A Review of Gamification for Health-Related Contexts

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Abstract. Gamification is an approach which seeks to positively impact diverse wellness and health-related contexts, not only because it can get people more engaged and make them more responsible for their health-related decisions, but also because it can enhance the performance of healthcare workers. It, therefore, affects both the costs of personal wellness and the healthcare. Gamification is an informal umbrella term for the use of video game elements in non-gaming systems that aim to improve user experience and user engagement. The current paper's focus is to introduce theoretical aspects of gamification and its potential impact on health-related contexts, as well as present the state-of-the-art on how gamification is being employed in such contexts. Examples from contexts such as exercise, nutrition, weight control, medication adherence, and hands' hygiene, among others, are included. Finally, the challenges inherent to the design of successful gamification strategies and approaches are discussed.

Keywords: gamification, health, motivation, behavior.

1 Introduction

Efforts to apply gamification to different contexts are, at the moment, being implemented. The focus of the current paper is to introduce theoretical aspects on gamification and its potential impact on wellness and diverse health-related contexts, as well as to present a state-of-the-art on how gamification is being employed in such contexts.

Gamification provides the means to increase an individual's (e.g., consumers, patients, healthcare workers) fun, engagement and compliance, while accomplishing wellness and/ or healthcare activities, with positive results on the healthy outcomes and costs of services [1].

The potential applications of gamification are considerable. Through the use of a game-like approach, game elements such as play, fun, challenges, rules, transparency and rewards, can be addressed to almost any real-world problem. For example,

Opower[1] reports a significant reduced consumption of electric energy which is associated to the use of gamified solutions. Content and media companies are using gamification to increase the engagement of their TV series' viewers; e.g., Psych[2,3] from NBC Universal, Inc. / USA Network. Through the Verizon Insider Community[4], Verizon Wireless is using gamification as a strategy to increase the time their clients spend on its website. Samsung created the Samsung Nation[5], a social loyalty program in which their customers earn badges and move up the ranks while exploring all Samsung has to offer. Game-like solutions have also been used in educational contexts for learning purposes [e.g., 2,3] and the formative assessment of students [e.g., 4].

The application of gamification in health-related contexts is also escalating. Many solutions are intended to promote wellness and consequently reduce the potential negative outcomes associated to unhealthier/risky behaviors. Similar trends are found for medical education and practice, which according to Bunchball[6], is the industry which is better-suited to gain from the benefits of such an approach. In a systematic review, Graafland, Schraagen and Schijven [5] identified a total of 25 articles that describe a sum of 30 serious games which are used to train medical professionals (e.g., surgical skills training) and group them for educational purposes, as well as commercial games for developing important skills which are relevant for medical professionals.

When compared to other approaches, gamification has some important advantages. For example, gamification can positively affect the participants' emotional experiences (e.g., promote curiosity, optimism and pride) [6,7], as well as can help them persist through negative emotional experiences and even transform them into positive ones [8]. The participants' sense of identity and their social positioning [8] can also be enhanced by gamification. Cognition can also be positively affected by providing complex systems of rules for players to explore through active experimentation and discovery [8]. Moreover, gamification is found to enhance communication, judgment and high-level social skills such as leadership and collaboration [9]. The time spent playing some type of entertainment games (which can be part of a gamification strategy) can also enhance psychomotor skills [10,11].

Building a gamification solution is a multidisciplinary effort which seeks to solve a set of problems pertaining to computer engineering, usability, interface design, marketing, among others. This wide range of fields poses challenging difficulties for design teams, which need to have a broad knowledge about each of these disciplines,

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[1] http://opower.com/utilities/results
[2] http://clubpsych.usanetwork.com/
[3] http://venturebeat.com/2011/01/21/
 usa-network-scores-with-gamification-on-psych-tv-show/
[4] https://insidersguide.vzw.com/
[5] http://www.samsung.com/us/samsungnation/
[6] http://www.bunchball.com/resources/
 gamification-cure-healthcare-industry

as well as to be able to adopt a User-Centered Design approach. A detailed discussion of the development of a gamification solution is beyond this paper's scope.

2   Theoretical Aspects on Gamification

The term 'Gameification' was first used in 2008 in a blog post by Bret [12], entitled "My Coverage of Lobby of the Social Gaming Summit", where he described the term as "taking game mechanics and applying them to other web properties to increase engagement". For Deterding, Dixon, Khaled and Nacke [13] gamification is the informal umbrella term which defines the use of video game elements in non-gaming systems in order to improve user experience and user engagement, i.e., gamification is about making use of the underlying principles of gaming and applying them to any non-game activity. According to Zichermann and Cunningham [14], gamification is "the process of game-thinking and game mechanics to engage users and solve problems, a definition that "unite(s) concepts such as serious games, advergaming, and games-for-change into a cohesive worldview that's informed by the latest research into behavioral psychology and the success of social games." Subsequently, gamification typically involves applying game design thinking to non-game applications in order to make them more fun and engaging. Several analysts have referred gamification as one of the most important trends in technology [e.g., 15]. By creating fun and engaging experiences, as well as by converting users into players it can potentially be applied to any industry and almost anything [16]. Recently, Chou [17], said: "Gamification is design that places the most emphasis on human motivation in the process. In essence, it is Human-Focused Design (as opposed to "function-focused design"). The author adds: "Gamification is the craft of deriving all the fun and addicting elements found in games and applying them to real-world or productive activities. Is the 'Human-Focused Design' as opposed to the 'Function-Focused Design'. It's a design process that optimizes for the human in the system, as opposed to pure efficiency of the system". Despite of its increased use, gamification, as a term, is not consensual. Alternative terms are also being used such as 'serious games' [18] and 'alternate reality games' [7]. For further details on the definition of gamification, readers are referred to Deterding, Dixon, Khaled and Nacke [13].

2.1   Elements of a Gamification Solution

There are many game mechanics and principles, which result in a myriad of different strategies that can be used to create gamified solutions. However, according to Palmer, Lunceford and Patton [19] main key-elements of gamification are:

   a. *Progress paths:* as part of a perception of play, objectives/tasks are usually concise in games. Also, clear rules (i.e., transparency) are fundamental. These are made obvious when progress paths are used to increase game completion. The degree of difficulty or complexity of the objectives can increase over time, i.e., easier for novice players and more challenging for advanced users, so that all of them remain engaged (e.g., state of flow).

b. *Feedback and reward:* adding feedback and rapid rewards (e.g., points, badges, statuses), at the right time, are used as indicators of success and are an important feature for motivation.

c. *Social connection:* accompanied by Internet, social networks and mobile applications of all sorts, gamified solutions boost group dynamics. In turn, this not only favors a positive interaction and communication between users, friends or not, as well as creates completion while providing support. Like this, participants tend to feel more satisfied and engaged with the gamification solution.

d. *Interface and user experience:* users are becoming more demanding in what regards their expectations for technology services and this embraces aesthetics, cross-platform integration/mobility, usability and fun. Recent technological developments, including the use of "smart" mobile devices, with connection to the Internet, ubiquitous computing, virtual environments, augmented reality and the use of sensors, linked to databases, promote the adoption of high quality gamified strategies.

These elements are also applicable for health-related gamification solutions. For example, Lehihan [1], suggests that higher levels of wellness will be achieved when using gamification together with strategies such as socialization, rewards/incentives, mobility and computation. According to this author, in order to maximize engagement in wellness solutions for participants, socialization is fundamental, since having the chance to connect with the caregivers/providers, family and friends will have a positive effect on their well-being. A myriad of rewards and incentives, from discounts, insurance premium reductions, to special offers are possible, and they can motivate, as well as increase the citizens' adherence to healthy behaviors, compliance to medications and/or timely vaccinations for the good of the public. Mobility is a crucial strategy since it enables a user to participate in his or her activities everywhere and anywhere, in real-time. When complemented with apps for baseline and real-time physical parameter monitoring and telemetry, these solutions have the ability to provide evidence of compliance, progress and results. Related with mobility, computation (i.e., data analytics and reporting) is an essential requirement for the wellness program's administration and management.

2.2   From Games to Gamification and Ahead

Game history tells us that the first electronic games were created in the early 1950s, in two distinct segments which were developed in parallel: at military bases, as well as by overworked students, programmers, faculty, and researchers in academic and government institutions [20]. According to this author, the term "video game" left the arcade business and was transported/transferred to the home console game business. However, such a term did not become mainstream until the 1970s and 1980s. The computer game industry was born when the appearance of Arcade video games, gaming consoles and the commercialization of personal computers became a popular form of entertainment.

Since then, an extraordinary development in the design of computer games has occurred and integrated new technologies such as hyper realistic 3D modulations, HD visuals, motion sensing and tracking, virtual and augmented reality, among others. Currently, an increasing release of games by social networks has taken place (e.g., simulation, adventure games, puzzles, and more).

Before the term gamification had emerged, gaming principles have been used for years. Examples are the frequent flyer programs which offer miles, as well as other loyalty programs which reward their customers with benefits. Even progression in school and work contexts can be seen as a gamified process, if we consider them as a sequence of challenges and levels to be surpassed, with a reward at the end (e.g., a diploma, a job promotion, a financial bonus).

Meanwhile, in many economical, educational, enterprise, governmental, health and social contexts, the use of gamification is becoming more and more popular, and many technology companies, as well as communities, which aim to help researchers, entrepreneurs, health workers, teachers, among others, have started to develop strategies for gamification. One example is the platform Badgeville[7], founded in 2010, recognized as a global leader in gamification technology. These leaders believe that gamification is much more than points, badges and leaderboards. It helps real business leaders achieve benefits.

According to Anderson and Rainie [21] "Tech stakeholders and analysts generally believe that the use of game mechanics, feedback loops and rewards will become more embedded in daily life by 2020, but they are divided about how widely the trend will extend. Some say the transition to implement more game elements in networked communications will be mostly positive and will aid education, health, business, and training. However, some authors warn us that such elements can take the form of invisible and insidious behavioral manipulation". For Burke [22] gamification is a tool used to design behaviors, develop skills and enable innovation. Combined with other technologies and trends, gamification can cause major discontinuities in innovation, employee performance management, education, personal development and customer engagement.

To Kapp [23], gamification seems to be exploding; in the near future, it is expected that more software will become available for game design, gamification and simulations, thereby incrementing the challenges as a way of learning. Gartner, Inc. (NYSE: IT) [8], believe that: "Over 70% of global 2000 organizations will be gamified by 2014" [15].

3   Potential Impact of Gamification on Health-Related Contexts

Gamification strategies are becoming frequent in health-related contexts, with efforts focused on personal wellness and healthcare. For the first case, diverse technology-based solutions were created which intended to help individuals in adopting healthy life habits (e.g., weight control, eating habits, exercise, smoking, hand hygiene).

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[7] http://www.badgeville.com/
[8] http://www.gartner.com/

There are a lot of strategies to promote healthcare, ranging from smartphone apps, to video games published by sites[9], and reality shows (e.g., The Biggest Loser Weight Loss Program), all which aim to help people either lose weight, change eating habits, understand the real importance of exercise to obtain a healthy life, or to promote hand hygiene.

Like this, through gaming principles, gamification has the ability to transform the obstacles that may lead to behavioral changes, such as failure, into engaging, positively reinforcing and perhaps even fun experiences that encourage users to make sound decisions and activate the desired behavior for the benefit of their health and wellness. For the second case, gamification has been used for many processes, for example, from diagnostics to treatment, from administration to side effects, from adherence obstacles to long-term care, and from education to training. The practice of medicine often involves tedious, repetitive, boring, and/or painful routines for both the practitioner and patient. Thus, with gamification, health workers can engage and collaborate more effectively, as well as administrative professionals can increase performance and customer service levels, all resulting in a positive influence across the activity. Further along in this paper, some examples are provided.

Paredes, Tewari and Canny [24], presented a list of principles that could be used to conceptualize games, which derived from lessons learned after teaching two design-centered courses around Gaming and Narrative Technologies for Health Behavior Change. It is composed of two broad goals: 1) designing effective technologies, with an emphasis on short-term behavior change, and 2) using metaphors, dramatic arcs and game dynamics as vehicles for increased engagement and long-term sustained change. Some example prototypes resulting from this design approach includes: "Monsters"[10], "Scheherazade's World"[11] and "Superbetter"[12]. Redbird's Guide[13] offers a compact analysis of current digital health promotion strategies and tactics. It analyses several provincial and national campaigns, showing that health promotion organizations have fallen behind in their understanding of how to attract large numbers of visitors to their campaigns [25].

Independently from the context in which they are intended, gamified solutions must take into consideration the specificities of the intended users. As McGonigal [7] suggests, games can involve hard work (e.g., high-stakes work – it is fast and action oriented; busy work – some games tend to become predictable and monotonous; mental work – it can be rapid-fire and condensed, challenging or to drawn-out complex; physical work – increases energy expenditure, as well as heart and respiratory frequency) and, some of them, require teamwork. Since a pleasurable, informed and voluntary participation (with freedom to leave) is required for everyone engaged in the game-like activities, two groups deserve a brief call of attention at this respect: children and older people.

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[9] http://www.livestrong.com/weight-loss-get-started/)
[10] http://2013.globalgamejam.org/2013/monster-healthcare
[11] http://strategywiki.org/wiki/The_Magic_of_Scheherazade
[12] https://www.superbetter.com/
[13] http://www.redbirdonline.com/

It is well known that children always have a special propensity for games and show great mental capabilities and great skills to play. This characteristic seems to not have changed with the use of video games, as well as the so-called new technologies. Once trained and motivated, children learn quickly. That is why, not surprisingly, they are the target that normally reaches the highest scores and are the largest, as well as the most enthusiastic fans of game-like activities [10]. A game's challenge-achievement-reward loop promotes the production of dopamine in the brain, which reinforces an individual's desire to play [14].

Regarding older people, such users have ambivalent attitudes towards technology. Typically they tend to be more unwilling of technological innovations, which can be due to limited experience with technology [26]. Therefore, their motivation becomes more difficult. For further reading on older people and games/ technology the reader is referred to Gamberini et al. [27]. Nevertheless, games and game-like solutions have been used as a tool to introduce older people to digital technology [28].

4   A State-of-Art on How Gamification Is Being Employed for Healthcare-Related Purposes

As the healthcare-related contexts are so vast, presenting an exhaustive list of application examples is impossible. Therefore, some examples of applications of games and/or gamification solutions were selected for further analysis, from the following areas:

(a) Physical activity
- Zamzee[14]: This is a game for children and teenagers, which uses a tri-axis accelerometer that measures the intensity and duration of the physical activity, and clips to their clothes, or fits in their pockets. It has a monitored computer, mobile application and a motivational website. It tracks physical activity, gives rewards for moving, allows progression, and poses challenges.
- Nike plus[15]: Is a multi-platform system for young adults and adults, that consists in: a running app for mobile phones, a sport watch and a fuel band bracelet which integrates a GPS and a Calorie/Time Elapsed/ Pace/ Distance/ Records Counter, providing feedback as the user runs and moves.
- Kinect Training for Xbox: This is a personalized Nike training at home. Kinect for Xbox 360 tracks every move the user carries out, therefore the user benefits from real-time coaching. It can connect with friends across Nike+ and Xbox communities around the world, training users together and driving/motivating each other to reach goals.

(b) Diet and weight loss
- Slimkicker[16]: A smart-phone and computer application that turns diet and fitness goals into a level-up game. A user is able to acquire more points as

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[14] Zamzee – https://www.zamzee.com/
[15] Nike plus – http://nikeplus.nike.com/plus/
[16] slimkicker – http://www.slimkicker.com/

he/she tracks healthy calories, more exercises, and completes challenges as milestones are reached.

(c) Personal hygiene

- Brain Pop Junior[17]: This is an online website for children which consists of activities, games and information, in a health and safety related area. It also contains a hands hygiene sub section, also with games and information.
- The Hand Washing Challenge[18]: An online flash built game for children in the hand hygiene theme. It contains videos with advices and information.
- Carex[19]: A website which promotes a brand of products for hand hygiene and contains an area for children and teachers, with information and games about this matter.
- BBC's Bobinogs[20]: A BBC's educational website for children, with games and activities on various themes, namely for health related subjects, such as hand hygiene.
- Edugames4all[21]: A website mainly for children, with games on personal hygiene and hand hygiene.
- Ella's Hand Washing Adventure[22]: Is a game created by Therefore Tork, a brand of SCA, which launches a tablet app intended to teach and encourage children to wash their hands.

(d) Hand hygiene for Healthcare workers

- Handwashingforlife[23]: A website with information and games for healthcare workers, mainly on hand hygiene.
- Wi-five game[24]: A National Patient Safety Agency website game, based on the World Health Organization program "Your 5 Moments for Hand Hygiene".
- HHCApp The Hand Hygiene Compliance Application[25]: Which has been developed for use by Australian hospitals to report their hand hygiene compliance rates as part of the National Hand Hygiene Initiative. HHCApp Mobile can be accessed via an Internet browser and/or by a mobile device.

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[17] Brain Pop Junior - `http://www.brainpopjr.com/health/bewell/washinghands/sequenceorder/`

[18] The hand Washing Challenge - `http://www.learnalberta.ca/content/hehh1/`

[19] Carex - `http://www.carex.co.uk/kids-zone,`

[20] BBC's Bobinogs - `http://www.bbc.co.uk/wales/bobinogs/games/gamespage.shtml`

[21] Edugames4all - `http://www.edugames4all.org/`

[22] `http://www.hellothere.se/blog/ellas-hand-washing-adventure-out-now/,` 2013

[23] handwashigforlife - `http://handwashingforlifehealthcare.com/resource-center/interactive-library/doctor-knows`

[24] wi-five game - `http://www.npsa.nhs.uk/cleanyourhands/resource- area/wi-five-game/`

[25] `http://www.hha.org.au/HHComplianceSystem.aspx`

- Hand Hygiene Awareness Programs[26]: Which presents interactive screensaver messages, sent to the health workers' workstations, aiming to promote hand hygiene awareness.

(e) Gamification for work enviroments

- Keas[27]: Keas platform is a social application that helps employees develop healthy habits. Their main objective is to increased job satisfaction and a more productive workforce. The game engages employees in wellness by being fun, mobile and social. They rely on key benefits such as: Higher engagement; Lower absenteeism; Increased productivity; Greater job satisfaction; More team spirit.

(f) Medication / medical treatment

- Empower[28]: Is an Ayogo platform for computer and mobile devices that helps patients, who are newly diagnosed with a chronic condition, to take control of their treatment. It helps patients create healthy new habits, specific to their condition. In addition, it targets patient specific vectors of health through a curriculum of activities, as well as self-reporting and social interactions.

(g) Health behavior changes

- GoodLife platform[29]: Allows Ayogo to rapidly build applications that use social patterning and the power of play to motivate people to make meaningful behavior changes in their lives, facilitating social connectivity between the patients that use them. GoodLife can be tailored to suit the patients' needs. Mobile, Web or Tablet, GoodLife applications can be delivered to all of the leading mobile and desktop devices.

5   Conclusion

It is noted that, in general the impact of gamification, applied to various contexts, has achieved significant results. With regard to healthcare, its growth has been impressive through campaigns and projects associated with various types of technologies and platforms. The examples reported here suggest that gamification can be successfully used in promoting healthcare and healthy habits (especially in eating habits and physical exercise).

From our point of view, in order to create good gamification solutions, the approaches, used to monitor the fulfillment of all gamification key points, require appropriate design contents, adjusted for the development of software which is generated by new technological solutions. Also, in order to be successful, gamification designers must acquire at all times, the users' feedback regarding how they think, how they behave and how they act, and then incorporate that knowledge when developing the software.

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[26] http://www.snapcomms.com/solutions/hand-hygiene-awareness.aspx
[27] Keas - https://keas.com/why-keas/
[28] Empower - http://ayogo.com/empower.html
[29] GoodLife platform - http://ayogo.com/goodlife.html

The implementation of gamification solutions is not a simple process, particularly in healthcare contexts. Some concerns regarding gamification use come from a variety of disciplines. For example, managers which are unfamiliar with the modern behavioral techniques embedded within these existing technological systems and processes tend to fear that a distracted workforce, doing nothing more than playing games, can be a problem. There is also a belief that gamification is only intended for gamers: this is mostly an issue of awareness and education. It's about understanding in which way design teams can elicit feedback, pose challenges, drive experiences that increase engagement and deliver improved business results. Another concern is related to a reward-driven behavior, in which users may work to achieve a reward solely for the sake of getting that reward. Although this approach may work for a short period of time, it is generally not sustainable. Cheating can also be a problem. Efforts which apply a gamification strategy are susceptible to cheating. Without a clear set of guiding rules and dynamics, cheating and dissatisfaction may increase. Also, game mechanics can be used with the purpose of hiding a flawed product and/or process, but eventually it will not fix something that's already broken. Furthermore, there is the problem of relying in only one game element. Gamification is a design process that includes several considerations, mechanics and theories. Relying on a single element may not contribute to an effective solution and application. Finally, there is the chance of creating systems which contribute to dependency and/or fatigue: as the use/application of gamification increases, there is both the risk of users demanding it in all interactions, as well as the users using it whenever they get bored.

In what concerns healthcare professionals, they might pose many barriers in the implementation of gamification. Such a solution can expose the professionals' performance and may impact their reputation and/or lower their credibility status among patients. In this context, some adjustments to gamification have to be made for this sector, in particular in what regards ethics, confidentiality, privacy and security of the gathered information. The successful implementation of gamification, in this context, will only be effective with campaigns and very large investments, which financial entities do not want to support. Before thinking of implementing gamification, an effort in raising awareness, among such entities, about the cost-benefit relationship that these campaigns can have, must be implemented. Healthy and happy human resources are more productive, but managers tend to fear that gamified solutions may be a source of distraction for employees. Such fears must be demystified.

Our vision of the future application of gamification, in the field of healthcare, includes the use of proximity sensors, georeferencing, augmented reality and artificial intelligence in order to promote and motivate healthcare professionals. Particularly in situations where there is risk of contamination, it can be useful to promote hand hygiene compliance. Furthermore, diagnostic and treatment processes can greatly benefit from gamification. In the future, most citizens and patients will be in constant communication, through sensors and communication devices, with health institutions that may, in turn, be involved in permanent gamification. Healthcare, in this context, will be a game which will contribute to the development of professionals and people who are prepared/open to challenges.

In conclusion, the implementation of gamification in the healthcare sector is not an easy task, it requires large/elevated investments and a change of attitude among professionals.

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