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QUALITY OF VIDEO GAMES: INTRODUCTION TO A COMPLEX ISSUE

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Abstract: The video games industry is one of the fastest growing branches of industry, reaching revenues comparable to (or even surpassing, depending on the source) the 70 year older film industry. The growth was not free from turmoil, as the industry faced many disruptive changes, market crashes, fusions and takeovers. High development costs and fierce competition make video games a high-risk business. While it seems obvious that companies in such unstable environment should strive to achieve the highest quality of their products, the uniqueness, variety, complexity, and constant evolution of video games makes common definitions and models of quality difficult to apply. This article provides an overview of problems concerning the application of the term "quality", it's frameworks and measurement methods to video games.
Keywords: video game, quality, customer requirements, games industry

1. INTRODUCTION

It is estimated that the global video game market brought nearly 138 billion USD in revenues in 2018, presenting a 13,3% increase from 2017 (Wijman, 2018). At the same time, the production of a video game can take several years, and cost (including marketing) well over 200 million USD (Villapaz, 2013). When undertaking such vast investments, it is desirable that the final product would be of the highest quality. The International Organization for Standarization (2015, clause 3.6.2) currently defines quality as a “degree to which a set of inherent characteristics of an object fulfils requirements”. An attempt to apply this definition to video games naturally rises several questions: What are the quality requirements of consumers? Which characteristics of video games influence their quality? How to measure them? This article discusses these issues and presents results from a preliminary research; finding the answer to these questions, however, may be more difficult than it seems.

A characteristic that first comes to mind is the graphics. It is what drives the evolution of gaming hardware, and usually the first thing that comes to customer’s attention when experiencing a game. The graphics quality of games is difficult to define; it is important to note that the complexity of computer graphics easily deserve a whole book, so the following paragraph is a crude simplification. At least a few technical characteristics of graphics can be measured. Resolution is the size of the pixel grid displayed (influencing

how “sharp” the objects look); color depth is the number of bits used to code colors (higher means richer palette). These parameters increase the amount of data to be processed by the hardware before it is displayed. Each time the image changes, the data needs to be processed again and again. This leads to another attribute - framerate, which is the number of frames displayed per second (FPS). High frame count means better smoothness of animations, while low not only can make the game look like a slideshow, but also limit the player's ability to control the game. Framerate is affected by amount of data to be processed and hardware’s processing power. However, this amount depends not only on *how*, but *what* is being displayed. A one-colored cube does not require much data, but modern games try to simulate whole environments, with every object being represented by a complex 3D model covered with textures (images on every surface), transformed by different sources of light, all of which is calculated in real time. The more detailed the graphics are, the more realistic it looks, but the limits in processing power may result in lower framerate. Aside the graphics, the hardware has to process the game’s physics, player input, artificial intelligence (AI) of virtual opponents, sometimes also exchange data for multiplayer purposes. Different hardware platforms (consoles, computers) or variants of their configuration, have different capabilities, thus the graphics of different *ports* (game versions for a given platform) may vary, depending on *optimisation* (the process of finding the right balance between the level of detail and smoothness of animations in the constraints of limited processing power of a given platform).

Despite the measurable attributes, the graphical aspect of different games is hard to compare. The *Battlefield* series tries to present realistic graphics; textures in *Dishonored* games look like they were hand painted; *Borderlands* series uses cel-shading technology to create a comic-book effect. All of these games could be categorized to one genre (First-Person Shooters), and yet they look completely different. They play different too - *Battlefield* has straight-forward, linear missions, *Dishonored* includes RPG elements and allows different solutions (including non-lethal) to achieve the game goals, while *Borderlands* enables free-roaming in an open world with 'grinding' (re-doing same things for better outcome and easier progression) mechanics. Video games are highly differentiated creations. While some strive to achieve top-notch graphics, some rely more on the story (e.g. *Pillars of Eternity*). *Minecraft*, on the other hand, presents a world made of cubic blocks with low-resolution textures, yet manages to be one of best selling games, by enabling the players to unleash their creativity and reshape the game world using the game's mechanics. Some racing games provide realistic simulation of driving physics (e.g. *Forza Motorsport, Gran Turismo* series), while 'arcade' racers simplify that aspect, sometimes adding unrealistic features like power-ups (e.g. *Split/Second, Blur*).

The complexity of video games differentiate their production process from other forms of software (Murphy-Hill et al., 2014), especially when it comes to reducing the occurrence of errors (commonly named *bugs*). Companies implement the process of quality assurance (QA), either internally or with the use of outsourcing. A decent overview of the QA process is provided by Ruuska (2015). QA can be divided into three main types. Functional QA (FQA) is, in short, the process of testing if the game behaves as intended, from the technical point of view. This covers a wide range of possible errors, concerning the graphics (e.g. improper display of textures, incorrect lighting effects), sound, AI (improper computer opponent/ally behavior, e.g. enemies trying to shoot through walls), physics (e.g. objects floating in air or otherwise acting unnaturaly),

scripting (e.g. actions do not work properly, game does not progress when conditions are met) or other general bugs (e.g. game freezes/closes itself). The process of FQA usually requires some degree of programming knowledge to properly analyze and fix encountered bugs. Linguistic QA (LQA) analyzes in-game written and spoken text, and checks the propriety of its translation and corrects found errors. It is an important part of the QA process, as games usually contain great amount of text, ususally scattered in different parts and forms of game data, often translated in parts by different people and/or with the use of software. Common bugs include (i.a.) missing or incorrect translation, improper display or inconsistency (different names of objects or actions can confuse the player and block progression). Platform Certification QA (sometimes called “Compliance QA”) is the process of testing if the game meets requirements of a platform publisher. These differ from one company to another, but are aimed to ensure some level of coherence when using the platform for different games. The requirements may concern consistency of nomenclature (e.g. device and services names, button signs, logos and iconography), information about the product use (e.g. not to turn off the power when the game is saved), and different functional and linguistic requirements (e.g. ability to progress in the game without issues). None of aforementioned types of QA aims to ensure the quality of more creative elements of video games, like the story, art style or soundtrack.

Video games have been considered one of "creative industries" in the models of different authors and organizations over the years (Howkins 2001; United Nations 2004; BOP Consulting 2010), meaning they "have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property” (BOP Consulting 2010, p. 16). Like other software, they are not manufactured, but created through a process of design; once designed, do not change during replication. Therefore, the application of statistical quality control methods, like Shewart's control charts or Six Sigma is questionable (Binder, 1997; Raczynski and Curtis, 2008).

The application of another well-known quality management method, the Quality Function Distribution (QFD) was discussed by Jacobs and Ip (2003). At first their suggestions were purely theoretical. For the sake of the example, they listed only 5 "Voice of customer" (VoC) quality factors: graphics, sound, gameplay, innovation and multiplayer. Authors highlighted a need for large market research to fully recognize these factors. Later (Jacobs, Ip 2006), they released the findings from such research, however decided to evaluate only one, rather niche sub-genre (rally racing). Based on literature study and unspecified amount of online discussions with customers, they came up with 42 VoC items, (as specific as "Realistic faults made by co-driver/team") later broadened to 45 during actual survey. The QFD method definitely has some potential, however the level of complexicity of VoC is overwhelming given the homogenous nature of rally games. Another issue is the "benchmarking" nature of the tool, which was already found problematic in the research (unable to determine the competitive position with no experience in making a given type of game). This issue could be even more problematic in other genres, as developing games based only on factors from previous releases could strongly limit innovation. *Fortnite Battle Royale*, for example, fits basically the same 'battle royale' multiplayer shooter (players get only one life, last one standing wins) category as *PlayerUnknown's Battlegrounds* (PUBG), released a few months earlier the same year. The use of QFD and listing PUBG-based VoC during development, would probably result in a very similar game, only with a

bigger map, more weapons and other improvements to current features. Instead, *Fortnite* presents a cartoon-like art style (opposed to realism of PUBG) and includes new mechanics (e.g. possibility to create traps), completely abandoning some features of its competitor (e.g. vehicles). Video games can be classified as intangible goods (see e.g. Parry et al., 2011), with limited tradability. The consumer never fully owns a game - only purchases its physical medium (if any), and the right to use a digital copy, not the right to claim the game's intellectual property as his own. Those characteristics may imply, that a video game is, in fact, more of a *service* than a *product*. This idea is supported not only by the paradigm shift to service-dominant logic in marketing theory (Vargo and Lush, 2004), but also a practical shift seen in the video game industry (Schreirer, 2017). This motivates to explore the theoretic developments in the scope of service quality. In various service quality models (Grönroos, 1984; Parasuraman et al., 1985; Gummeson and Grönroos, 1987), quality is the difference between the expected and perceived service, with the moderating effect of such factors as prior experience, word of mouth or marketing. Otto and Ritchie (1996) while researching tourism services, suggested a more holistic and subjective approach and proposed analyzing "experience quality" instead, focusing on emotional than technical aspects. Similarly to the SERVQUAL range of methods, their scale was modified by other authors (e.g. Kao, Huang and Wu, 2008). Coincidentaly, service quality and experience quality may easily be confused with "Quality of Service" (QoS) and "Quality of Experience" (QoE), which are approaches used to capture the quality of different telecom services. Similarly to developments in the tourism sector, QoS focused on strictly technical aspects of services (see ITU-T 2008), while QoE "expands this horizon to capture people's aesthetic and even hedonic needs" (Laghari and Crespl, 2012). This shows that even in strictly technical fields, evaluation of quality is not limited to purely technical aspects. Nacke (2009) includes user experience analysis as a part of a broader model of game usability, containing different quality dimensions (machine/system quality, gameplay quality, social/metagame quality).

Having in mind previous considerations, it was decided to conduct a preliminary research in order to capture the general image of how consumers of video game determine their quality.

2. RESEARCH METHODOLOGY

The research was conducted in the form of computer-assisted interview with the use of Google Forms. The link to the form was given to full-time students of logistics. A total of 53 (31 male, 21 female, 1 undisclosed) students volunteered to participate. The respondents were asked a filtering question, if they play video games at all; 42 (79%) gave a positive answer. The "gamers" group consisted of 29 (69%) male, 12 (29%) female participants and 1 (2%) of undisclosed gender. All participants were asked an open-ended question "How can you define quality of a video game? What does it mean that a game is 'of high (or low) quality'?". "Non-gamers" finished at this point and were redirected to demographics section. "Gamers" were additionally asked to list the games they remember playing in the past 12 months, then asked a second question "Which of these games is (in your opinion) of highest quality and why". This proved helpful, as most respondents indicated at least one additional factor.

3. RESULTS

Due to open-ended character of the questions, almost every answer was unique; the answers were analyzed and quality factors were extracted from both questions (omitting duplicates). The “gamer” group gave a total sum of 146 quality factors (average of 3,47 per respondent). While some of them are potentially synonymous, the list contained 93 differently phrased factors. They were later counted by occurrence and grouped by similarity. It was a problematic process, as affiliation of some factors was obvious, while some raised doubts concerning the interpretation of respondents wording. The process ended when it was decided that further categorization would be too subjective; factors were divided into 41 groups, of which some are robust, representing factors listed 21 times in 7 different phrases (“Graphics”), while some are mentioned only once (e.g. “Porting quality”). The groups of factors were additionally divided into different “types”, however the division is very loose and arguable, mostly for reading convenience. The quality factors pointed out by “gamer” respondents are listed in Table 1.

Table 1
Quality factors extracted from the survey

Technical factors (34):	**Design/artistic factors (40):**	**Design/gameplay factors (38):**
1. Graphics (21): a. Graphics (14) b. Quality of graphics (2) c. Level of graphics d. Quality of graphical details e. Detailed graphics f. Top graphics g. HD graphics **2. Optimisation (3):** a. Well optimized (2) b. High FPS in HD resolution **3. Amount of bugs/glitches (3)** **4. Engine (3)** **5. Audio-visual quality** **6. Porting quality** **7. Good server maintanance** **8. Smooth transitions from one location to another** (i.e. no loading screen)	**1. Plot (21):** a. Plot (general) (16) b. Plot quality c. Quality of storytelling d. Great story e. Extensive, logically built scenario f. Interesting scenario **2. Game world (4)** a. Complex game world (2) b. Extensive game universe c. Excellently presented world d. Game world size **3. Characters (2):** a. Excellently presented characters b. Originality of different characters **4. Art style (2):** a. Graphic style (not necessarily realistic) b. Artistic vision **5. Design (general) (2)** **6. Level design (2):** a. Level design b. Location design **7. Climate** (i.e. feel, atmosphere) **(2)** **8. Soundtrack (2)** **9. Colorful (2)** **10. Appearance**	**1. Ingenuity (2):** a. Ingenuity b. Puts in new situation **2. Mission design (3):** a. Lot of interesting missions b. Lot of varied sidequests c. Quality of quests **3. Gameplay (4):** a. Gameplay (2) b. Well-structured gameplay c. Well-thought gameplay **4. Functionality (4):** a. Number of functions b. How complex is the game c. Number of possibilities d. Number of possible interactions **5. Difficulty (6):** a. Difficulty curve b. Difficulty levels c. Learning curve d. Challenging e. Punishing for mistakes f. Requires strategy **6. Multiplayer aspect (4):** a. Multiplayer (2) b. Good offline and online (2) **7. Content (2)** a. Amount of content b. Regular content updates **8. Playability (5)** **9. Physics (3)** **10. Controls (2)** **11. Mechanics (2)** **12. Comprehensibility**
Current industry and market situation (14): **1. Contemporaneity (5)** a. Recently released (2) b. New technology (2) c. Meets current requirements **2. Company (2)** a. Good company (developer)		

b. Company listens to players and meets their expectations **3. Market-related aspects (7)** a. Worldwide b. Long history on the market c. Best in category d. Over a dozen tie-in books e. Good compared to rest of the series f. E-sport scene g. High prize pool in tournaments **h.** Microtransactions model	**Social and emotional factors (13):** **1. Emotional aspects (8):** a. Fun (2) b. Satisfying (2) c. Engaging d. Builds involvement, not boring e. Unleashes creativity f. Relaxing g. Sense of rivalry h. Few annoying elements **2. Social aspects (5):** a. Community (2) b. Popularity (2) c. User opinions	**Genre- and game-specific factors (7):** **1. Realistic driving model (2)** **2. Polished combat system** **3. Elements of risk management** **4. Elements of economy** **5. Teaches about logistic and transport** **6. Favourite genre**

"Non-gamers" had more trouble defining video game quality; out of 11, 5 did not know how to answer the question, one of the remaining 6 answered "processor and graphic card", which – while they can affect the way the game operates – are hardware components of platforms running video games, not of video games themselves. Other "non-gamers" listed a total of 10 factors (graphics – 3, plot – 2, realism, functionality, comprehensibility, engagement) with only one – game speed – being a new addition.

4. DISCUSSION

The number of different factors can be overwhelming, and there is a reasonable suspicion, that with the increase of the research sample, this number could grow even further. One important finding is that technical aspects, including graphics, constitute a part (around ¼) of listed factors, while more "artistic" or "creative" ones are at least equally important. This complicates the assessment of quality of video games, as it is hard to measure the quality of a story or art style, which are subjective to taste. A considerable amount of factors is linked to the design of gameplay, including e.g. mechanics, physics, difficulty, controls, or "playability". While not directly connected to the game itself, there were some factors that could be linked to the current or past market situation of a title or it's developer, and only a part of them could be reproduced by a different company in another product; nonetheless, these "external" factors should be taken into account, as they were not discussed by previous research. The social dimension of game quality was highlighted, a few factors were also connected to the emotions the games induced. Some factors were specific to a given genre or a particular game only, as it is hard to expect, e.g., all games containing educational elements concerning logistics.

As mentioned before, keep in mind that an unequivocal categorization of factors might be impossible for several reasons: 1) the process of making a video game is complex and mostly unseen by the end users, thus, through limited knowledge, they may incorrectly name different aspects of production influencing the final effect; 2) a video game is usually experienced as a whole, not as individual assets; 3) interpretation of respondent intention in naming different elements may be subjective. For example, it is hard to tell, if someone listing the "graphics" factor was referring only to the technical aspects, the art style, or a combination of both (as a synonym of equally problematic

"appearance"). Term "Engine", commonly associated to rendering graphics, actually refers to the software packages used to create different aspects of games, including, i.a., graphics, sound and physics. "Physics" might be a part of mechanics influencing gameplay (e.g. ability to move, throw or destroy in-game objects) or refer to visual elements (particle effects representing smoke, water, weather conditions, etc.). A more in-depth, unstructured, face-to-face interview would be useful to clearly determine respondent's intention, although it would greatly increase time and effort needed by the research. On the other hand, a bigger research sample would possibly bring more factors influencing the perceived quality. The design of future research definitely has space for improvement, especially that this study only analyzed the quality factors, not methods of their measurement.

5. CONCLUSION

It is difficult to define, capture and measure the quality of video games for several reasons. The use of statistical quality methods to software is debatable. The use of QFD method rises concerns over originality and innovation. Developments in service quality theory suggest more focus on the totality of experience, analyzing the subjective, aesthetic and hedonistic quality factors, instead of purely technical aspects. A preliminary research interviewing 41 gamers brought a list of 93 differently phrased quality factors. The technical factors, including graphics quality, were listed almost equally often as more artistic elements (plot, art style) and factors related to gameplay design. Respondents also highlighted the social and emotional aspects of video game quality, as well as those related to the market and industry situation. To ensure high quality perception of video games from a customer point of view, all of those factors should be considered by the producers. The current usability of this preliminary research is limited, however, as answers of respondents are ambiguous and subject to misinterpretation. In-depth interviews with a larger sample could possibly bring better results. Means of measuring different factors are also needed.

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