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Towards understanding the effects of individual gamification elements on intrinsic motivation and performance

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ABSTRACT

Research on the effectiveness of gamification has proliferated over the last few years, but the underlying motivational mechanisms have only recently become object of empirical research. It has been suggested that when perceived as informational, gamification elements, such as points, levels and leaderboards, may afford feelings of competence and hence enhance intrinsic motivation and promote performance gains. We conducted a 2×4 online experiment that systematically examined how points, leaderboards and levels, as well as participants' goal causality orientation influence intrinsic motivation, competence and performance (tag quantity and quality) in an image annotation task. Compared to a control condition, game elements did not significantly affect competence or intrinsic motivation, irrespective of participants' causality orientation. However, participants' performance did not mirror their intrinsic motivation, as points, and especially levels and leaderboard led to a significantly higher amount of tags generated compared to the control group. These findings suggest that in this particular study context, points, levels and leaderboards functioned as extrinsic incentives, effective only for promoting performance quantity.

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1. Introduction

Digital games have become increasingly popular over the last few years (ESA, 2015) and empirical research in psychology has further lent evidence for their motivational appeal (e.g., Peng, Lin, Pfeiffer, & Winn, 2012; Przybylski, Rigby, & Ryan, 2010). Industry professionals have taken notice of this trend and have attempted to apply games' motivational potential to various non-gaming contexts to foster user engagement. This practice is nowadays best known under the moniker "gamification", commonly defined as *the use of game design elements in non-game contexts* (Deterding, Dixon, Khaled, & Nacke, 2011), and has become a heavily debated subject in its own right (Deterding, 2012; Hamari, Koivisto, & Sarsa, 2014; Seaborn & Fels, 2015).

Most prominently, gamification has been commonly associated with points, levels and leaderboards (Hamari et al., 2014; Seaborn & Fels, 2015). While several studies have shown that the implementation of game elements may promote user behavior in various

contexts (refer to Hamari et al., 2014; Seaborn & Fels, 2015; for an overview), some have cautioned against the over-reliance on such elements, as they may diminish users' intrinsic interest and hence lead them to stop engaging with the application or service altogether (Deterding, 2011; Koivisto & Hamari, 2014; Seaborn & Fels, 2015). In fact, previous research in psychology provides ample evidence that certain forms of rewards, feedback, and other external events can have detrimental effects on intrinsic motivation (for an overview see Deci, Koestner, & Ryan, 1999), and a recent study suggests that the same may hold true for gamification under certain circumstances (Hanus & Fox, 2015). On the other hand, it has been argued that – provided a non-controlling setting, – the well-thought out implementation of game elements may indeed improve intrinsic motivation by satisfying users' innate psychological needs for autonomy, competence and relatedness (Deterding, 2014; Francisco-Aparicio, Gutiérrez-Vela, Isla-Montes, & Sanchez, 2013; Pe-Than, Goh, & Lee, 2014; Peng et al., 2012).

Deterding (2011, 2012) suggested that in order to gain a better understanding of the psychological mechanisms underlying gamification, the effects of *individual* game design elements on user motivation should be studied, referring to the concept of *motivational affordance*, that is, *the properties of an object that determine whether and how it [...] supports one's motivational needs* (Zhang

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(2008), pp. 145). While efforts have since been undertaken to link game design elements to the satisfaction of motivational needs (Francisco-Aparicio et al., 2013; Pe-Than et al., 2014; Peng et al., 2012; Wang, Schneider, & Valacich, 2015), to date only few studies attempted to experimentally investigate the effects of individual game elements on motivation and performance (Deterding, 2011; Hamari et al., 2014; Seaborn & Fels, 2015).

Yet, this issue is highly relevant to gamification research. Firstly, the majority of currently available gamification literature focuses predominantly on studying the effectiveness of game design elements in promoting certain behavioral outcomes (Hamari et al., 2014; Seaborn & Fels, 2015), largely ignoring the underlying psychological mechanisms that may actually account for these effects (Antin & Churchill, 2011; Deterding, 2014), (but refer to Hanus & Fox, 2015; Lieberoth, 2015; Mekler, Brühlmann, Opwis, & Tuch, 2013b; for notable exceptions). Secondly, game elements, such as points, levels and leaderboards have been and continue to be applied to a broad spectrum of non-game contexts with varying degrees of success (Hamari et al., 2014; Seaborn & Fels, 2015). But most empirical gamification studies investigate the impact of multiple game elements, making it difficult to pinpoint how and to what extent these game elements contribute to user motivation and behavior (Hamari et al., 2014; Seaborn & Fels, 2015). Moreover, most pattern-based approaches to gamification, such as the one described by Francisco-Aparicio et al. (2013), offer little guidance in deciding whether points, levels or leaderboards are suitable for a given context, or how they should be implemented (Deterding, 2015). Studying the effects of individual game elements on both behavioral outcomes and users' intrinsic motivation thus contributes to gamification research by providing a more nuanced understanding of how particular game elements function in a given context, and may potentially benefit designers, as it allows for more informed decisions on how and under what circumstances game elements, such as points, levels or leaderboards, should or should not be implemented (Seaborn & Fels, 2015).

Based on self-determination theory (SDT), one of the most established theoretical frameworks within gamification and game motivation research (Deterding, 2015; Seaborn & Fels, 2015), the present paper aims to address the aforementioned research gaps by systematically assessing the impact of individual game design elements on both user motivation and behavior. Specifically, this study examines how points, leaderboards, and levels, – three of the most commonly employed game elements (Hamari et al., 2014; Seaborn & Fels, 2015), – affect need satisfaction, intrinsic motivation and performance in an image annotation task. Moreover, because apart from situational factors, individual differences may also account for the differing effects of gamification (Hamari et al., 2014), we additionally examine whether users' causality orientation further determines the effects of gamification.

2. Theoretical background

2.1. Intrinsic motivation, cognitive evaluation and causality orientation

Self-determination theory (SDT) differentiates two forms of motivation (Ryan & Deci, 2000) – (but refer to Vansteenkiste, Niemiec, & Soenens, 2010; for a more nuanced differentiation of varying types of extrinsic motivation): *Extrinsic motivation* is defined as doing something due to a separable outcome, such as pressure or “extrinsic rewards” in the form of money or verbal feedback (e.g., praise) (Deci et al., 1999), whereas *intrinsic motivation* denotes the pursuit of an activity, because it is inherently interesting or enjoyable. A recent literature review by Seaborn and Fels (2015) identified intrinsic and extrinsic motivation as some the

most frequently discussed, yet rarely empirically studied constructs in gamification research. It is important to note that both extrinsic and intrinsic motivation promote performance gains (see Cerasoli, Nicklin, & Ford, 2014; for an overview), but only the latter has been associated with improved psychological well-being, enhanced creativity and learning outcomes (Ryan & Deci, 2000), as well as increases in the extent and quality of effort that people put into a given task (Cerasoli et al., 2014).

While certain extrinsic rewards have been found to reduce intrinsic motivation in various domains (Deci et al., 1999; Ryan & Deci, 2000), external rewards must not invariably undermine people's intrinsic motivation (Cerasoli et al., 2014; Deci et al., 1999). According to cognitive evaluation theory – a subtheory of SDT (Ryan & Deci, 2000; Vansteenkiste et al., 2010), – the effects of extrinsic rewards on intrinsic motivation are mediated by a person's perception of these events as informational or controlling (Deci et al., 1999; Ryan & Deci, 2000), which in turn determines how these events influence the innate psychological needs for competence and autonomy (see Fig. 1). *Competence* signifies the perceived extent of one's own actions as the cause of desired consequences in one's environment (Ryan & Deci, 2000) and thrives when met with direct and positive (i.e., *informational*) feedback. However, feelings of competence will not increase intrinsic motivation unless they are accompanied by a sense of *autonomy*, that is, people must experience their behavior as self-determined rather than *controlled* by some outside source. If perceived as controlling, even positive feedback may thwart people's inherent need for autonomy and hence, decrease intrinsic motivation (Deci et al., 1999), whereas feedback that is perceived as both non-controlling and informational, supports people's need for competence and subsequently boosts their intrinsic motivation.

Finally, according to causality orientation theory (Deci & Ryan, 1985), another subtheory of SDT (Vansteenkiste et al., 2010), people differ in the extent to which they experience their actions as self-determined, which further influences whether they perceive feedback as informational or controlling (see Fig. 1). Hence, a person's causality orientation acts as a moderator of the effects of feedback on need satisfaction. Autonomy oriented individuals are more likely to act according to their own interests and values and interpret external events as informational rather than controlling (Deci & Ryan, 1985; Vansteenkiste et al., 2010), therefore experiencing more competence need satisfaction. Control oriented people, in contrast, are more likely to act due to external demands and perceive external events as pressuring and therefore experience less feelings of autonomy.

2.2. Need satisfaction and game design elements

The intrinsically motivating nature of digital games has been attributed to their potential to satisfy the psychological needs for autonomy, competence and relatedness (Przybylski et al., 2010). Satisfaction of those needs has also been found to be positively associated with the enjoyment of human computation games (Pe-Than et al., 2014). Additionally, Peng et al. (2012) compared different versions of an exergame, designed with a variety of autonomy-supportive (i.e., avatar customization) and competence-supportive game features (i.e., dynamic difficulty adjustment, various performance indicators). As posited by cognitive evaluation theory (Ryan & Deci, 2000), they found that need satisfaction mediated the effects of the game elements on participants' enjoyment (as measured by the Intrinsic Motivation Inventory; Ryan, Mims, and Koestner (1983)), motivation for future play and game recommendation. However, since their study combined several game elements in each experimental condition, Peng et al. (2012) acknowledge that it is not possible to assess which and to what

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