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GAMIFYING EDUCATION: A PROPOSED TAXONOMY OF SATISFACTION METRICS

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***Abstract**: This paper considers several popular modalities of electronic games, serious and otherwise, and outlines the reasons why some are successful and some are not at the task of retaining the attention of their core audience. In order to accomplish this task, a taxonomy of satisfaction metrics for end-users is proposed based on modern trends in electronic entertainment. A new approach is needed in order to account for dramatic changes in the electronic gaming landscape wrought by the explosion of mobile gaming on one hand and social gaming on the other. Two main modifications to the taxonomy incorporate social obligations as a motivating factor separate from a desire to socialize in and of itself and consider the importance of feedback both in light of Fogg's work (Persuasive Technologies, 2010) and Shneiderman's well known eight rules of interface design and related work. This taxonomy is then correlated to previous advances in this field of study, such as Fogg's Behavioral Model and Bartle's quartet of gamer archetypes. The taxonomy, thus improved, is demonstrated by using it to examine exemplars of the various categories of game now popular or being created. The analyses conducted lead to ways in which the current approach to serious game design methodology can be modified and possibly improved. This paper then examines specifically how this new methodology may be best employed in the field of e-learning. Of special interest is gamifying presence and distance learning supported by traditional e-learning materials and doing so both effectively and with few resources. Finally, the paper presents a discussion on the means and methods which may be used to verify the new taxonomy and its applicability to the field of gamification.*

***Keywords:** gamification, education, e-learning, behavioural model*

I. INTRODUCTION

Trends clearly show that gamification is a very popular subject that is thought to have great significance with regards to the field of serious games and electronic education. Part of this is the unavoidable cycle of hype as codified by the Gartner Hype Cycle[1, 2] (Figure 1). This cycle charts rising technological concepts, paying attention to their viability and their presence on the mediascape. As can be seen the concept of gamification is still on the rise, though it is not far from the peak of hype and the period of disappointment which invariably seems to follow. However, gamification is popular for reasons that have nothing to do with current trends. Simply put, as the size of the gaming industry testifies, games are popular and have excellent market penetration and unrivalled customer devotion. This is excellent incentive to use gamification and reason to expect it to always work. This paper examines why gamfication can fail, and how this failure can be avoided.

The obvious first question is what's gamification. The term was first mentioned on the DICE summit in 2010[3], but the core concept is older than that. Gamification, simply put, is the application of concepts derived from electronic games to serious tasks. The idea is that the serious task would

benefit from the same mechanisms games use to engender such devotion and to retain user attention. This can be seen as an expansion of the, much older, concept of edutainment[4]. Specifically, insofar as edutainment *software* can be viewed as a naive attempt to gamify education.

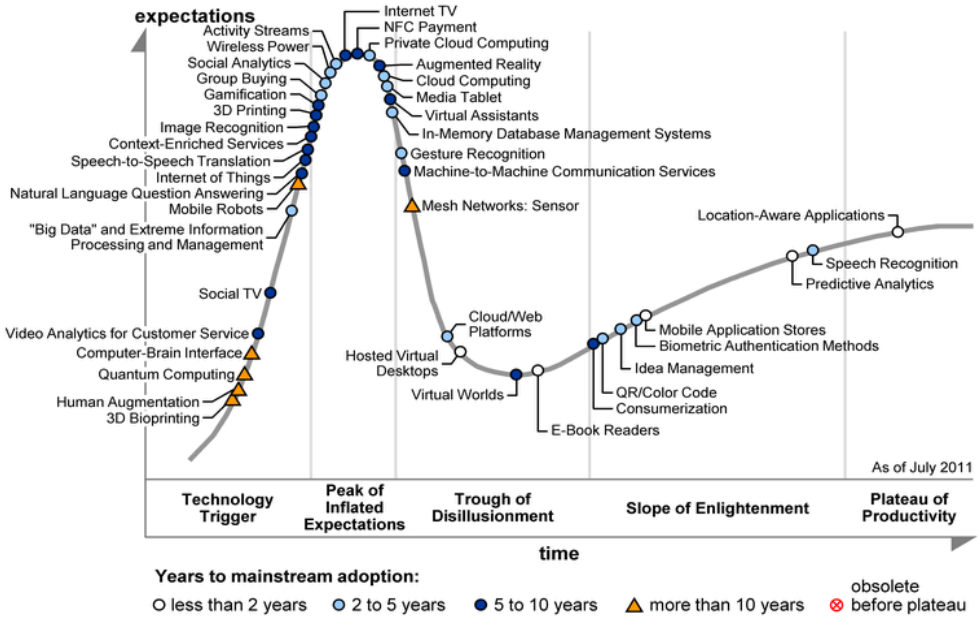

Figure 1. The Gartner Hype Cycle for 2011

Despite the fact that it is a young concept gamification has been the subject of a large amount of research and application. Currently the leading use is commercial, mostly focusing on marketing[5] especially in promoting and rewarding customer loyalty. There are also those who promote gamification as almost a panacea that will change the way the world operates[6]. Others still, view gamification as another layer through which we will perceive the world, something how the revolution in social networking brought forth the social layer[7]. Less dramatically gamification is used for personal improvement via fitness[8, 9] or to promote positive habits, like ecological awareness[10].

The gamification of education has been studied before, for instance in [1]. Edutainment software[4], of course, can also be viewed as a crude form of gamification, or perhaps the intersection between the concept of serious games and gamification. It is too early for comprehensive results for modern education gamification, education being harder to create a metric for than marketing, but the effect of edutainment is known. The field has had some successes, such as the Oregon Trail series, but these have been more than balanced by a surfeit of failures. This has lead some people to criticize edutainment. Some criticise it for engendering unrealistic expectations towards learning[11], while others claim it detracts attention from the concept of "playful learning"[12] and instead treats learning as a bitter peel in need of sugar-coating.

This paper is divided into three chapters. The first chapter is the introduction which outlines the goals of the paper, previous work in the general area and the organization of the paper. Chapter 2 outlines the core idea of the paper – the new taxonomy, its connection with the work of Bartle and Fogg and its application to already existing examples of various forms of game. Chapter three is the conclusion and details the strategies for education gamification that flow from the newly described taxonomy as well as further avenues of research.

II. THE PROPOSED TAXONOMY AND APPLICATIONS

This chapter details the new taxonomy and its connection to the work of Fogg[13,14], Bartle[15] and certain concepts from the work of Czikszentmihalyi[16]. The concept of feedback here is compared and contrasted with the work of Schneiderman[17]. It than takes this taxonomy and uses

it to analyze exemplars of popular games that are known for user engagement. The games observed are the archetypical AAA title, the indie addictive casual title and the social game. The examples chosen are World of Warcraft by Blizzard Entertainment, Angry Birds by Rovio Mobile and FarmVille by Zynga. The easiest way to sum up the new taxonomy is through the list of the six main satisfaction metrics: Feedback, Social, Competition, Progression, Mechanics and Context, ordered from the easiest to incorporate into a gamified system to the hadest.

Feedback refers to the information about the user's work that is returned from the gamified system to the user. It's not only that this is good practice in UI design in general[17], it is also an important metric for user satisfaction and engagement in a gamified system. The simples case to observe would be feedback which measures, say, the time it takes for the user to master a topic or that displays all the work the user has done over some time period. Feedback is the easiest to implement in a manner that is satisfactory, but on its own does not provide any guarantee of user engagement. However, it may be easily imagined as the prerequisite for nearly all other metrics, which explains the way it is represented on (Figure 2).

Social represents two distinct phenomena. The first is what we'll refer to as *socialization* which represents the capacity of the system to enable certain interactions between the user of the system. This aspect of the metric simply corresponds to the need of the user to socially interact and how satisfied that need is. The way the user wishes to interact with the system in general and other users in particular has been studied by Bartle[15] and he identified two player/user archetypes out of his four that rely on interaction with other players to define themselves: they are the Socialiser and the Killer. Both of this rely on what's termed *socialization* in this paper, the difference is that the Socialiser relies on positive, affirming interactions with other players/users, while the killer relies on negative interactions – he or she thrives on conflict and the defeat of other players/users. Kim[18] has taken this approach a step further and has divided potential actions that can be preformed vis-à-vis the other players/users into four quadrants that respond to the four archetypes described by Bartle.

The second phenomenon that falls under social is what we'll refer to as *obligation*. Obligation indicates the capacity of the system and the social links it creates to accept the emotional investment of the user. What this means is that, not only is the user capable of interacting with other users, but is capable of forming relationships with them in such a way that the system is part of the bedrock of the relationship itself. In order for *obligation* to be possible at all it is necessary for the system to be capable of fulfilling the *socialization* criterion. The presence of obligations ties well with Fogg's[13] behaviour model. Specifically, the existence of an obligation to other users may serve as the *trigger* in the model. For instance, the user may be motivated to use the system because of the other satisfaction metrics being fulfilled, and the user may have the ability because the system is well designed making it both easy to use and capable of always challenging the user no more than is necessary, but due to the drive to procrastinate, the user may remain indecisive and without a trigger. This is where the integration of the system into the social life of the user will prove invaluable.

Competition encompasses two distinct phenomena and relies heavily on feedback. The first phenomenon is self-competition. This means that the system carefully measures user performance and successfully exhorts the user to improve it, either by enticing the user to perform the same task again, but better or by always presenting the user with interesting goals which seem to be in immediate reach. The first strategy corresponds closely to the concept of *score* as present in games from the earliest days (see Pong, Space War and Tennis for Two) while the other corresponds to the relatively modern concept of *achievements.* Self-competition is very important to the *achiever* archetype as described by Bartle[15]. In Fogg's model, self-competition can be a great source of motivation though may pose problems in the field of ability. Score is linear and is difficult to adjust it so that there is always an achievable goal for the player. Achievements are better, and with careful design can be so constructed that the player always has a clearly recognizable goal to work towards. A well designed game or gamified system can also be designed in such a way that the user can set his or her own goals and work towards them, thus bypassing the problem of "running out" of things to do. For self-competition to even exist, feedback must exist and the activities that the user performs within the system must be such that they can be either quantified numerically or described by a collection of goals.

The second form of competition is highly social and represents striving to surpass the results set by other players. This is of importance to both the *killer* and the *achiever* archetypes, but may lead

to problems, especially with the *killer* archetype. As can be seen in Kim's[18] work, the killer's need for negative interaction may lead him or her to try to exploit the system in such a way as to gain an unfair advantage. In essence, competition may breed cheating, either directly, by subverting the system or indirectly by altering the style of play/interaction in a way that isn't logical but provides maximal advantage. The tactic of "grinding" in massively multiplayer games comes to mind. A certain amount of policing may help with this problem, but the only permanent solution is to ensure than any tactic that brings advantage is such that it involves activities that the system wishes to encourage. This form of competition depends on both the social and feedback metric being adequately fulfilled.

Progression is the capacity of the system to provide to the user the illusion of *persistence.* Persistence means that the system tacks user achievements and archives so that they are always available. This ties in with feedback, as without feedback there is precious little to archive. If this data is available to the user at all times, the metric of self-competition is bolstered. Social competition is likewise helped if the data is available to other users as well. This is common in modern gaming, with the concept of leaderboards and gamer points and profiles with up-to-the-minute achievement statistics. The permanence of the user's recorded progression can also be a powerful aid to the social aspect of the metrics, as visible differences among the users, say by using badges and medals, may lead to the users dividing according to perceived skill or some other similar attribute. The division of users may lead to the creation of groups which help with the obligation aspect of the social metric. Another aspect of progression is the *arc*. The arc means that the player has a sense that his or her experience with the system has a clear beginning and clear present moment and a definite end to work towards, even if this end is nebulous and very difficult to attain. The awareness of a finale, no matter how distant, helps the user pace his experience and set intermediate goals which are necessary for self-competition.

The mechanics metrics is where gamification shades into a game. Mechanics represents the pleasure which can be found in manipulating the system. This may be satisfaction in exploring a complex system of interconnected elements and seeing different outcomes result from different stimuli which is chiefly the province of the *explorer* archetype. On the other hand, the satisfaction may result from mastering a difficult task, which suits the *achiever* archetype. Either way, all satisfaction comes strictly from the pleasure of interaction with the system. This is a feature which, in conventional games, is most often termed *gameplay* and is, psychologically dependant on the state termed flow[16]. The problem with the mechanics is that they are difficult to gamify. In some systems the mechanics of manipulation are inherently attractive to at least some subset of users. In most, however, the task is not particularly attractive. If it were, one could reason, one would not need gamification in order to entice people to perform it. Mechanics is easiest to gamify when the purpose of the gamified system isn't to encourage the performance of a task, but rather to be persuasive. Using the Fogg's[14] terminology these would be games designed to achieve Black Path results.

The context is the hardest to gamify. This metric measures the interest to be found in the context of the users actions on the system, i.e. what those actions mean. The easiest way to illustrate context isn't to look to gamified systems, but instead to conventional games. In a game such as Modern Warfare 2, say, the context is a semi-realistic simulation of tactical warfare in a modern setting. The mechanics of the game is, stripped of context, simply a series of rather basic strategic choices and reflex/perception tests. This alone isn't enough to hold interest, so a narrative is constructed that puts the player in a familiar fantasy surrounding and enables easier identification with the player avatar. In the terminology used to described conventional video games, context covers the field of *story* and *setting.* Early edutainment games make the mistake of trying to alter the context and creating a story that, since it must justify the educational elements, fails to captivate. However, in certain scenarios, gamfication might progress all the way to the level of context. A good example would be a gamified system for cognitive training. Pretty much any form of puzzle can be used as this, and puzzle solving as such is a fascinating game mechanics, hence the popularity of puzzle and adventure games. Furthermore games such as Professor Layton and the Curious Village (available on the Nintendo DS) clearly demonstrate that a collection of puzzles can be linked together by a consistent aesthetic style and simple narrative and be commercially viable.

The first game to consider is World of Warcraft. This is a Massively Multiplayer Online Role-Playing Game (MMORPG) which boasts a userbase of 10.2 million, as of December 2011. It is

undeniably popular and retains user attention far longer than most games, let alone gamified systems. What makes it so addictive? Work by Yee[19] identifies several key factors in the success of an MMORPG. These are: Relationship, Immersion, Grief, Achievement and Leadership. Relationship is the capability of the player to form meaningful semi-permanent relationships within the game. It is represented in the proposed taxonomy by the social metric, specifically the obligation metric. Immersion measures the ability of the player to interest him or herself in the workings of the fantasy world and to identify with his or her avatar in said world. Immersion is covered by the context metric. Grief is the ability to cause difficulties for other players. This is represented by the social competition metrics and corresponds to the desired goals of the *killer* archetype. Achievement relies on the self-competition, progress and mechanics metrics for its impact. Only with self-competition do the players acquire goals and with progress and concomitantly strong feedback, the goals become interesting to the player. The fact that accomplishing these goals is mechanically pleasant is an added advantage. Finally, Leadership is clearly represented in the social category, in the areas of both socialisation and obligation. What Yee's work misses is how the elements of self-competition, which always provide fresh goals, elements of good feedback and progress lead to a nearly perfect Skinner Box, where no matter what the user does there is always an attainable goal to work towards with a tangible award. This constant switch between attainable goals and noticeable awards alongside the social obligation aspects are the root of World of Warcraft's great popularity.

World of Warcraft is a game which uses every part of the taxonomy it possibly can. Angry Birds, on the other hand, is different. The context is whimsical, but not crucial. There is limited competition, though the concept of awards does help with self-competition. There is no true progress, except insofar as the level progression is retained. What this game has, above all others is a superb mechanic and great feedback. Every turn is instantly responsive and reveals something else about the system. That being said, despite having 500 000 000 downloads, the game is a poor example for gamification. What it relies upon, most of all is the mechanic which, as the taxonomy shows, is hard to incorporate into a system being gamified.

FarmVille is one of the most popular social games in the world. It has over 71 million users and, despite costing nothing to play, has generated something like $50 million dollars in revenue. It is an excellent model for gamification, because the context is light and the mechanic isn't particularly engaging. What the game does have is superb feedback, not only tracking everything the user does and displaying it in a context of continuing progress but also rewarding the user for every action that serves to increase engagement. There is not direct social competition, but it does provide incredible levels of self-competition considering that the game measures everything and constantly generates new tasks for the player, using time-delays to teach the behaviour of constantly returning. Progress is also very important, not just in the short run, as explained by feedback, but also in the long run – using the limited capabilities for self-expression the game engine has to staggering effect. The absolute peak is reached with the social sphere, however. The game does everything it can in order to get the player to create relationship inside the game, thus satisfying socializers. Then, once those relationships are set it exploits them mercilessly, creating an interlocking web of mutual obligation, where "real-life" friends help each other weather tough times on their virtual farms. The net result is that even if some player is drifting away from the game, he or she is quickly returned and re-focused by a two-pronged approach: first the social obligations to friends provide the impetus to return to the game, even if for a little while, and the extreme number of options available once in the game entice the user to perform a few extra actions beyond helping their friend. The carefully time-delayed effect of these actions ensure that the user will be back, thus drifting back into the game. This mechanism, as described, isn't unique to FarmVille. Social networks are teeming with similar applications that exploit identical strategies to staggering effect.

III. CONCLUSIONS

The proposed taxonomy can be put to good use in gamifying education. First, the task of computer-mediated education isn't in and of itself game-like. While it is possible to use game-like environments to practice certain skills, generally speaking, education isn't something that can be

easily gamified using strategies reliant on the mechanics metric. The same can be said about context. The context in a system used for education is too reliant on what is being taught and attempting to add a narrative can, and probably will clash horribly. There is however room to maneuver with strategies focused on the other metrics. Here, FarmVille and similar social games can serve as excellent models. A gamified education framework must keep track and measure everything the student does – every unit of knowledge learned, every lecture listened to, every exercise done. It must display as much of this data as possible to the student and his or her peers and it must constantly recognize effort by awarding achievements, medals and other distinct signs of progress. Furthermore, the more such achievements are unlocked, the more the system must display as being just in reach. This ensures that the student always has a goal to work towards, even if he or she aren't highly self-motivated. The most important thing, however, is to utilize the social aspect as much as possible. The preferred method would be direct social network integration. This way, existing relationships can be used and students programmatically directed to help their struggling friends or to seek aid from those doing better. In this way not only is the education system inextricable from the student's day-to-day social surfing but it also build a web of obligations that keep the student from losing engagement.

This is an interesting field for further study. Further avenues of research would include empirical validation of the proposed taxonomy first by conducting a study that analyzes existing successful gamified systems and seeing if they fit into the confines of the proposed taxonomy. Once this study is complete and the conclusions are worked into the proposal, the second phase can begin and a pilot gamified electronic education system can be built based on the lessons of the proposed taxonomy.

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