught to player. To prevent players getting bored or game getting stagnated, there should be variety in challenge. The player should be also able to choose the proper difficulty for their proficiency as a player (Sweetser & Wyeth, 2005; Korhonen & Koivisto, 2006; Federoff, 2002; Pinelle et al., 2008; Zhu & Fang, 2004). It should be also noted that there should be more than one way to beat the challenges offered by the game and multiple ways progress in the game (Sweetser, 2005; Desuvire et al., 2004; Fedroff, 2002; Korhonen & Koivisto, 2006). This adds to the sense that it is not a tube where you progress linearly and offers the sense of control and immersion that is vital for creation of flow experience in games.

Goals are multi-dimensional element of the game that is considered in each of the models addressed in this paper. They can be seen as an end point of an challenge, i.e. beating the boss of the level, or as driving force of the action in game, i.e. collect all coins in the space. Goals should be always clear, so player knows what they need to do to achieve them (Sweetser & Wyeth, 2005; Korhonen & Koivisto, 2006). Also, goals should be presented early in the game (Sweetser & Wyeth, 2005; Desuvire et al., 2004; Federoff, 2002). This could mean that the goal of the game is to fight enemies or it could be the overall goal such as to save the princess from the evil forces. Presenting overall goals can be seen to serve more

like motivational starting points for narrative as in the current standards in writing it might be that the game is more of a story where characters and their motives develop. The best way to look at goals could be categorization of goals to increase the understandability. In mechanical sense it would be necessary that goals are presented early (i.e. collecting coins) to allow players to understand what to do, but narratively the goals can adapt to the changes in the game world.

Feedback or in other words rewards and punishments are the last big element of intrinsic dimension. It can be seen as questionable to make a connection between feedback and rewarding. Yet in gameplay context it is clear that connection is there as, if the player does the correct choices and actions the game rewards him by allowing him to continue further and if not, usually what follows is game over screen. The concrete rewards in the game should be meaningful, appropriate and open up further customization of the game (Korhonen & Koivisto, 2006; Sweetser & Wyeth, 2005; Desuvire et al., 2004). These are in order to make reward to fit the situation where they are acquired and to increase immersion in to the game i.e. experience systems (Sweetser & Wyeth, 2005; Desuvire et al., 2004). It also can work as some sort of meter of progression as it can be seen at role playing games that players in higher levels have better rewards in form of equipment. The stance on penalization is that it shouldn't be done if the same mistake occurs and it never should be loss of gained benefits (Desuvire et al., 2004; Korhonen & Koivisto, 2006; Zhu & Fang, 2004). This stance is understandable as goal of the game is to keep player playing the game, and loss of the rewards such as equipment could drive a wedge in the motivation of the player. The penalization on reoccurring mistake has been tackled in practice with effective checkpoint system that autosaves between certain times, which diminishes the loss of time that would be if the game would force player to start the stage over again. Desuvire (2004) presents a thought of feedback being direct towards player, which means each action done by player has immediate action that follows that is in line with expected outcomes in the game world.

4.2   Intrapersonal dimension

The underlying idea of this dimension is engagement, desired player involvement and immersive qualities. The area does not have multiple criteria that can be derived to create qualitative design principles as most of the internal states that are sought, cannot really be pinned to certain element due to their subjective nature. Sweetser & Wyeth's (2005) Gameflow –model is basically created based on the intrapersonal dimension and therefor almost all of their criteria apply to this category. The generalizable attributes circle around concentration, immersion and challenge. First noteworthy factor is engaging player in to the game from the first play time and sense of control over the game. (Sweetser & Wyeth, 2005; Korhonen & Koivisto, 2006).

Immersion is sought by rewarding in Desuvire et al.'s model (2004) and Sweetser and Wyeth's model explain what the factors that create it are, such as altered sense of time and undivided focus on the game itself. Even though these relate on practical level more on intrinsic facet that intrapersonal. It can be seen as well that immersion relates to the Korhonen & Koivisto's criteria of meaningfulness of story as meaningfulness is intrapersonal factor and it is listed in Sweetser's model that player should feel emotionally involved, which can argued to come from sense of meaningfulness. Most of the story related criteria by Desuvire et al. are related to intrapersonal dimension rather than actual elements of the story or characters. They relate to the immersion element heavily with criteria such as "player spends time thinking about story outcomes" and player is interested in story. She also adds to the immersion factor with her criteria for personal involvement that is in line with Sweetser & Wyeth and Korhonen & Koivisto. Cognitive load is something that should not burden the player, but offer appropriate challenge to players from different skill levels. Game should not force players to memorize unnecessary things. (Desuvire et al., 2004; Sweetser & Wyeth, 2005; Korhonen & Koivisto, 2006).

4.3   Artistic dimension

The artistic dimension will take stance on elements such as narrative and characters, visual style and use of sounds. First element in artistic dimension to address is the story of the game. One important factor to this is sense making of actions of the player in the game, in other words the motive of the character in sense of narrative. This is used to immerse players to further to the game by allowing you to relate to the character (Desuvire & Chen, 2004 ; Desuvire et al., 2004). The interest of player in the story is one of the factors that should be taken in to account. This is subjective value yes, but it can be interpreted as something that should be worked on with effort by the developers (Desuvire et al., 2004 ; Federoff, 2002) Consistency of the story is noted also noteworthy (Desuvire et al., 2004 ; Zhu & Fang, 2004). The most common criteria among models is related to the sense that world must feel like it is alive without interaction of the player, but also if the player interacts with it, it should feel like they have impact upon it. Sounds should be used with intention; to be part of the feedback or be used with intention to stir emotions. (Desuvire et al., 2004 ; Federoff. 2002). Korhonen & Koivisto (2006) brings forth that audio-visual representation and story should support the game, which extends claim of the usage of the sound with intention to also to graphical and narrative elements. This is backed up by criteria such as Federoff's (2002) "art should speak its function", which means i.e. that item with qualities of sword should be presented as a sword, and thus creating sense of intentionality in the artistic dimension. Also, it is pointed out that artistic elements should be arousing (Federoff, 2002) and recognizable (Desuvire et al, 2004) which can be seen that game should be appealing and recognizable from other

games. In other words: game should be one of a kind. There are presented also artistic conventions such as skipping non-playable content (Pinelle et al., 2008)

4.4   Mechanical dimension

Unlike in original model, this section does not only take a stance on game engine but also game mechanics and AI. The single biggest nominator of the mechanical dimension was the appropriateness of the mechanics (Sweetser & Wyeth, 2005 ; Pinelle et al., 2008 ; Federoff, 2002). This can be seen as that the game state responses in expected manner for the interaction that is given. As an example a car steers in a manner that is expected from that type of a car. As can be seen this is issue that stretches over the mechanical dimension to other dimensions such as art, by creating of appropriateness with suitable animation and audio feedback, or to intrinsic dimension, where it can be measured by the effects on the game state. The good baseline for this appropriateness can be found from Pinelle et al.'s (2008) 7th heuristic where they stumble on mechanical dimension in their talk about control responsiveness with thought about that games should mirror expected real life situations of similar kind. This resonates with Federoff's heuristic of mechanics feeling natural and having correct weight and momentum. So in conclusion, appropriateness is multi-dimensional question that relates to multiple dimensions and elements.

Other significant common nominator in models is reasonability of AI (Pinelle ; Desuvire, ; Federoff, 2002). I think it is best put by the Federoff who calls for "reasonable, but yet unpredictable AI". This can be understood that player needs to and is able to figure out how AI works, but it changes as game progresses and enemy units changes. Due to this, there is heavy relation towards other elements such as challenge and pace of the game, as it cannot be expected that the game throws the most powerful AI units against it right away.

Mechanical dimension has few other significant notifications, even though they are not common across the models. Pinelle et al.'s (2008) notification on the views of the game is one of these that might be considered important, even though it has gained little attention from other models. The game is simply ruined if the player is not able to adjust camera according the action, or the distance of the view is too close or far away.

4.5 Interactive dimension

Interactive dimension will be constructed from controls, user interfaces and other markers that players use to interact with the game state. This section should be started with controls as they are the most direct meaning of interaction. Sweetser & Wyeth (2005) does not go detail in to the controls and their view is more of intrapersonal view of sense of control over controls. All the other models (Desuvire et al., 2004; Pinelle et al, 2008; Korhonen & Koivisto, 2006; Zhu & Fang, 2004) strive for similar needs on controls: they should be intuitively mapped, convenient, responsive, customizable and follow genre related conventions. This means that game should act like other games in its genre, with recognizable control schemes by offering sense of familiarity that extends the intuitivity of the play. This all strives for controls becoming an extension of the player, which fades the line away between the real world and the game world, allowing further immersion to happen. Customization is just option for those who have different sense of intuitivity i.e. developers consider button x to be the one to cause your character to jump, but you feel like it should be button y. Also, there is contradiction with general line in Federoff's (2002) model where she instructs to minimize the control options.

Other major factor to interaction is the UI. Obvious but important part of it is consistency (Desuvire et al., 2004 ; Korhonen & Koivisto, 2006,). By this it is meant that the elements should stay the same throughout the game. UI should also be informative (Korhonen & Koivisto, 2006; Pinelle et al., 2008; Desuvire et al., 2004) by this minimize all the unnecessary micromanagement and deliver all the important information about game state to support decision making. This relates to the mastery of the game as it allows player to take all the instances of the game play into account to make more advanced decisions. Also, the information about status or score should be visible for player all the time, so they can have sense of progression.

The two last important factors for interaction are control over game shell (Sweetser & Wyeth, 2005, Desuvire et al., 2004; Federoff) and error prevention (Sweetser & Wyeth, 2005; Federoff, 2005; Korhonen & Koivisto, 2006). Game shell basically means that players are able to control how and when they play. They are able to save and load progress at any given moment and thus be able to decide when to play or stop playing. Error prevention can be understood in multiple dimensions. It can be seen as something that is related to the mechanics, in a way that players can't break the game with their actions. The interactive view is more of a game giving directions to players so that they do not make those errors or cover from them. Good example is a race car game, where the UI informs the player that they are driving towards wrong direction.

5   Conclusion

As it becomes apparent, the field of the heuristic models in game evaluation come with multiple agendas, with multiple formations with a great deal of issues that this research on its own tries to address. Definitions on categories are often mixed up, with criteria that crosses with other categories and criteria. Some of the criteria can be questioned if they are applicable due to their subjective nature. The validity of the models can be questioned as they are formed from sources that can be considered not to be focused on usability issues or are unreliable by their nature. Also, the practical applicability that some papers present as benefit of their model cannot be confirmed as they have been validated with only one test case or with none. (Paavilainen, 2010.) Never the less these models bring out the entertaining attributes of the game very well forth and as Bevan (1995) argues that quality relates heavily to the purpose of product, which in the case of the games is to entertain. Also, presenting the issue of the differential needs of the users forming the perception of quality, he admits that on some level the attributes of the quality are shared. After all of the players are can be categorized to be the same, even though they can be driven to further sub-categories that have own definitions of the quality. These qualities that are shared, are extracted from the models, and compared and formed into comprehensive list categorized by facets of playability by Sanchez et al. (2009) without analytics suggested to go with it as I am not evaluating games but other models. The multiplayer component is left out of this research due to its wide extent that wouldn't fit in to the scope of the research which is focused on the core elements of the game. What was revealed during this extraction and categorization is that many of the issues reach out to other facets or dimensions and by this affect each other. Still there were multiple attributes or elements that can be used in future to design games that ensure qualitative outcome. Intrinsic or gameplay elements were the broadest area by the number of good principles. There were also extensive guidance on mechanical and interactive side of the elements. The artistic guidelines were more of a general than anything that can be turned in to an concrete attribute. The reason for this is apparent as art is something that can't be dictated to be something formal that needs to be the same to succeed in each production. Sweetser & Wyeth's (2005) GameFlow theory relates to intrapersonal dimensions by the aim of the model, yet in this research only the parts that are related to the other models are picked as it would be fruitless to conduct intrapersonal facets entirely based on that theory. Overall the research compressed multiple different views on qualitative attributes of games under understandable categorization and thus offers good basis for game design. Future research could be focused on the quality assurance that game companies conduct in order to get more insight how quality of games is perceived by the developers.

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APPENDIX 1 - SWEETSER & WYETH GAMEFLOW CRITERIA

Element	Criteria
Concentration Games should require concentration and the player should be able to concentrate on the game	- games should provide a lot of stimuli from different sources - games must provide stimuli that are worth attending to - games should quickly grab the players' attention and maintain their focus throughout the game - players shouldn't be burdened with tasks that don't feel important - games should have a high workload, while still being appropriate for the players' perceptual, cognitive, and memory limits - players should not be distracted from tasks that they want or need to concentrate on
Challenge Games should be sufficiently challenging and match the player's skill level	- challenges in games must match the players' skill levels - games should provide different levels of challenge for different players - the level of challenge should increase as the player progresses through the game and increases their skill level - games should provide new challenges at an appropriate pace
Player Skills Games must support player skill development and mastery	- players should be able to start playing the game without reading the manual - learning the game should not be boring, but be part of the fun - games should include online help so players don't need to exit the game - players should be taught to play the game through tutorials or initial levels that feel like playing the game - games should increase the players' skills at an appropriate pace as they progress through the game - players should be rewarded appropriately for their effort and skill development - game interfaces and mechanics should be easy to learn and use
Control Players should feel a sense of control over their actions in the game	- players should feel a sense of control over their characters or units and their movements and interactions in the game world - players should feel a sense of control over the game interface and input devices - players should feel a sense of control over the game shell (starting, stopping, saving, etc.) - players should not be able to make errors that are detrimental to the game and should be supported in recovering from errors - players should feel a sense of control and impact onto the game world (like their actions matter and they are shaping the game world) - players should feel a sense of control over the actions that they take and the strategies that they use and that they are free to play the game the way that they want (not simply discovering actions and strategies planned by the game developers)

Clear Goals Games should provide the player with clear goals at appropriate times	- overriding goals should be clear and presented early - intermediate goals should be clear and presented at appropriate times
Feedback Players must receive appropriate feedback at appropriate times	- players should receive feedback on progress toward their goals - players should receive immediate feedback on their actions - players should always know their status or score
Immersion Players should experience deep but effortless involvement in the game	- players should become less aware of their surroundings - players should become less self-aware and less worried about everyday life or self - players should experience an altered sense of time - players should feel emotionally involved in the game - players should feel viscerally involved in the game
Social Interaction Games should support and create opportunities for social interaction	- games should support competition and cooperation between players - games should support social interaction between players (chat, etc.) - games should support social communities inside and outside the game

APPENDIX 2 – PINELLE ET AL. (2008) GAME USABILITY CRITE-RIA

1. Provide consistent responses to the user's actions.
Games should respond to users' actions in a predictable manner. Basic mechanics, such as hit detection, game physics, character movement, and enemy behavior, should all be appropriate for the situation that the user is facing. Games should also provide consistent input mappings so that users' actions always lead to the expected outcome.

2. Allow users to customize video and audio settings, difficulty and game speed.

2. Allow users to customize video and audio settings, difficulty and game speed.
The video and audio settings, and the difficulty and game speed levels seen in games are not appropriate for all users. The system should allow people to customize a range of settings so that the game accommodates their individual needs.

3. Provide predictable and reasonable behavior for computer controlled units.
In many games, the computer helps the user control the movement of their character, of a small group of teammates, or of a large number of units. Computer controlled units should behave in a predictable fashion, and users should not be forced to issue extra commands to correct faulty artificial intelligence. The game should control units so that pathfinding and other behaviors are reasonable for in-game situations.

4. Provide unobstructed views that are appropriate for the user's current actions
Most games provide users with a visual representation (i.e. a "view") of the virtual location that the user is currently occupying. The game should provide views that allow the user to have a clear, unobstructed view of the area, and of all visual information that is tied to the location. Views should also be designed so that they are appropriate for the activity that the user is carrying out in the game. For example, in a 3D game different camera angles may be needed for jumping sequences, for fighting sequences, and for small and large rooms.

5. Allow users to skip non-playable and frequently repeated content.
Many games include lengthy audio and video sequences, or other types of non-interactive content. Games should allow users to skip non-playable content so that it does not interfere with gameplay.

6. Provide intuitive and customizable input mappings.
Most games require rapid responses from the user, so input mapping must be designed so that users can issue commands quickly and accurately. Mappings should be easy to learn and should be intuitive to use, leveraging spatial relationships (the up button is above the down button, etc.) and other natural pairings. They should also adopt input conventions that are common in other similar games (e.g. many first-person shooters and real-time strategy games use similar input schemes). Games should allow users to remap the input settings, should support standard input devices (e.g. mouse, keyboard, gamepad), and should provide shortcuts for expert players.

7. Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness.
Many games allow users to control avatars such as characters or vehicles. Controls for avatars should be designed so that they are easy for the user to manage, i.e. they are not too sensitive or unresponsive. When controls are based on real world interactions, such as steering a car or using a control stick in an airplane, the game should respond to input in a way that mirrors the real world. Further, games should respond to controls in a timeframe that is suitable for gameplay requirements.

8. Provide users with information on game status.
Users make decisions based on their knowledge of the current status of the game. Examples of common types of information that users need to track include the current status of their character (such as their health, armor status, and location in the game world), objectives, teammates, and enemies. Users should be provided with enough information to allow them to make proper decisions while playing the game.

9. Provide instructions, training, and help.
Many games are complex and have steep learning curves, making it challenging for users to gain mastery of game fundamentals. Users should have access to complete documentation on the game, including how to interpret visual representations and how to interact with game elements. When appropriate, users should be provided with interactive training to coach them through the basics. Further, default or recommended choices should be provided when users have to make decisions in complex games, and additional help should be accessible within the application.

10. Provide visual representations that are easy to interpret and that minimize the need for micromanagement.
Visual representations, such as radar views, maps, icons, and avatars, are frequently used to convey information about the current status of the game. Visual representations should be designed so that they are easy to interpret, so that they minimize clutter and occlusion, and so that users can differentiate important elements from irrelevant elements. Further, representations should be designed to minimize the need for micromanagement, where users are forced to interactively search through the representation to find needed elements.

APPENDIX 3 - DESUVIRE ET AL. CRITERIA OF PLAYABILITY

		Heuristic and Description
Game Play		
	1	Player's fatigue is minimized by varying activities and pacing during game play.
	2	Provide consistency between the game elements and the overarching setting and story to suspend disbelief.
	3	Provide clear goals, present overriding goal early as well as short-term goals throughout play.
	4	There is an interesting and absorbing tutorial that mimics game play.
	5	The game is enjoyable to replay.
	6	Game play should be balanced with multiple ways to win.
	7	Player is taught skills early that you expect the players to use later, or right before the new skill is needed.
	8	Players discover the story as part of game play.
	9	Even if the game cannot be modeless, it should be perceived as modeless.
	10	The game is fun for the Player first, the designer second and the computer third. That is, if the non-expert player's experience isn't put first, excellent game mechanics and graphics programming triumphs are meaningless.
	11	Player should not experience being penalized repetitively for the same failure.
	12	Player's should perceive a sense of control and impact onto the game world. The game world reacts to the player and remembers their passage through it. Changes the player makes in the game world are persistent and noticeable if they back-track to where they've been before.
	13	The first player action is painfully obvious and should result in immediate positive feedback.
	14	The game should give rewards that immerse the player more deeply in the game by increasing their capabilities (power-up), and expanding their ability to customize.
	15	Pace the game to apply pressure but not frustrate the player. Vary the difficulty level so that the player has greater challenge as they develop mastery. Easy to learn, hard to master.
	16	Challenges are positive game experiences, rather than a negative experience (results in their wanting to play more, rather than quitting).
Game Story		
	1	Player understands the story line as a single consistent vision.
	2	Player is interested in the story line. The story experience relates to their real life and grabs their interest.
	3	The Player spends time thinking about possible story outcomes.
	4	The Player feels as though the world is going on whether their character is there or not.
	5	The Player has a sense of control over their character and is able to use tactics and strategies.
	6	Player experiences fairness of outcomes.
	7	The game transports the player into a level of personal involvement emotionally (e.g., scare, threat, thrill, reward, punishment) and viscerally (e.g., sounds of environment).
	8	Player is interested in the characters because (1) they are like me; (2) they are interesting to me, (3) the characters develop as action occurs.
Mechanics	1	Game should react in a consistent, challenging, and exciting way to the player's actions (e.g., appropriate music with the action).
	2	Make effects of the Artificial Intelligence (AI) clearly visible to the player by ensuring they are consistent with the player's reasonable expectations of the AI actor.
	3	A player should always be able to identify their score/status and goal in the game.
	4	Mechanics/controller actions have consistently mapped and learnable responses.
	5	Shorten the learning curve by following the trends set by the gaming industry to meet user's expectations.
	6	Controls should be intuitive, and mapped in a natural way; they should be customizable and default to industry standard settings.
	7	Player should be given controls that are basic enough to learn quickly yet expandable for advanced options.
Usability	1	Provide immediate feedback for user actions.
	2	The Player can easily turn the game off and on, and be able to save games in different states.
	3	The Player experiences the user interface as consistent (in control, color, typography, and dialog design) but the game play is varied.
	4	The Player should experience the menu as a part of the game.
	5	Upon initially turning the game on the Player has enough information to get started to play.
	6	Players should be given context sensitive help while playing so that they do not get stuck or have to rely on a manual.
	7	Sounds from the game provide meaningful feedback or stir a particular emotion.
	8	Players do not need to use a manual to play game.
	9	The interface should be as non-intrusive to the Player as possible.
	10	Make the menu layers well-organized and minimalist to the extent the menu options are intuitive.
	11	Get the player involved quickly and easily with tutorials and/or progressive or adjustable difficulty levels.
	12	Art should be recognizable to player, and speak to its function.

APPENDIX 4 - KORHONEN & KOIVISTO PLAYABILITY HEURISTICS FOR MOBILE GAMES

Table 1 Heuristics for evaluating game usability

No.	Gameplay Heuristics
GP1	The game provides clear goals or supports player-created goals
GP2	The player sees the progress in the game and can compare the results
GP3	The players are rewarded and rewards are meaningful
GP4	The player is in control
GP5	Challenge, strategy, and pace are in balance
GP6	The first-time experience is encouraging
GP7	The game story supports the gameplay and is meaningful
GP8	There are no repetitive or boring tasks
GP9	The players can express themselves
GP10	The game supports different playing styles
GP11	The game does not stagnate
GP12	The game is consistent
GP13	The game uses orthogonal unit differentiation[4]
GP 14	The player does not lose any hard-won possessions

No.	Game Usability Heuristics
GU1	Audio-visual representation supports the game
GU2	Screen layout is efficient and visually pleasing
GU3	Device UI and game UI are used for their own purposes
GU4	Indicators are visible
GU5	The player understands the terminology
GU6	Navigation is consistent, logical, and minimalist
GU7	Control keys are consistent and follow standard conventions
GU8	Game controls are convenient and flexible
GU9	The game gives feedback on the player's actions
GU10	The player cannot make irreversible errors
GU11	The player does not have to memorize things unnecessarily
GU12	The game contains help

No.	Mobility Heuristics
MO1	The game and play sessions can be started quickly
MO2	The game accommodates with the surroundings
MO3	Interruptions are handled reasonably

APPENDIX 5 – ZHU & FANG PLAYABILITY HEURISTICS (PG. 501 – 502)

Playability-related Adjectives	Playability Heuristics
Sound, complete, intelligent, substantial, stable, sensible	• Players are instructed to make intelligent decisions and carry out sensible actions; • The outcomes of players' actions must make sense to them; • Players understand the story line as a consistent and/or stable vision; • Non-player characters behave in a manner that is sensible in context of the story and setting.
Different, various, diverse, opposite, unusual, contrary, variant, polar, mean, normal, average, typical, natural	• There should be various tasks for each stage of playing in order to create an enduring gameplay; • The controls are mapped in a natural way, and the game's default settings must follow typical ones from games of similar kind; • The game can be manipulated in a number of ways or explored through various modalities.
Boring, tedious, dull, tiresome	• The tediousness during game-play can be solved by adding different tasks and adjusting the pacing of gameplay; • Customizations (e.g., control, sound, color) can help minimize possible tediousness. • Game mechanics are not mundane.
Repetitive, repetitious	• The tasks in the games should not be perceived to repeat themselves; • When the same mistakes are made again, there should not assistance instead of the same penalties; • Repetitive activities can be reduced by simplifying controls.

Playability-related Adjectives	Playability Heuristics
Pretty, beautiful, nice, nasty, pleasant, respectable	• The game characters look adorable (e.g., beautiful, intelligent, interesting) to players; • Impressive setting designs can facilitate presence.
Hard, solid, challenging, strong, tough, serious, tricky, rough, soft, stale, severe, punishing, troublesome, grueling, easy, difficult, available, smooth, comfortable, user-friendly, abundant, simple, plain, complex, mere, bare	• The game should be easy to learn but hard to master; • The players should not be given severe punishment and/or penalty if failing difficult tasks; • The level of challenges is well-balanced; • The interface is user-friendly and easy to navigate to locate available features; • The Artificial Intelligence (AI) needs to assist players when they have difficulty dealing with tricky tasks; • Players should be able to overcome challenges eventually and feel a sense of accomplishment.