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Gamification for health and wellbeing: A systematic review of the literature

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ABSTRACT

Background: Compared to traditional persuasive technology and health games, gamification is posited to offer several advantages for motivating behaviour change for health and well-being, and increasingly used. Yet little is known about its effectiveness.
Aims: We aimed to assess the amount and quality of empirical support for the advantages and effectiveness of gamification applied to health and well-being.
Methods: We identified seven potential advantages of gamification from existing research and conducted a systematic literature review of empirical studies on gamification for health and well-being, assessing quality of evidence, effect type, and application domain.
Results: We identified 19 papers that report empirical evidence on the effect of gamification on health and well-being. 59% reported positive, 41% mixed effects, with mostly moderate or lower quality of evidence provided. Results were clear for health-related behaviours, but mixed for cognitive outcomes.
Conclusions: The current state of evidence supports that gamification can have a positive impact in health and wellbeing, particularly for health behaviours. However several studies report mixed or neutral effect. Findings need to be interpreted with caution due to the relatively small number of studies and methodological limitations of many studies (e.g., a lack of comparison of gamified interventions to non-gamified versions of the intervention).

1. Introduction

1.1. Background

The major health challenges facing the world today are shifting from traditional, pre-modern risks like malnutrition, poor water quality and indoor air pollution to challenges generated by the modern world itself. Today, the leading global risks for mortality and chronic diseases – high blood pressure, tobacco use, high blood glucose, physical inactivity, obesity, high cholesterol – are immediately linked to a modern lifestyle characterized by sedentary living, chronic stress, and high intake of energy-dense foods and recreational drugs (Stevens et al., 2009). In addition, following calls from the World Health Organization's (2015/(1946) inclusive conception of health, researchers, civil society, and politicians have been pushing to extend policy goals from preventing and reducing disease towards promoting people's holistic physical, mental, and social well-being (Carlisle and Hanlon, 2008; Hanratty and Farmer, 2012; Huppert and So, 2013; Marks and Shah, 2004; Schulte et al., 2015).

Practically all modern lifestyle health risks (and resulting diseases) are directly affected by people's individual health behaviours — be it physical activity, diet, recreational drug use, medication adherence, or preventive and rehabilitative exercises (Glanz, K., Rimer, B. K., & Viswanath, K, 2008, pp. 6–8; Schroeder, 2007). By one estimate, three quarters of all health care costs in the US are attributable to chronic diseases caused by poor health behaviours (Woolf, 2008), the effective management of which again requires patients to change their behaviours (Sola et al., 2015). Similarly, research indicates that well-being can be significantly improved through small individual behaviours (Lyubomirsky and Layous, 2013; Seligman, 2011). Behaviour change has therefore become one of the most important and frequently targeted levers for reducing the burden of preventable disease and death and increasing well-being (Glanz, K., Rimer, B. K., & Viswanath, K, 2008, p. xiii).

A main factor driving behaviour change is the individual's motivation. Even if different theories contain different motivational constructs, "the processes that direct and energize behaviour" (Reeve, 2014, p. 8)

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feature prominently across health behaviour change theories (Glanz and Bishop, 2010; Michie, van Stralen, & West, 2011). Motives are a core target of a wide range of established behaviour change techniques (Michie et al., 2011a,b).

However, following self-determination theory (SDT), a well-established motivation theory, not all forms of motivation are equal (Deci and Ryan, 2012). A crucial consideration is whether behaviour is intrinsically or extrinsically motivated. Intrinsic motivation describes activities done 'for their own sake,' which satisfy basic psychological needs for autonomy, competence, and relatedness, giving rise to the experience of volition, willingness, and enjoyment. Extrinsically motivated activity is done for an outcome separable from the activity itself, like rewards or punishments, which thwarts autonomy need satisfaction and gives rise to experiences of unwillingness, tension, and coercion (Deci and Ryan, 2012). In recent years, SDT has become a key framework for health behaviour interventions and studies. A large number of studies have demonstrated advantages of intrinsic over extrinsic motivation with regard to health behaviours (Fortier et al., 2012; Ng et al., 2012; Patrick and Williams, 2012; Teixeira, Palmeira, & Vansteenkiste, 2012). Not only is intrinsically motivated behaviour change more sustainable than extrinsically motivated change (Teixeira, Silva, Mata, Palmeira, & Markland, 2012): satisfying the psychological needs that intrinsically motivate behaviour also *directly* contributes to mental and social well-being (Ryan, Huta, & Deci, 2008; Ryan, Patrick, Deci, & William, 2008).

In short, in our modern life world, health and well-being strongly depend on the individual's health behaviours, motivation is a major factor of health behaviour change, and intrinsically motivated behaviour change is desirable as it is both sustained and directly contributes to well-being. This raises the immediate question what kind of interventions are best positioned to intrinsically motivate health behaviour change.

1.2. Computing technology for health behaviour change and well-being

The last two decades have seen the rapid ascent of computing technology for health behaviour change and well-being (Glanz, K., Rimer, B. K., & Viswanath, K, 2008, pp. 8–9), with common labels like persuasive technology (Fogg, 2003) or positive computing (Calvo and Peters, 2014). This includes a broad range of consumer applications for monitoring and managing one's own health and well-being (Knight et al., 2015; Martínez-Pérez et al., 2013; Middelweerd et al., 2014), such as the recent slew of "quantified self" (Wolf, 2009) or "personal informatics" tools for collecting and reflecting on information about the self (Li et al., 2010).

One important sector is serious games for health (Wattanasoontorn et al., 2013), games used to drive health-related outcomes. The majority of these are "health behaviour change games" (Baranowski et al., 2008) or "health games" (Kharrazi et al., 2012) affecting the health behaviours of health care receivers (and not e.g. training health care providers) (Wattanasoontorn et al., 2013). Applications and research have mainly targeted physical activity, nutrition, and stroke rehabilitation, with an about equal share of (a) "exergames" or "active video games" directly requiring physical activity as input, (b) behavioural games focusing specific behaviours, (c) rehabilitation games guiding rehabilitative movements, and (d) educational games targeting belief and attitude change as a precondition to behaviour change (Kharrazi et al., 2012). Like serious games in general, health games have seen rapid growth (Kharrazi et al., 2012), with numerous systematic reviews assessing their effectiveness (DeSmet et al., 2014, 2015; Gao et al., 2015; LeBlanc et al., 2013; Lu et al., 2013; Papastergiou, 2009; Primack et al., 2012; Theng et al., 2015).

A main rationale for using games for serious purposes like health is their ability to motivate: Games are systems purpose-built for enjoyment and engagement (Deterding, 2015b). Research has confirmed that well-designed games are enjoyable and engaging because playing them provides basic need satisfaction (Mekler et al., 2014; Przybylski et al., 2010; Tamborini et al., 2011). Turning health communication or health behaviour change programs into games might thus be a good way to intrinsically motivate users to expose themselves to and continually engage with these programs (Baranowski et al., 2008; though see Wouters et al., 2013).

However, the broad adoption of health games has faced major hurdles. One is their high cost of production and design complexity: Health games are typically bespoke interventions for a small target health behaviour and population, and game development is a cost- and time-intensive process, especially if one desires to compete with the degree of "polish" of professional, big studio entertainment games. Thus, there is no developed market and business model for health games, wherefore the entertainment game and the health industries have by and large not moved into the space (Parker, n.d.; Sawyer, 2014).

A second adoption hurdle is that most health games are delivered through a dedicated device like a game console, and require users to create committed spaces and times in their life for gameplay. This demand often clashes with people's varied access to technology, their daily routines and rituals, as well as busy and constantly shifting schedules (Munson et al., 2015).

1.3. Gamification: a new model?

One possible way of overcoming these hurdles is presented by gamification, which is defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011; see Seaborn and Fels, 2015 for a review). The underlying idea of gamification is to use the specific design features or "motivational affordances" (Deterding, 2011; Zhang, 2008) of entertainment games in other systems to make engagement with these more motivating.[1] Appealing to established theories of intrinsic motivation, gamified systems commonly employ motivational features like immediate success feedback, continuous progress feedback, or goal-setting through interface elements like point scores, badges, levels, or challenges and competitions; relatedness support, social feedback, recognition, and comparison through leaderboards, teams, or communication functions; and autonomy support through customizable avatars and environments, user choice in goals and activities, or narratives providing emotional and value-based rationales for an activity (cf. Ryan and Rigby, 2011; Seaborn and Fels, 2015).

Since its emergence around 2010, gamification has seen a groundswell of interest in industry and academia, easily outstripping persuasive technology in publication volume (Hamari, Koivisto, & Pakkanen, 2014). By one estimate, the gamification market is poised to reach 2.8 billion US dollars by 2016 (Meloni and Gruener, 2012). It is little wonder, then, that several scholars have pointed to health gamification as a promising new approach to health behaviour change (Cugelman, 2013; King et al., 2013; Munson et al., 2015; Pereira et al., 2014; Sola et al., 2015). Popular examples are *Nike+*[2], a system of activity trackers and applications that translate measured physical exertion into so-called "NikeFuel points" which then become enrolled in competitions with friends, the unlocking of achievements, or social sharing; *Zombies, Run!*[3], a mobile application that motivates running through wrapping runs into an audio-delivered story of surviving a Zombie apocalypse; or *SuperBetter*[4], a web platform that helps people achieve their health goals by building psychological resilience, breaking goals into smaller achievable tasks and wrapping these into layers of narrative and social support.

[1] Authors like Deterding et al. (2011) caution to not delimit gamification to a specific design goal like motivation, but grant that motivating behaviours is indeed the overwhelming use case for gamification, as borne out by systematic reviews.
[2] https://secure-nikeplus.nike.com/plus/
[3] https://zombiesrungame.com
[4] http://superbetter.com