

Motivation through gamification: a Self-Determination Theory perspective for the design of an adaptive reward system

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Research on the nature and origins of human motivation has addressed the role of rewards in learning and behaviour. Gamification finds its raison d'être in being able to leverage motivational theories, to foster motivation in users through the use of game elements. One of the main criticisms moved to the use of gamification for learning purposes is related to the one-size-fits-all approach that tends to characterize many gamified applications. In this paper we explore the possibilities that can arise from the convergence of Self-Determination Theory principles and machine learning, to improve the efficacy of gamification reward systems.

CCS CONCEPTS • Human-centered computing • Human Computer Interaction • HCI theory, concepts and models

Additional Keywords and Phrases: Gamification, Self-Determination Theory, Adaptive rewards

1 INTRODUCTION

Research on the nature and origins of human motivation has addressed the role of rewards in learning and behaviour. Importantly, this research points at the distinction between motivation that comes from within an individual vs motivation that is driven by a desire to achieve an external goal [1,2,3]. Intrinsically motivated behaviours are autonomous and reflect a person's internal willingness to learn and perform, while extrinsically motivated behaviours depend on the degree of internalizations of external regulation.

Gamification finds its *raison d'être* in being able to leverage motivational theories, to foster motivation in users through the use of game elements. The breadth of fields in which gamification is used is substantial, ranging from personal development to learning, corporate training to marketing. As a result, gamified solutions' target audiences are extremely broad. Among all the fields, the educational domain took significant advantage of the use of gamification, with encouraging results about its efficacy but not without some shadows and limits [4,5,6,7,2]. Indeed, one of the main criticisms moved to the use of gamification for learning purposes is related to the one-size-fits-all approach that tends to characterize many gamified applications [8,9,10].

The ultimate purpose of using gamification in educational contexts is to foster the adoption of learning conducive behaviours by learners and scaffold their motivation to learn; for this to happen, virtuous behaviours are rewarded by the design and procedures of the system.

2 THE ROLE OF REWARDS IN GAMIFICATION

While rewards have originally been linked to behaviourist's approaches to learning and reinforcement, stamping in behaviour in the environment [1,2], more recent research into the psychology of motivation has discovered that the reinforcement function of rewards undermines intrinsic motivation and fosters extrinsic motivation. The concept of intrinsic motivation is rooted in White's [3] work on fundamental psychological inclinations, according to which particularly competence influences behaviour. White's work, conducted in the late fifties of the last century, considers activities and behaviour that satisfy these psychological tendencies to be intrinsically gratifying and satisfying [1].

Later, Ryan and Deci exploited White's work to examine intrinsic motivation [11] and identify the psychological needs that, according to self-determination theory (SDT), are at the root of a user's intrinsic motivation. SDT posits that an individual's self-determination is based on three basic intrinsic needs: requirements that motivate the self to initiate behaviour and needs that describe nutrients that are required for psychological health and well-being. These needs, which include the need for competence, autonomy, and relatedness, are thought to be universal and innate. Building on the foundation laid by SDT, Ryan et al. explored how motivation is developed in video games and concluded that gameplay can be an inherently rewarding experience [12].

Follow-up studies by Przybylski et al. [13] and Ryan et al. [14] stated that the video game medium may perfectly match and satisfy the three basic psychological needs (BPNs) of SDT: autonomy, competence, and relatedness [13,14] because of the experiences that it frequently provides for its users.

With all of this in mind and considering that one of the aims of gamification is to redesign processes to make them more game-like and to provide users with game-like experiences, it's safe to suppose that the basic psychological demands that are required to create intrinsically engaging video game experiences are also required to create intrinsically motivating gamified learning experiences. In contrast with this assumption, it must be noticed that gamification usually intends to reach its objective by leveraging game elements [15], like badges, points or leaderboards used as extrinsic reinforcement

for users' actions in the gamified system [16], more from the point of view of behaviourists [1,2] than from the SDT's one [11,13,14].

To improve the approach to the use of rewards in gamification, one necessary step is to better understand rewards' nature and if, and to which extent, they can be used to satisfy the SDT's three BPNs.

There is a fair amount of research that attempts to categorise game rewards, with a strong view to generalisability, highlighting the function they can have in a system [17,18,5,6], but also, in a more specific frame, identifying the single reward characteristics [19]. Only in one case among the ones considered in [6], the study was conducted with the perspective of applying the results to a gamified system.

3 A FRAMEWORK FOR INVESTIGATING THE ROLE OF REWARDS IN GAMIFICATION

The present research aims to offer a framework for the understanding and examination of the role of rewards in motivating users, not only in games but also in gamified systems. Building on the notion that intrinsic motivation promotes learning, increases sustained behaviour and wellbeing, our framework is key in supporting the design of effective solutions for gamification. Importantly, it is crucial to keep in mind while designing gamified solutions, that there is much room for individual differences, as various people are motivated by different things in different ways, and therefore by varied game interactions (i.e., as resulting from distinct game mechanics like rewards, achievements, etc.) [20].

Our framework aims to address two main questions that are highly relevant for a gamified system to be more effective, according to which rewards should be able to satisfy the three BPNs considering individual differences among players [21].

- **RQ1:** Is there a correlation between rewards' categories and the impact on the three BPNs? More specifically, how are the plethora of different rewards employed in gaming associated with the psychological needs of autonomy, competence, and relatedness?
- **RQ2:** In a gamified application for learning, is an adaptive reward system that considers individual differences and adapts itself according to RQ1 results, more effective than a non-adaptive one? That is, how does an adaptive reward system that is personalized to the user's needs and interests affect learning and performance?

Accordingly, the answers to RQ1 and RQ2 could lead to the design and development of gamified systems that are better suited to satisfy the users' BPNs, and therefore motivate them more efficiently and effectively, also avoiding the detriment of intrinsic motivation that sometimes can occur when adopting a fully extrinsic reward system (overjustification effect) [22,23,24,25].

4 APPROACH

More specifically, to answer RQ1 the following steps will be followed:

- Identify, among the ones in literature, the most general and versatile rewards' taxonomy;
- Analyse, in the light of the taxonomy, a number of video games, so to be able to put the single rewards under the proper taxonomy category;
- Construct a questionnaire, based on existing validated questionnaires about the satisfaction of the three BPNs, to assess the impact of the rewards of the analyzed games on the three basic needs;

- Investigate the correlation between the needs and the categories to which such rewards belong;
- Define the relationship between general rewards' categories and the three BPNs;
- Identify the common characteristics (as tags) that define these rewards.

In Fig.1 these steps are part of Phase1 of the research process.

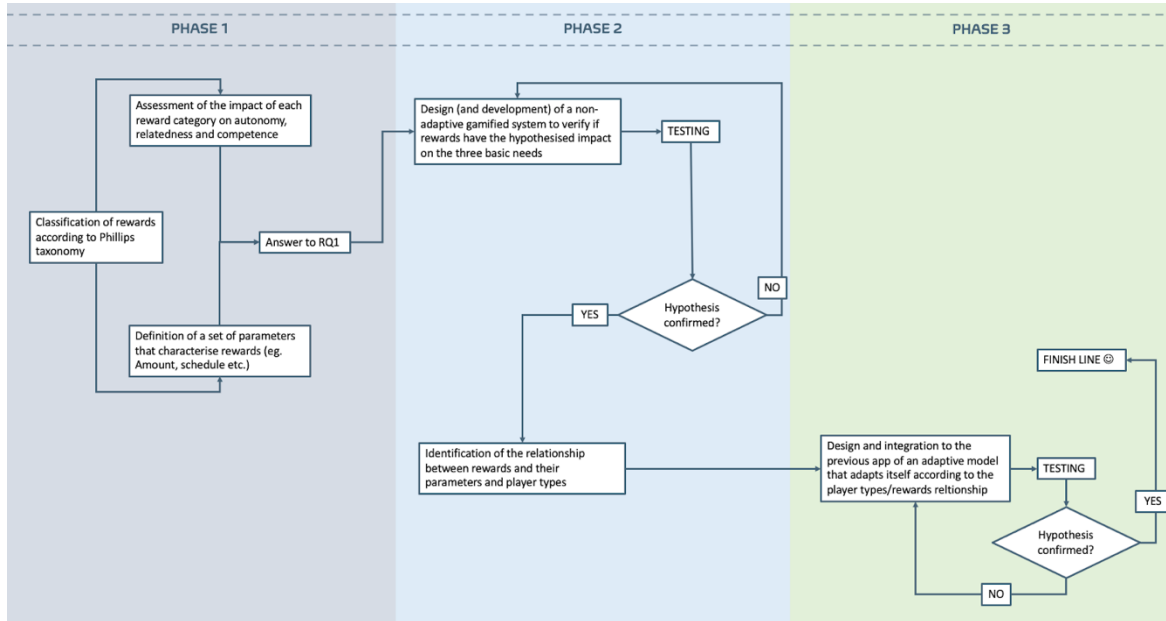


Fig.1 - research process scheme

To answer RQ2, we start from the assumption that the purpose of human-computer interaction (HCI) development is to make computers serve and adapt to human requirements. Rather than forcing people to conform to the computer, adopting a human-centred approach.

By acquiring and analyzing data from HCI we can learn more effectively and construct better systems. Gamified applications should be no exception to that. In Fig.1 these steps are part of the Phase2 and three of the research process.

Indeed, the convergence between machine learning and gamification is progressing, and one of the main fields where such convergence is expressing its full potential is the educational one [29]. In regard to that, a small gap in the research seems to exist, since none of the experiences reported considers the SDT's BPNs as the criteria for designing the adaptive system [26].

5 CONCLUSION

Having in mind the purpose of the workshop, authors intend to bring a proposal of research design, supported by literature, aiming at answering the previously identified research questions, and to verify, through discussion with other participants,

the validity of the research steps described and of the research tools that will be implemented. It will be also interesting to highlight possible synergies with the work of other researchers to add new value and knowledge to the SDT in HCI field, with a special reference to gamification studies. We'll also present a framework for investigating the role of rewards in gamification.

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