Generic and Adaptive Gamification

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Abstract. Gamification is a method in which game elements are applied within a non-game environment to deliver tasks in an appealing fashion. If appropriately designed, it is believed that gamification enhances user experience. Motivational psychology suggests that intrinsic motivation in a task (i.e. being motivated by internal factors; for example, if one believes performing the task is intrinsically a good thing) more effectively increases engagement and player performance than extrinsic motivations (motivation due to external factors like badges, fame and points). Intrinsic motivation leverages the player's *mental state*, aiming at amplifying their degree of enjoyment and immersion in an activity; while extrinsic motivation is guided by the desire to gain an external reward. This paper introduces the concept of Adaptive Gamification, that is, gamification achieved by leveraging the user's *motivation*. Adaptive Gamification personalises the experience based on the player's gameplay and preferences, which in turn is connected with the player's personality. A framework for Adaptive Gamification is presented and the state of the art in this area is reviewed.

1 INTRODUCTION

Games as a concept can be seen as free activity that provides entertainment while intensely absorbing the player in an experience, and in this regard digital technology evolution has played an essential role in the growth of users' engagement and enjoyment [1]. Nevertheless, not all games have the sole purpose of entertainment at heart, as in the case of serious games, where it has been used for simulations and education [2]. However, serious games are complex to develop and have a high production cost. Gamification [3] provides a way to extract game characteristics and incorporate them into other environments to improve them [1], while retaining such positive characteristics of games and serious games as high engagement and learning.

In this paper, we introduce the concept of gamification and deliberate its differences and similarities with serious games, together with the relevant gamification typologies. We consider intrinsic and extrinsic motivations, and introduce the concept of *Adaptive Gamification*. Finally, we review the gamification frameworks present in the literature, and show a clear lack of Adaptive Gamification frameworks and present one possible conceptualization. We conclude that this is a gap in the literature that warrants further research.

2 SERIOUS GAMES AND GAMIFICATION

Serious games are purpose-built games with other purposes alongside entertainment [3]. The main challenge of video games, however, is to develop a solution with the ability to engage and maintain the user's attention [4]. Designing and developing a game is a complex task combining science and art. The design team starting from an inspirational idea generates the storyline/plot or an environment that sets the game genre; adds the entertainment and aesthetic features and decides the gameplay, interface look and supporting hardware. Finally, the code is implemented by the programmers. The developers are responsible for creating all the game features that involve programming, such as the artificial intelligence and user interface [5]. Besides the art and science of video games, serious games activities include educational aspects, requiring an educator to join the creative team. These aspects ensure that the player acquires certain knowledge or skills [6]. Serious games are most often topic-specific, which makes transferring the work done for one subject to a broad range of disciplines rather difficult, if not impossible. Several attempts have been made to generalise the approach [7][8] and diminish serious games' design complexity, due to the high costs and development times involved [9]; and prove their effectiveness [10][11].

Gamification is becoming an increasingly popular choice to achieve the same level of engagement and effectiveness as games, and often the educational aspect of serious games, but using a more flexible and reusable approach. The incorporation of game-driven structures and incentives into a non-game context also falls under the concept of Gamification. Serious games and gamified activities can serve the same purpose, which is engaging learning, but gamification can be applied to any kind of activities to raise the user's engagement level, not only learning. However, if applied to learning often the two approaches can produce a similar result, making the boundary between a serious game and a gamified activity blurry. The main difference between the two approaches is perhaps more easily seen from the developer's prospective, where the task of devising a serious game is unlike developing a gamified application. Serious games follow the same development methodology as games, and require similar developmental effort [3], whereas gamified products follow a different methodology and often only include game elements of relevance.

3 MOTIVATIONS AND ADAPTIVE GAMIFICATION

Motivational psychology, as in the Self-Determination Theory [12], proposes that the effectiveness of intrinsic motivation is greater than that of extrinsic motivation in increasing users' engagement and performance.

Peoples' extrinsic motivation arises from external factors, conversely to intrinsic motivation, which instead is governed by inner emotions. Extrinsic motivation drives people to do things for noticeable rewards or pressures, whilst intrinsic motivation spurs them to undertake tasks for their enjoyment, or because they believe it is good to do so or the right choice.

In our context, we consider game mechanics and immersive dynamics including points, levels, badges, leader boards or trophies, as used in the current gamification trends [13], to be elements that trigger extrinsic motivation. We suggest instead that gamified activities should focus more on users' intrinsic motivation, and theorise that such gamification could have a stronger effect. For example achieving self-determination, heutagogy [14] and 'flow' (widely considered an attribute of a

successful game design) [15] is gamification that leverages intrinsic motivations.

We believe that considering the player's personality and preferences we can gamify an activity also by appealing to the user's inner motivation. We argue that when this is achieved, the player experiences high levels of enjoyment and immersion that lasts beyond the rewards or pressure of the task; thereby obtaining long-term learning, or a shift in behaviour towards the desired activity, even when the gamification stimulus ceases.

We believe this sort of gamification, *Adaptive Gamification*, could be proven more effective than gamification based on extrinsic factors alone, which we call *Generic Gamification*.

4 GAMIFICATION FRAMEWORKS REVIEW

The concept of gamification brings together several disciplines including designers, psychologists, sociologists, computer engineers and others. However, most of the current frameworks are either too generic and do not include details on how to build things in practice, or include a wide range of gamification elements that do not necessarily suit all players. This section will review the available frameworks according to their background and approach.

Hunicke [16] introduced the game design framework Mechanics/Dynamics/Aesthetics (MDA) that describes three pillars of a good game. Players should be equipped with *mechanics*, which are the functioning components, such as actions, behaviours and control mechanisms, used by the player to interact within the game. *Dynamics* describes the run-time behaviour of inputs and outputs between player and game; they are the player's interactions with the mechanics. Finally, *aesthetics* are the desirable emotional responses evoked by the game dynamics. These features determine how the game makes the player feel [17].

Di Tomasso and Taylor [18] used Ryan and Deci's self-determined theory (SDT) [12] to design a framework for success based on user differences and social influences. The guidelines include finding a reason to gamify, and also highlight the need to define clearly the players' profiles and motivational drivers. These then dictate the aims and objectives of the game. Furthermore, the users' skills should be identified, tracked and evaluated, alongside their interests and wanted outcome. This would then be tested and polished.

The Six Steps to Gamification, also known as 6D by Wrebach [19], is one of the best know design frameworks. It starts by defining the business goals and then moves to the anticipated behaviour, describing the users, deducing the activity loops by putting fun in perspective and eventually deploying the gamified system with the appropriate tools. This framework implicitly reflects Hunicke's famous MDA design framework [16]. The influences are illustrated in the Pyramid of Gamification Elements that delineates elements of Mechanics, Dynamics and Components as the foundation for other gamification frameworks.

However, Marczewski [20] has proposed a simpler framework called GAME, which is subdivided in two parts. Planning and designing comprise the first stage, which uses surveys in the gamification context to gather key information like user types. The second stage includes designing goals and engagement to measure user behaviour and outcomes. Marczewski also designed and applied a motivation framework called RAMP (Relatedness, Autonomy, Mastery, Purpose). Updates of this framework have been followed up; for example, Marache-Francisco and Brangier [21] defined gamification design based on the principles of HCI (Human-Computer Interaction).

Robinson and Bellotti [22] proposed a framework based on a taxonomy they created. They state that diverse frameworks from literature can help in gamification design but not entirely comply with all the requirements. Inspired by the literature, they presented six categories of gamification elements: *general frames*, *general rules and performance frames*, *social features*, *incentives, resources and constraints*, and *status information and feedback*.

In 2013, Versteeg [23] proposed a simple framework focused mainly on the ethical perspective for morally persuasive gamification. It includes the approach for assessing the ethics of persuasive technologies. This involves the identification of moral principles, the partaking of the stakeholder, and the evaluation of the developed application.

More recently, Al Marshedi et al. proposed in 2015 "A Framework for Sustainable Gamification Impact" [24]. The framework aims at achieving an increase in the sustainability of the gamified activity's impact. The proposed framework is a User-Centred Design and based mainly on three other theories: Csikszentmihalyi's Flow Dimension Theory [15], Pink's drive motivation elements and SDT.

5 PLAYER TYPOLOGIES

Various behaviours exhibited during game-play have led researchers to categorise players into "player types". However, most of the models and the patterns presented in the literature share the same features, although some models are more detailed than others are. These models and patterns are reviewed in the sections below.

Caillois [25] introduced one of the oldest typologies for playing. He described four different playful behaviours that can be seen as playing styles: *Agon* ("contest" in Greek) describes challenge games, those which involve a direct conflict or competition. *Alea* ("dice" in Latin)" describes games that involve chance and randomness. *Mimicry* is used to describe role-playing. And *Ilinx*: ("whirlpool", "vertigo" in Greek) is used for games with visceral impact.

Multi-User Dungeons (MUD) is one of the first real-time virtual world environments that is entirely text-based. The game brokered a debate between 1989 and 1990 upon Bartle's question on online forums regarding what people want out of MUD. Bartle found from the responses to his enquiry that people fell in one of the four categories [26]: *Achievers*: people who play to get the sense of winning and achievements through completing goals and missions in the game. *Socialisers*: people who find their reward through interacting with others in the game. *Explorers*: people who find great pleasure in exploring their surroundings, discovering new places and gaining new knowledge. *Killers*: people who enjoy dominating others by means of violence or hindering.

Based on Bratle's test, Yee [27] analysed why MMORPGs are appealing. Ten component grouped in to three groups emerged from a 40-question factor-analysis questionnaire described as follows.

Achievement Components:
- Advancement: the will to get more powerful, advance quickly, and gather indicators of wealth or status.
- Mechanics: being interested in understanding the underlying system to improve the player's performance.
- Competition: the will to challenge other players.

Social Components:
- Socialising: being interested in helping and chatting with other players.
- Relationship: the will to form a meaningful long-term relationship with other players.
- Teamwork: Gaining satisfaction by taking part in a group achievement.

Immersion Components:
- Discovery: Explore and find clues that other players are not aware of.
- Role-playing: Creating a story with an interacting character.
- Customisation: the ability to customise the player's in-game character.
- Escapism: the use of virtual world to escape real life difficulties.

Fullerton [28] categorises different player types based on the agendas, need, pleasures of the players when entering the virtual world. These types are: *The Competitor*: plays for winning. *The Explorer*: plays to explore the surrounding world and discover adventures. *The Collector*: plays to gain items, trophies, or knowledge. *The Achiever*: plays for excelling and acquiring levels of achievement. *The Joker*: plays for the fun of playing and is not serious. Jokes may annoy serious players, but can provide a social aspect to the game. *The Artist*: motivated by creation and design. *The Director*: plays to be in control of the play. *The Storyteller*: plays to create or live in virtual worlds. *The Performer*: loves to show off in front of others. *The Craftsman*: Plays to build, craft, engineer, or create puzzles.

Nacke proposed the BrainHex model [29] which is derived from the previous models and based on data collected though an online website. The model describes seven types: *Seeker*: is curious about the game environment and enjoys its wonders. *Survivor*: is someone who enjoys the intensity of the fictional activities such as horror movies and games and its associated experience. *Daredevil*: enjoys the excitement of playing on the edge and taking risks. *Mastermind*: enjoys riddles, strategizing, and making effective decisions. *Conqueror*: enjoy challenging and defeating extremely difficult opponents, struggling until they achieve their goal, by channelling their anger towards achieving victory. *Socialiser*: like talking and helping others, the socialiser trust and get angry with those who betray that trust. *Achiever*: is goal-oriented and thrives on long-term tasks. Achievers favour games amenable to ultimate completion.

6 ADAPTIVE GAMIFICATION FRAMEWORK

Monterrat et al. [30] proposed an adaptive web-based system called "project Voltaire" that was designed to teach and help in memorising French grammar rules. Their system is based on the BrainHex gamer typology by Nacke et al. [29] that classifies players into seven types. Game features are mapped to the classified player's type and then presented. The results showed 39% increase in the time spent on the learning system, which suggests that exploiting a player's type might be a way to achieve gamification with an improved effect, as described in section 3 of this article.

Several studies like [31][30][13][17][32] among others, suggest the use of *badges, points and leader-boards* as main gamification features. However, Deterding [33] criticised choosing only these features and neglecting other game features. To these gamification features, we also add *time and resources pressure*, *social elements* in a game and the game *aesthetic*. *Flow* is one of the most important outcomes of the gamification process, and can be described as having the player floating in a balanced between boredom and anxiety, where s/he is sufficiently challenged not to be in ether of the two states.

We propose a framework, *Adaptive Gamification*, as a vehicle to achieve gamification by personalization of gamification elements, thereby leveraging more of the player's inner motivation. The Adaptive Gamification framework, in figure 1, includes different layers that need to be applied together and recursively, rather than being a static process. Starting from establishing the player's unique characteristics (e.g. age, gender and player type) an initial conceptualization of the type of gamification elements the player might prefer is made (e.g. rewards, social elements, time pressure), also the game aesthetics will be tailored to the type of player and the game genre chosen.
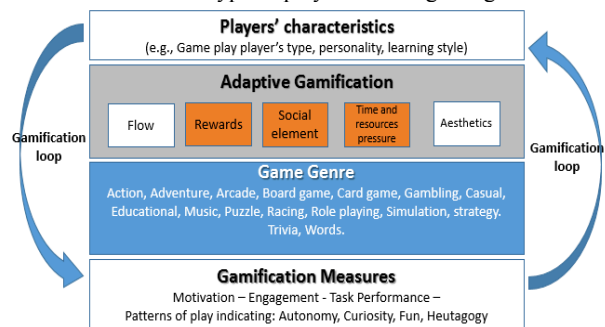

Figure 1 − Adaptive Gamification Framework

This initial gamification considers the game elements that match the player type and presents them in a personalised manner matching the player's preferences. The player's behaviour (actions and reactions) further informs the system on how well the events and features of the game are able to keep the player in a state of *flow*. Observing the user's game play it is possible to further characterise the players' preferences and triggers, developing the gamification features as a function of those characteristics and the game genre under consideration, for example by adding and events, features and triggers.

The gamification effectiveness can be measured by looking at evidence such as the player's mood, motivation, engagement, enjoyment and task performance. Furthermore, the pattern of play that can be measured to extract the learner's autonomy, curiosity, heutagogy or fun. These in turn will further characterise the learner and provide further opportunity for tailored gamification. For example, if the gamified system can infer that the player is currently bored, it might generate a trigger (tailors to the player's type) that would call the player's attention, reformulate a goal for the characters in the game to

achieve or the overall goal of the game might be changing and shifting and improving as game elements are added. In this manner it possible to connect what motivates the players (as evident in the players' characteristics), with the gamification features and the gamified environment features (e.g. fantasy world or not, more or less immersive, etc.).

7 CONCLUSIONS & FUTURE WORK

In this article we discussed gamification and how it can be used as an effective tool for motivating users. Nonetheless, little is known about gamification based in stimulating intrinsic motivation in players. The integration of game elements currently adopted in most gamified systems does not take into account user's motivation and preferences, despite the fact that individualised teaching is much more efficient than generic teaching in generic settings like classrooms [34]. In contrast, we have introduced the concept of Adaptive Gamification, which is gamification that considers the player's characteristics in applying the gamification process to eliciting intrinsic motivations. We advocate the need for an Adaptive Gamification Framework for developing effective gamified applications, and have presented a conceptualization. We are working towards realising a system able to provide Adaptive Gamification. Such engine relies heavily on artificial intelligent components (not described in this paper) to understand and deliver the personalised features. Adaptive gamification is still in its infancy and the formulation of frameworks for adaptive gamification requires further research.

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