The Dark Side of Gamification:
How We Should Stop Worrying and Study also the Negative Impacts of Bringing Game Design Elements to Everywhere

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Abstract: There are always two sides to every story. This statement is true also for the most recent hype term gamification – i.e., bringing game design elements into non-game contexts – that has been used to improve users' motivation and performance in various domains. Previous studies on gamification have mainly taken a positive approach towards the phenomenon and its implications. To depart from the existing research, this tertiary literature review assesses the negative effects of gamification (such as game addiction and ethical issues). The systematic literature review method is followed in collection of 22 literature studies published on gamification. The analysis of these secondary studies show that while several researchers acknowledge possible problems and consequences, there is a clear research gap in understanding the negative impacts of gamification. We categorize the presented negative implications to limiting and harmful issues. Finally, this study calls for further work assessing and defining the limitations and borders for the ethical use of game design elements in everyday life as well as for growing our understanding for harmful issues.

1. Introduction

An old idiom of English language states that *"there are two sides to every coin"*, which emphasises that there can be two different but closely related features for the same idea. For example, punishments and rewards can both be used to guide people towards set goals. Recently, this idiom has been in a central role in the design of new information systems as well as new services, where the aim has not been in forcing either the employee or the customer to use the invented solution but, rather, in making them enjoy the use of the artefact by adding elements that were previously met in games and traditionally not in workplace or other environments. The term 'gamification' was coined by Nick Pelling[1] in 2002 to describe such use of game design elements in non-game contexts (Huotari & Hamari, 2012).

Gamification has become popular among information and software system researchers as well as practitioners during the last few years. For example, Google trends[2] indicates that in the beginning of 2010s, there was practically no (search) interest towards the concept. The search activity started to grow in 2011 and peaked in 2014. Since then, curiosity towards the concept has remained stable. Furthermore, one can easily find numerous examples of gamified solutions in a business domain such as *Visual Studio Achievements*, *JIRA Hero*, in a well-being area such as *Nike+*, *Zombies, Run!*, *Superbetter* as well as in an educational sector (see e.g. Hidalgo-Céspedes; Marín-Raventós; & Lara-Villagrán, 2016).

Gamification has been showed to improve motivation of, e.g., improving motivation and performance, while there are some caveats (Hamari; Koivisto; & Sarsa, 2014). Adding game design elements into educational systems seems to be useful in motivating students, improving their skills and learning (de Sousa Borges; Durelli; Reis; & Isotani, 2014). The use of gamification has been even discussed in li-

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[1] Conundra Ltd. http://www.nanodome.com/conundra.co.uk/ Accessed January 30th, 2017.
[2] Google Trends for the search term 'gamification' - https://www.google.com/trends/explore?q=gamification Accessed January 30th, 2017.

braries (Brown, 2014) as well as in software development environments (Pedreira; García; Brisaboa; & Piattini, 2015).

While gamification has been mainly used on improving users' interests on virtuous issues and tasks, there are also clearly dark issues where it has been applied. As an example, the rumored Russian game 'Blue Whale'[3] is claimed to give increasingly more dangerous tasks to players. To proceed in the game, 50 daily tasks have to be completed and documented, and to "win" the player has to complete the final task, committing a suicide. Although there is no conclusive proof that this game actually exists, it gives an extreme example of how gamified elements could be used for harmful purposes. Similarly, there are reports that gamification techniques have been used to motivate anarchists to steal or damage CCTV cameras in Berlin, Germany (Versteeg, 2013). However, these are examples of extreme malpractices of any kinds of technologies, methods and tools.

In addition, there are naturally *limits* to where gamification works. That is, there are domains and tasks where applying gamification is not clearly virtuous or immoral. As gamification is often used to motivate the user, it does not add anything extra if there is enough motivation already (e.g. meeting friends). Certain areas of application require utmost speed, usability and urgency (e.g. paramedics or firefighters), and adding gamified elements there could have serious negative results. There is also the consideration, when gamification clashes with ethics (e.g. casinos, gambling, game addiction). This is the grey area where we focus in this paper.

The old English idiom, that every coin has two sides, translates badly to Finnish language. The idiom can be translated word-by-word to Finnish but its meaning changes: the verbatim translation states that every story has two sides. The same applies for 'gamification': no change in a complex system can be done without consequences (c.f. 'inseparability postulate' by Nurminen & Forsman, 1994). The objective of this study is to uncover what are researchers' perception of the negative side effects caused by adding game elements to everyday life. The study is loosely motivated by the observation that addiction to games is a growing, although it still is a niche problem in modern societies (see e.g. Søraker, 2016). Thus, an interesting question arises on how the gamification research community has strived to solve the problem of bringing potentially addictive gaming elements into the design of everyday things. To generalize this question, this study seeks to answer to the research question:

RQ: How researchers have perceived the negative side effects of applying gamification?

To seek an answer to the question, we study the extant literature of gamification. We use systematic literature review (SLR) approach to collect existing meta-studies of gamification. As there is already a plethora of existing literature surveys, we decided to focus on these to map the current knowledge from all fields. The meta-studies are used to analyse what is the current knowledge on gamification's unwanted impacts.

This study is structured as follows. In the following section, we will present the search and analysis protocol used in this study. The third section presents results found from the analysis of selected secondary studies. The last two sections, discuss the implications of this study, propose new avenues for future inquiries and, finally, conclude this study with key arguments as well as limitations.

2. Research Approach

The aim of this study is to map existing knowledge on negative impacts of gamification. We use Systematic literature review (SLR) method to gather all relevant tertiary studies for this study. In SLR, we follow the guidelines given by Kitchen and Charters (2007). For the selected tertiary studies, we perform content analyses and attempt to find all relevant evidence and primary studies related to the RQ.

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[3] The Sun - 'Blue Whale' suicide game linked to 130 teen deaths is just tip of the iceberg in the world's suicide capital Russia https://www.thesun.co.uk/news/3002981/blue-whale-game-suicide-russia-rules-challenge-social-media/ Accessed April 19th, 2017.

Table 1. The publication databases used and the number of matches as well as the number of included publications (contains duplicates).

Database	Hits	Included
ACM Digital Library	6	5
AISel	5	4
IEEE Xplore Digital Library	7	6
ScienceDirect	5	5
Scopus	6	6
Wiley Online Library	1	0
All together	30	26

This study uses a simple three steps research process. In the first phase, we construct a search term, inclusion and exclusion criteria and decide the used publication forums and databases. In the second phase, we apply the search term and select the studies to be included. In the final phase, the chosen studies are analysed and issues raised in them are collected and categorized. In the following we will go through these steps with more detail.

There are two main approaches for selecting primary studies in a systematic literature review method: either a *manual* search to selected publication forums or an *electronic* search to the selected databases (Kitchenham & Charters, 2007). We decided to use the latter in order to maximize the coverage of the search. If we would have decided to concentrate on pre-selected publication forums and stick to those only, we would have unnecessary restricted the potentially small set of tertiary studies. The selected electronic publication databases are given in Table 1 with the number of hits returned and selected studies by each database.

In the first phase, we constructed a search term that we applied to all selected electronic publication databases. The search term used contains two parts: First, we request that the term 'gamification' appear in the publication. Second, the study has to be some sort of a literature study. Therefore, at least one of the most common keywords related to literature reviews have to be present in the publication. The general search term is:

gamification AND ("literature review" OR "literature study" OR "systematic review" OR "systematic mapping")

The search was targeted, when possible, to the title, abstract, and keywords. Naturally, the search term was adapted to each of the electronic publication databases used according to the specific features of the database. The searches for all databases were done at January 27th, 2017.

In the second phase, all the found tertiary studies were evaluated based on the title and abstract. We used simple inclusion and exclusion criteria: Studies were included if they were written in English, published in a peer-reviewed forum, focused on some aspect of gamification and the research approach was a literature survey. Both systematic and non-systematic literature studies were included. We excluded posters, commentaries, extended abstracts and prefaces; studies written with other language than English as well as studies that did not either focus on gamification or were not literature surveys.

In the final phase, the selected studies were analysed. We used content analysis. In this, all negative aspects of gamification found in the tertiary studies were marked and referred primary studied were sought. The researchers then synthesized the results found by grouping similar issues raised into categories. Finally, in the discussion among the authors, gaps in the existing literature were spotted and proposed topics for future inquiries were formed.

3. Results

In the following, we will first present a categorization of found negative aspects that fall into two main groups: *limiting* issues and *harmful* issues. In the latter parts of this section, we will focus more on the issues belonging to the harmful category.

In total, we selected 22 literature studies assessing gamification from various viewpoints. The selected secondary studies are shown in Table 2. Out of the selected studies, six are journal articles and the rest

are published as part of conference proceedings. The studies cover a broad area of different research fields from education and library science to information systems science and software engineering. Therefore, the decision to use electronic search in a wide set of different publication databases seems to be justified.

Despite a large number of systematic and disorganized literature reviews published on gamification, we did not find a prior meta-study focusing solely on the negative aspects of gamification. On the contrary, most of the secondary studies have mainly a positive view towards gamification. That is, the studies were focusing on the found positive implications and effects of the gamified solutions. We share this same observation with Bui et al. (2015) who state that most of the primary studies that they went through have rarely addresses potential downsides of gamification. In addition, Kim and Werbach (2016) argue in their study that the ethical side of gamification has been left without much attention.

Most of the analysed secondary studies had only little if any discussion on the negative effects of gamification. The negative observations summarized in the secondary studies can be categorized roughly into two main themes: The first group is formed from the worries about gamification *limiting* the full capabilities of an artefact. The second group contains discussions on the *harmful* implications of gamification. To put it simply, the observations in the former group are related to gamification not producing the best results. The discussion in the latter group is related on clearly negative impacts of gamification to for example, the behaviour of the users.

First, several authors have expressed their worries about *limitations* of gamification. For example, users might be optimizing the end-result of the 'game' (e.g., positions in leader boards), and not the task at hand (Knaving & Björk, 2013; Silpasuwanchai; Ma; Shigemasu; & Ren, 2016). Gaming elements, that are lucrative for a single person, can present competing interests against teamwork, thus hindering the team to achieve the best performance (Marlow; Salas; Landon; & Presnell, 2016). Both of these two previous limitations fall within "you get what you measure" problem. In addition, gamified solutions can also be found demotivating due to, e.g., frustrating simplicity or childishness of a request task (Augustin; Thiebes; Lins; Linden; & Basten, 2016).

Second, only a few authors have discussed the *harmful* consequences of gamification. Harmful consequences, as the name suggest, are questionable – and potentially unethical – side effects of the gamified features. For example, as pointed out by Bui et al. (2015), gamified solutions could encourage users to perform behaviours only when rewarded. Furthermore, losses in productivity can be faced when gamified elements distracts users from the main purpose of the system (Thiebes; Lins; & Basten, 2014).

To generalize, the observations in the limiting category are more or less related to unsuccessful implementation of gamified features or failed deployment of the new system. That is, if positions in the leader board are not reflecting all wanted tasks, it is likely a signal of failed requirements elicitation work. Similarly, if gamified elements do not support learning for all kinds of students, alternative solutions should be studied and supported. Even though these are extremely important aspects of successful deployment of a new system or a process, these are mainly limiting either the system or user to achieve the full potential value that the gamified solution could offer. The main dichotomy between the two groups is that limiting elements are usually issues that can be fixed more easily than the issues belonging to the harmful category.

The issues belonging to the latter of the two groups, the *harmful* issues, are more complex and the number of primary as well as secondary studies assessing these is scarce. The secondary studies analysed refer to some primary studies touching the topic. For example, Nicholson (2012) argues for bringing user-centred design principles into gamification discussion. However, he also discussed the problem that gamification might replace internal motivation with pursuit of extrinsic rewards. This would, ultimately, diminish the initial goal of gamification practices: to increase the motivation of the users.

By far, the most thought-provoking article has been written by Kim and Werbach (2016). In their study, they present a two-by-two framework for mapping gamification ethics. The main question of the taxonomy's four categories are whether or not (1) gamification practices take unfair advantage of workers; (2) they infringe users autonomy; (3) do they harm users or others; and (4) whether gamified practices have a negative effect on the moral character of the involved users?

Table 2. The selected secondary studies.

ID	Selected study and the authors
1	*Are We Playing Yet? A Review of Gamified Enterprise Systems* (Augustin;Thiebes;Lins;Linden;& Basten, 2016)
2	*A Literature Review of How Videogames Are Assessed in Library and Information Science and Beyond* (Brown, 2014)
4	*Gamification – A Novel Phenomenon or a New Wrapping for Existing Concepts?* (Bui;Veit;& Webster, 2015)
5	*A systematic mapping on gamification applied to education* (de Sousa Borges;Durelli;Reis;& Isotani, 2014)
6	*Gamification in education: A systematic mapping study* (Dicheva;Dichev;Agre;& Angelova, 2015)
7	*Does Gamification Work? -- A Literature Review of Empirical Studies on Gamification* (Hamari;Koivisto;& Sarsa, 2014)
8	*Learning principles in program visualizations: A systematic literature review* (Hidalgo-Céspedes;Marín-Raventós;& Lara-Villagrán, 2016)
9	*Gamification for health and wellbeing: A systematic review of the literature* (Johnson, et al.., 2016)
10	*Designing for Fun and Play: Exploring Possibilities in Design for Gamification* (Knaving & Björk, 2013)
11	*Eliciting teamwork with game attributes: A systematic review and research agenda* (Marlow;Salas;Landon;& Presnell, 2016)
12	*A Literature Review of Gamification Design Frameworks* (Mora;Riera;González;& Arnedo-Moreno, 2015)
13	*Fun beliefs in digital games from the perspective of human nature: A systematic review* (Normal;MdNor;& Ishak, 2014)
14	*Gamification in software engineering – A systematic mapping* (Pedreira;García;Brisaboa;& Piattini, 2015)
15	*Competing or Aiming to Be Average?: Normification As a Means of Engaging Digital Volunteers* (Preist;Massung;& Coyle, 2014)
16	*Serious games and active healthy ageing: A pilot usability testing of existing games* (Pyae;Raitoharju;Luimula;Pitkäkangas;& Smed, 2016)
17	*Developing a Conceptual Model for Facilitating the Issuing of Digital Badges in a Resource Constrained Environment* (Salerno;Ouma;& Botha, 2015)
18	*A Descriptive Literature Review and Classification Framework for Gamification in Information Systems* (Schlagenhaufer & Amberg, 2015)
19	*Developing a Comprehensive Engagement Framework of Gamification for Reflective Learning* (Silpasuwanchai;Ma;Shigemasu;& Ren, 2016)
20	*Gamifying Information Systems - A Synthesis of Gamification Mechanisms and Dynamics* (Thiebes;Lins;& Basten, 2014)
21	*A Systematic Mapping Study on Gamified Software Quality* (Vargas-Enríquez;García-Mundo;Genero;& Piattini, 2015)
22	*A survey of gamification for healthcare system* (Wen;Hsien;& Huang, 2015)

4. Research Gaps

This study seeks an answer to the research question how researchers have perceived gamifications' negative implications and to uncover what do we know about the dark side. Based on the literature study of 22 secondary studies and selected primary studies, the answer is simple: *Not much*. The most complete work has been presented by Kim and Werbach (2016), while they also acknowledge that their framework is not complete and there could be more moral issues that should be noted.

Nevertheless, at least some researchers are aware of the negative impacts and possible side effects. Several of the studied literature reviews mention that there are clear limitations and potentially unwanted side effects that should be noted. However, only a few studies have taken a step forward concretizing the ethics of gamification, and there are clear ethical and practical questions still left unanswered. In the following, we will present few of the open research avenues regarding the negative implications of gamification.

First, we can take an assumption that where gamification is applied, there are also similar problems that have been faced with games. Thus, the questions related to cheating – that have seen in all single-player, multiplayer and online multiplayer games – are present also in a gamified solutions. Second, if games can exploit their users, also gamified solutions can follow that path. However, if gamification solutions follow the rules of games, then researchers could follow, for example, the guidelines set by Søraker (2016) regarding exploitation in games. He has suggested that the 'gamers' should be educated on the incentives of the systems so that they would be aware of possible problems by themselves. This could be a reasonable approach to study as nowadays the number of gamified solutions is growing rapidly.

Third, one of the most interesting questions faced during this study is: can gamified solutions be used with employees who have a history or tendency towards game or gambling addiction? Also, how ethically justified is it to use gamified solutions in systems and services marketed for children (see also e.g. Sprenkels and van der Ploeg, 2011)? These questions have been amazingly little discussed in the literature. We were also surprised that health and well-being related secondary studies selected for this assessment do not cover this issue.

Fourth, what can and cannot be gamified? We assume that applying gamification in the work of paramedics or firefighters might not be a good solution as unnecessary steps in their work might rather cause harmful impacts. However, where is the line between useful gamification and adding game design elements into tasks that can cause dangers, remarkable losses or that are ethically questionable? Furthermore, can gamification cause threatening situations and what would be an ethically justified way of handling these? As an example of blind trust to technology, we could consider cases where a car driver has uncritically trusted in a GPS navigator and driven his or her car to a lake[4].

5. Discussion and Conclusions

This study addressed the extant knowledge on the negative effects of gamification by using a literature study. We used systematic literature review to collect the articles and we focused on existing literature studies on gamification. In total, 22 secondary studies were analysed for this tertiary study. As a result, we found little prior discussion on the negative impacts of gamification. Few of the existing studies have addressed the topic; however, this study seems to be the first secondary study to be devoted to this theme.

We classified the present worries into two categories: *limiting* and *harmful* issues. After the categorization of the issues and analysis of the presented taxonomy, we noted that there are inherited similarities with Brooks' (1987) classic categorization of software engineering fields' complexity. While the similarity is unintentional, it serves well in concretizing the difference between the two categories. In Brooks' observation, *accidental complexities* are software engineering issues that engineers create and, thus they can be fixed. For example, inefficient tools, processes and methods belong to this complexity group. *Essential complexity*, on the contrary, rises from the basic nature of the software. For example,

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[4] Lauren Hansen. 8 drives who blindly followed their GPS into disaster. The WEEK. http://theweek.com/articles/464674/8-drivers-who-blindly-followed-gps-into-disaster Accessed January 31th, 2017.

the changeability of software causes that everything can be changed almost any time in a software engineering project – even after the deployment of the product.

First in our categorization, there are issues *limiting* to achieving the full capability of either gamified solutions or their users. While these issues are important for the successful deployment and use of any gamified solution, they are, by following Brooks' (1987) taxonomy, accidents – issues that can be fixed with relatively reasonable amount of work. Second, there are *harmful* issues that clearly represent the negative side effect of gamification. These are, in Brooks' (1987) taxonomy, the essential aspects of gamification; prevalent issues that are visible in the horizon of the decade regardless of new techniques, taxonomies and methods developed.

The key argument of this study is that the gamification research field should do the same that software engineers did after Brooks' seminal paper: We should move our attention from tackling limiting problems to study and understand harmful issues. Even though removing the limiting issues is important for the acceptance and successfulness of any gamified solution, the open questions on applicability and on borders of gamification lies in the latter, more important category.

Naturally, there are certain limitations for this study that are noteworthy to discuss. First, instead of focusing on primary studies, we used secondary studies as the main study objects in this tertiary review. The decision was justified with the existence of several literature studies and with the observation that gamification research is widely applied in several disciplines from tourism studies to library sciences. Nevertheless, this study is limited by the quality and discussion presented in the selected secondary studies. Further work is needed to map primary studies in order to draw a richer picture of the field.

Second, while we strictly followed the guidelines for conducting SLRs, the search term, selected databases as well as inclusion and exclusion criteria are crucial for the generalization of a literature review's results. Whereas these were carefully chosen by following the existing literature surveys (e.g. Hamari et al., 2014), the decision made has likely still ruled out relevant venues and studies.

This study opens interesting avenues for future inquiries. We showed that there is a clear research gap on understanding what the limits of gamification are and proposed four topics for future work. The list is not complete and not all of the presented questions might be, in the end, relevant in the gamification context. However, this study aims to wake up the discussion about the limitations and harmful aspects of gamification for the gamification research community and beyond.

Finally, while the subtitle of this study humorously refers to Stanley Kubrick's classical movie, there is also a darker tone present in the topic. The history of video games has been full of strange prejudices and 'studies' (see e.g. Anderson, 2004, amongst others by him and his ilk). The aim of this study is not to encourage users to avoid gamified solutions; instead, we call the researchers to also address the darker side of gamification and to honestly investigate the negative impacts of gamifying everyday solutions.

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