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Gamification, quantified-self or social networking? Matching users' goals with motivational technology

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Abstract:

Systems and services we employ in our daily life have increasingly been augmented with motivational designs which fall under the classes of 1) gamification, 2) quantified-self and 3) social networking features that aim to help users reach their goals via motivational enforcement. However, users differ in terms of their orientation and focus toward goals and in terms of the attributes of their goals. Therefore, different classes of motivational design may have a differential fit for users. Being able to distinguish the goal profiles of users, motivational design could be better tailored. Therefore, in this study we investigate how different goal foci (outcome and focus), goals orientation (mastery, proving, and avoiding), and goal attributes (specificity and difficulty) are associated with perceived importance of gamification, social networking and quantified-self features. We employ survey data (N=167) from users of HeiaHeia; a popular exercise encouragement app. Results indicate that goal-setting related factors of users and attributes of goals are connected with users' preference over motivational design classes. In particular, the results reveal that being outcome-focused is associated with positive evaluations of gamification and quantified-self design classes. Users with higher proving-orientation perceived gamification and social networking design classes as more important, users with lower goal avoidance-orientation perceived social networking design as more important, whereas users with higher mastery-orientation perceived quantified-self design more important. Users with difficult goals were less likely to perceive gamification and social networking design important, whereas for users with high goal specificity quantified-self features were important. The findings provide insights for the automatic adaptation of motivational designs to users' goals. However, more research is naturally needed to further investigate generalizability of the results.

Keywords: gamification, quantified-self, social networking, goal-setting, goal orientation, motivational information system

1. Introduction

Systems are increasingly imbued with motivational design with the aim of positively engaging users towards using a system as well as towards engagement with the task they are attempting to accomplish through the use of the system (Bouvier et al. 2014; Deterding 2015; Hamari et al. 2014a; Jung et al. 2010; Landers et al. 2017; Lieberoth 2015; Oinas-Kukkonen 2013; Santhanam et al. 2016; Zhang 2008). In fact, it has been predicted that most organizations will eventually implement a form of motivational design into their systems (Gartner 2012). Today, the use of motivational design seems prominent across software families of varying sizes and purposes SAP[1], Google Maps (in form of Google Waze[2]), Microsoft Office (Ribbon Hero[3]), Fitocracy[4] (fitness), Mindbloom[5] (life planning), and Yousician[6] (learning) to name a few.

Since the inception of this wave of design, the designs have converged into three primary classes: 1) *gamification* - draws from game design (Deterding 2015; Hamari and Koivisto 2015b; Huotari and Hamari 2017; Santhanam et al. 2016; Vesa et al. 2017), 2) *quantified-self* - draws from big data, wearables and dashboard design (Choe et al. 2014; Gurrin et al. 2014; Swan 2009) and 3) *social networking* - draws from social networking services (Boyd and Ellison 2007; Chen et al. 2014; Krasnova et al. 2015; Lin and Lu 2011). Most popular implementations of motivational design include all three in one form or another.

However, motivational design is difficult to implement as it requires the command of several disciplines such as (motivational/social/behavioral) psychology and game design beyond software development (Deterding 2015; Huotari & Hamari 2017; Morschheuser et al. 2017; Nicholson 2012; Rigby 2015; Zhang 2008). Moreover, the end goal of motivational design is commonly not the mere motivation but the accomplishment of a level of behavioral change, thus

[1] https://www.sap.com/
[2] https://www.waze.com
[3] https://ribbon-hero.en.softonic.com/
[4] https://www.fitocracy.com/
[5] www.mindbloom.com/
[6] https://yousician.com/

adding to the complexity of such design (Bouvier et al. 2014; Hamari et al. 2014b; Orji et al. 2014). Due to these difficulties, the optimistic prediction about the successful penetration of motivational design into modern information systems has turned less optimistic (Gartner, 2012).

Specifically pertaining to this study; users do not share the same kinds of goals, nor the same orientations towards goal-setting. Goals define what individuals wish to attain and consequently what they require motivation for (Elliot and Harackiewsicz 1994; Latham, 2003; Locke and Latham, 2013). It would be hence motivationally beneficial to design motivational technology that is capable of providing the motivation individuals need depending on the differentiated characteristics of their goals. Specifically, goals for example differ with regards to their defining attributes such as difficulty and specificity (Elliot and Harackiewsicz 1994; Freund et al. 2010; Mann et al. 2013), their attainability, and goal seeking outcomes (Freund et al. 2010; Hackel et al. 2016; Landers et al. 2017; Lunenburg 2011; Mann et al. 2013). Individuals who focus on attaining specific outcomes rather than enjoy the process of attaining these outcomes could be expected to draw more motivation out of motivational features that emphasize to them the outcomes they want to attain and their value e.g. badges and medals. Individuals who would rather focus on enjoying the process of goal attainment, might see little value in such features and require a different set of motivational features that might make the process more enjoyable through for example features of messaging and friending. Thus, the design principles most suited for differentiated user needs depending on their various orientations towards goals are expected to differ as it is hard to expect a single solution to fit all users (Koivisto and Hamari 2014; Mann et al. 2013; op den Akker et al. 2014; Wang et al. 2015). Therefore, being able to differentiate these design principles and consequently develop differentiated services and systems along goal profiles of users may help to more effectively target system features to individual users, increasing their adoption rates and the value individuals could draw from them.

Thus far each of the three principle motivational designs has been investigated in isolation and there has been no comparison across them, making it hard to draw conclusions about their fit with different goals and consequent differentiated user needs (Hackel et al. 2016; Landers et al.

2017; Lunenburg 2011). There is a lack of understanding of how goal-setting and the attributes of goals affect the importance of the design classes of motivational systems. To this end, this study sets the following research question: "*how different goal foci (outcome and focus), goals orientation (mastery, proving, and avoiding), and goal attributes (specificity and difficulty) are associated with perceived importance of gamification, social networking and quantified-self -features"* with the aim of producing knowledge for the problems of which of the motivational designs are better suited for users with different goal focus, orientation and attributes of their goals. We employ survey data (N=167) gathered among users of HeiaHeia[7]; a popular exercise encouragement app that combines all three technologies of gamification, quantified-self and social networking as the core of the service. The exercise context is one of the largest domains that employ these motivational designs, and therefore, provides an apt context to undertake the present study in to both derive insights into this specific context but also beyond, into what motivational technologies are.

2. Background

2.1. Goal-setting

Goal-setting is a crucial aspect of human behavior; it has a heightened role in activities that require perseverance and planning such as is the case with practically all activities of modern individuals or organizations. Goal-setting refers to an individual's or a group's process of determining desirable end-states that they wish to achieve and intend to use in self-regulation (Burnette et al. 2013; Locke and Latham 2002; Loock et al. 2013). Concretely set goals rather than wishful thinking are important for goal attainment (Elliot and Harackiewsicz 1994; Latham, 2003; Locke and Latham, 2013). Thus, the process of goal-setting has been extensively studied (Elliot and Harackiewsicz 1994; Freund et al. 2010; Locke et al. 1981; Latham 2003; Locke and Latham 2002; Locke and Latham 2013; Mann et al. 2013), and it has been linked to improvements in performance in a variety of settings such as in education, personal development

[7] https://www.heiaheia.com/

or work productivity (Locke and Latham 2013; Loock et al. 2013; Nahrgang et al. 2013; Presslee et al. 2013; Rasch and Tosi 1992; Wack et al 2014).

Goal-setting facilitates self-regulation; a continuous psychological process necessary for the evaluation of one's performance towards one's goals, thus allowing individuals to realign their performance when needed and remain on the path of their intended outcomes (Burnette et al. 2013; Mann et al. 2013; Zimmerman 2013). Self-regulation necessitates receiving feedback to evaluate performance (Burnette et al. 2013; Zimmerman 2013). Consequently, systems that allow individuals to monitor their performance, or those that provide feedback mechanisms may be of importance to self-regulation (Loock et al. 2013; Zimmerman 2013) and attainment of goals. However, not all individuals share the same types of goals or attitudes towards goal setting (Capa et al. 2008; Elliot and Harackiewsicz. 1994; Freund et al. 2010; Hackel et al. 2016; Locke et al. 1981; Lunenburg 2011; Roskes et al. 2014).

Three important aspects of goal-setting that vary across individuals are 1) *goal focus* (outcomes, process) (Burnette et al. 2013; Freund et al. 2010; Locke and Latham 2002; Mann et al. 2013) 2) *orientation* of the goal-setter towards goals (trichotomous goals) (mastery, proving, avoidance) (Elliot and Harackiews 1994; Freund et al. 2010; Hackel et al. 2016; Lunenburg 2011; Mann et al. 2013; Zimmerman 2013) and 3) *goal attributes (difficulty, specificity)* (Drach-Zahavy and Erez 2002; Locke et al 1981; Locke and Latham 2013). Due to such variance across individuals and consequently system users, it is hard to expect that a single motivational design would fulfill the needs of all variety of users with such a diversity of goals attributes (Mann et al. 2013; Wang et al. 2015).

2.1.1. Goal focus

Goals are concerned with the attainment of a desirable end-state (Elliot and Harackiewsicz 1994; Latham, 2003; Locke and Latham, 2013). A goal focus describes this resilient aspect of the goal-setting behavior in terms of what end-state do individuals wish to attain or what loss do they intend to avoid (Freund et al. 2010). The literature distinguishes between goals that are outcome-

focused and goals that are process-focused; a goal focused on the outcomes of a given activity is mainly concerned with ends rather than the process by which outcomes are attained. Vice versa, process-focused goals are concerned with the process of attaining outcomes, rather than the end results of a goal pursuit (Burnette et al. 2013; Freund et al. 2010; Latham 2003; Locke and Latham 2002).

These two goal foci place different weights on the goal attainment process and its outcomes. For example; individuals with an outcome focus could intend to close 50 sales deals or to lose 10 pounds of weight, while on the other hand individuals with a goal focused on a process might focus on attempting to follow the process leading to closing deals or weight-loss regardless whether that end outcome is attained or not. The desirable end-state of such a goal only extends to following and enjoying the process of closing deals or weight-loss. Due to these differences, it should be expected that different features of motivational designs might be better suited to individuals with either one of the goal foci more than the other depending on whether the features motivate through perceived betterment of the goal attainment process or by increasing the perceived value of attained outcomes. For example, it could be likely that individuals focused on goals' outcome would prefer features that would clearly showcase to them the outcomes they attained while individuals focused on a process would not be as appreciative of these features but might appreciate others.

2.1.2. Goal orientation

Goal attainment is also dependent on the *goal orientation* of the goal-seeker. Goal orientations describe the purpose for which an individual sets or does not set a goal (Pintrich 2000). Common orientations towards goal-setting are 1) mastery, 2) proving, or 3) avoidance (Hackel et al. 2016; Locke and Latham. 2002; Mann et al. 2013). 1) Mastery oriented users focus on self-development, and acquiring and developing skills, (Elliot and Harackiews 1994; Freund et al. 2010; Lunenburg 2011; Mann et al. 2013; Nahrgang et al. 2013; Zimmerman 2013). A goal to learn or to improve one's productivity relative to previous performance is an example of mastery orientations to goal-setting, similarly a goal could be to improve one's health for the sake of

one's own personal development rather than to for example show to others that one is healthy other orientations to goal-setting (proving) would tend to set goals. Individuals with mastery orientations could then focus on a specific outcome as a measure of mastery such as getting a high grade on a test, or losing a certain amount of weight, or they could focus on the process of continuous learning and health improvement as a measure of how much they are developing.

2) Proving oriented individuals validate their performance through comparison with external standards. For example, an employee with a proving orientation to goal-setting would seek to appear better than others through for example being regarded as the best sales person in their team regardless whether that goal is attained by a focus on an outcome number of deals to close or by a focus on following the process of closing deals most efficiently. Similarly, a person wanting to lose weight with a proving orientation to goal-setting would want to showcase to others how much weight they have lost and socially validate their accomplishments. 3) Avoidance oriented individuals avoid the setting of goals in order to avoid failure, or dodge negative some negative consequences (Capa et al. 2008; Hackel et al. 2016; Mann et al. 2013; Roskes et al. 2014; Zimmerman 2013). A sales person afraid of negative self or peer evaluations might hence avoid setting a goal altogether so that they do not experience a negative affect when their behavior falls short of expectations. An individual sharing these same fears of the same person but attempting to lose weight would similarly as the sales person avoid the setting of any goals to avoid negative self and social evaluations.

These orientations tend to be stable across time unless an intervention is in place (Tuominen-Soini et al. 2011), and they are acknowledged to influence the goal-attainment process and outcomes, and thus should be explicitly considered as independent variables of goal-setting. For example: individuals with a mastery orientation tend to make the process of goal attainment more enjoyable, while individuals with proving orientations have been correlated with better performance in terms of outcomes attainment (Freund et al. 2010; Lunenburg 2011). Orientations might hence influence what features individuals would employ to showcase their goal-setting outcomes or the lack thereof.

2.1.3. Goal attributes

Perceptions and attitude towards goal difficulty and specificity, are considered important attributes of set goals (Drach-Zahavy and Erez 2002; Latham 2000; 2003; Locke et al. 1981; Loock et al. 2013; Mealiea & Latham 1996; Rasch and Tosi 1992). Goal specificity as the relativistic perception of how clearly defined a goal is in relation to the goal-setter and the context of the goal; the more specific a goal is perceived, the better individuals are able to articulate it and evaluate their performance towards it, in contrast, perceptually unspecific or vague goals articulated by goals such as "do your best" could delude individuals and their social group into misevaluating their performance towards goals attainment (Capa et al. 2008; Latham 2003; Locke and Latham. 2002). On the other hand, a goal to increase productivity by a certain percentage relative to the last quarter or to lose a certain amount of weight is more defined and specific in terms of an intended outcome and hence easier to evaluate than the same goal articulated as "do your best".

Goal difficulty generally refers to the perceived effort needed for goal accomplishment (Capa et al. 2008). Difficulty is a subjective attribute as perceptions of difficulty differ from one individual to another and from a context to another, depending on a variety of variables. For example, a goal to lose 1 kilogram of weight or close one sales deal per week may be perceived as easy goals to an individual as they are goals that seem to require little effort for their attainment however the same goals to for example a person on a bed rest or working in a very competitive industry may perceive these goals as difficult as their attainment under such conditions would require a lot of effort. Nonetheless, perceptually *challenging* goals, positively influence persistence, and motivate individuals to exert more energy towards their attainment to match this perception of challenge (Locke et al. 1981; Locke and Latham 2002; 2013; Lunenburg 2011; Presslee et al. 2013; Rasch and Tosi 1992) if perceived in the right frame of mind (Drach-Zahavy and Erez 2002). The literature on motivational technologies recognize the variance across users in the evaluation and perception of difficulty and specificity, we hence see motivational systems that aim to tailor the difficulty and competition level afforded by the system to users' abilities and perceptions to ensure that they experience goals as optimally

difficult relative to their perception of difficulty so as to encourage energy exertion towards goal attainment, while still ensuring that the perceptually difficult goals are within users' ability ceiling and hence motivating rather than demotivating (Bouvier et al. 2014; op den Akker et al. 2014).

If an individual perceives a goal of for example closing one deal or losing one kilogram of weight per week as easy, they might exert less effort and be less likely to attain that goal compared to an individual who perceives the same goal as difficult yet within their abilities /not as an impossibly to attain goal). This difference in perception could be influenced by various variables, such as experience, understanding of the industry in which the individuals are employed and their levels of self-efficacy. Difficulty is hence to be evaluated relatively since it is generally acknowledged that the more relatively specific or relatively challenging the goals, the more likely individuals are to be motivated towards their attainment and to seek the means possible to improve their performance (Capa et al. 2008; Locke et al. 1981; Locke and Latham 2002; Nahrgang et al. 2013).

2.2. Motivational design

The information systems discipline has traditionally been characterized as the pursuit of knowledge pertaining especially to productivity and efficiency (see e.g. Hirschheim & Klein 2012), and ways in which they may be improved. A substantial body of knowledge has sprung from this rational, utility-seeking premise of aiding in the development and construction of efficiently managed and operated organizations and information systems within them. However, this utility-driven lens of information systems has not been geared towards capturing users' motivations as an important aspect of productivity within these computerized contexts. The first wave of literature started to widen the perspective of research into understanding that using a system might also be enjoyable in the early 1990s by studying the concepts of playfulness and enjoyment in relation to technology acceptance and use (see e.g. Webster & Martocchio 1992;

Davis, Bagozzi, & Warshaw 1992), and later in 2004 by e.g. van der Heijden (2004) via the development of models that addressed the acceptance and use of hedonic information systems.

However, during the last years this continuum has taken a new step; rather than only acknowledging the hedonic aspects of system use in its own right, new literature has sprung up that attempts to wield it towards productivity and in pursuit to help users reach their goals. These systems and veins of literature are primarily related to gamification (Deterding 2015; Hamari et al. 2015; Huotari & Hamari 2017; Santhaman et al. 2016), social networking design (Boyd and Ellison 2007; Chen et al. 2014;; Krasnova et al. 2015;; Lin and Lu 2011), and quantified-self (Choe et al. 2014; Gurrin et al. 2014; Swan 2009). Together they form the field of what is known as "*Motivational design*" or "*Motivational information systems"*. In the following subsections, we discuss popular design streams of motivation technology; gamification, social networking, and quantified-self, relating these discussions to the previously outlined variables of goal-setting under investigation.

2.2.1. Gamification

Games are often seen as pinnacle form of media that facilitates the emergence of enjoyable self-purposeful and motivating experiences (Deterding 2015; Hamari et al. 2015; McGonigal 2011). It was only a matter of time for the idea to come about that these 'gameful' affordances that games consist of could be employed to boost productivity and task engagement outside games (Deterding 2015; Hamari et al. 2015; McGonigal 2011; Santhanam et al. 2016). Today, this technological development has been coined as "gamification". In general, gamification refers to designs that attempt to give rise to similar experiences as games do (Deterding et al. 2011; Huotari and Hamari 2017). Gamification commonly attempts to employ mechanics familiar from games (See Table 1). Gamification has been employed to enhance motivation and engagement in various contexts that include; education (Christy and Fox 2014; Hamari et al. 2016; Hanus and Fox 2015; Landers 2014; Lieberoth 2015); government services (Bista et al. 2014; Hassan & Nader 2016), exercise and health (Hamari and Koivisto 2015a; Jones et al. 2014), enterprise resource planning (Alcivar and Abad 2016; Raftopoulos 2014), commerce (Bittner and Schipper

2014; Hamari 2013; Hamari 2017), intra-organizational communication and activity (Farzan et al. 2008a, 2008b; Jung et al. 2010).

However, gamification implementation can vary in terms of how deep-rooted and varied they are. Some gamification implementation may for example attempt to immerse the user in a narrative rich role-play (Döpker et al. 2014; Uhlmann and Battaiola 2014), whereas others may attempt to add gamefulness via reaction and finesse -requiring gameplay (See e.g. Hamari et al. 2014a; 2014b; Morschheuser et al. 2016; Seaborn and Fels 2015 for reviews). Most commonly, however, gamification implementations have focused on easily transferable mechanics such as points, badges and leaderboards that easily fit into a variety of services across the information systems sphere (See e.g. Hamari et al. 2014; Morschheuser et al. 2017).

Goal-setting foci. As prior research indicates, positive perceptions of gamification that lead to its adoption, may depend on users' relationships with goals (e.g. Hamari 2013; Landers et al. 2017). Differences in individual preferences and personal goals influenced the effects gamification has on motivation and goal attainment (Zuckerman and Gal-Oz 2014). Gamification can be often seen geared towards the attainment of rewards such as badges, points or higher placement in a game hierarchy such as beating others on a leaderboard (e.g. Christy and Fox 2014; Cruz et al. 2015; Hamari 2013; 2017; Hamari et al. 2014b), therefore, gamification may be more suited for users who focus on *outcomes* as opposed to a focus on the goal-attainment *process*. However, gamification also intends to create a gameful, enjoyable experience (Deterding et al. 2011; Huotari and Hamari 2017; Lieberoth 2015; Nicholson 2012; Vesa et al. 2017), that may make the use of gamified systems more enjoyable (Jung et al. 2010), matching the preferences of process-focused individuals. We could thus additionally expect that if the gamification implementation is successful in creating an immersive enjoyable experience, that it might be appreciated by individuals focused on enjoying the process of goal attainment.

Goal-setting. orientations. It follows from the above discussions that *proving oriented* individuals who wish to showcase and prove their competence to others, would positively

perceive gamification features; leaderboards, points, badges and such mechanics allow for the communication of achievement easily to others (Burke 2014; Landers et al. 2017). *Mastery oriented* individuals may also find benefits from the use of gamification as it would allow them to observe their self-development through the same game mechanics. For example, progress bars and points allow individuals to visualize the effort they have put thus far towards the achievement of a goal or the attainment of a skill. They also allow individuals to infer their progress and the effort needed to reach their goals, thus supporting their journey of self-improvement. We can consequently expect that proving and mastery-oriented individuals would positively perceive gamification and intend to use it in the future.

On the other hand, *avoidance*-oriented individuals with would in contrast place little importance on use of gamification and may even perceive such a design class negatively and avoid its usage. As previously indicated, individuals with a goal-avoidance orientation would generally avoid setting explicit goals so as not to be negatively perceived by their peers if they fail in goal attainment (Capa et al. 2008; Hackel et al. 2016; Mann et al. 2013). While they might still use gamification features for enjoyment and immersion purposes, these same features emphasize progress and may thus emphasize failures and achievement shortcomings; dangers which individuals with a goal-avoidance orientation would be expected to avoid. It is thus expected that individuals with a goal-avoidance orientation would negatively perceive gamification features and intend not to use them in the future.

Goal attributes. It is believed that one of the main motivational effects of gamification stem from its ability to make goals more SMART (Burke 2014; Hamari 2013; Hamari 2017; Landers et al. 2017); that is, more Specific, Measurable, Attainable, Realistic, and Time-bound. Such goals, according to goal-setting theory and decades of research, assist individuals towards the attainment of their goals (Locke and Latham 2002; Mann et al. 2013). We could thus postulate that individuals who lean towards *specificity* in goal-setting may positively perceive the features of gamification because of this trait. The affordances gamification offers would resonate with the specificity attribute of their goals, thus increasing the likelihood that they would continue to use

gamification features to support their appreciation for specific goals. Although, a few studies have discussed the relationship between gamification and goal-setting, currently there is a dearth of literature that specifically measured this relationship between the specificity attribute of goals and perceptions of gamification and thus no final conclusions on the relationship could be drawn.

Difficulty and challenge is a matter of utmost importance in game design, some games attempt to match for example their difficulty and challenge level to the skills of players sometimes in real-time and according to player types as quickly and frequently as these differences are discovered (Cowley & Charles 2016). The aim is to ensure engagement with the game by matching the challenge level to user preferences and skills, thus putting players in an enjoyable state of "flow" where they are immersed in the task at hand (Csikszentmihályi 1975). Gamification attempts to mimic this experience (Hamari & Koivisto 2014a) that may facilitate user engagement with their goals long enough to attain them. Gamification also as explained has the ability of molding goals into SMART-ness, that may additionally assist in making difficult goals seem more attainable (Burke 2014; Landers et al. 2017). Thus, we may expect individuals who tend to set difficult goals to positively perceive features of gamification design once they realize its potential to assist them in attaining their goals. Furthermore, the gameful experience afforded by gamification (Huotari and Hamari 2017; Nicholson 2015), may also be appreciated by these individuals, as they may wish to offset the perceived difficulty of their goals with gamefulness. However, currently there is a dearth of literature that specifically measured this relationship between the difficulty attribute of goal-setting and perceptions of gamification and thus no final conclusions on the relationship could be drawn.

2.2.2. Social networking

Social computing application have existed for a long time before and after the inception of the internet (Mamdani et al. 1999; Parameswaran and Whinston 2007), however, no other technological development has taken social computing to the heights we see today than the emergence of Social Networking Services (such as Facebook[8], Twitter[9] and Instagram[10] to name

8 https://www.facebook.com/

a few) (Boyd and Ellison 2007; Richter and Koch 2008). We can even observe many social networking features (such as messaging, friending, virtual cheers and discussion forums) added to information systems and not just as part of standalone services for social networking (Farzan et al. 2008a, 2008b; Jung et al. 2010). This design movement spawned off as a consequence of the growingly networked nature of our society and its unprecedented enabling infrastructure (both hardware and software layers) (Boyd and Ellison 2007; Butler 2001). Today, we can interact with peers and non-peers anywhere, anytime to a degree, that has started to regulate and direct how we live our lives, what aspirations we develop and what goals we set for ourselves as well as how we progress towards those goals (Butler 2001; Butler and Wang 2012; Hamari and Koivisto 2015a; Richter and Koch 2008). Individuals gravitate towards social features as humans potentially rely on the feedback – and social support and encouragement (Hamari & Koivisto 2015a) - received from these networks to stay motivated. Communities, peers, and social groups are increasingly considered important facets of self-regulation and goal attainment (Bouvier et al. 2014; Latham 2003; Loock et al. 2013; Mann et al. 2013).

Social comparison (Festinger 1954) understood as a process of comparing goals and accomplishments to those of others often to evaluate one's performance against an external standard, is a process thought to motivate individuals to improve their performance relative to others according to the social comparison theory and many research studies (Chan and Prendergast 2007; Hamari and Koivisto 2015a; Petkov et al. 2011; Zuckerman and Gal-Oz 2014). Social Networking Services and features unparalleled expose us to social influence and comparison (Cialdini and Trost 1998; Cialdini and Goldstein 2004; Hamari and Koivisto 2015) and additionally increase users' perceptions of relatedness (e.g. Deci and Ryan 2000) and their sense of community (e.g. Hernandez et al. 2011).

Communities influence their members through their tendency to develop shared norms of behavior to be adhered to by the community members and through the social feedback the community exchanges (Hamari and Koivisto 2015a). Social feedback facilitated by sharing

9 https://twitter.com/
10 https://www.instagram.com/

within the community provides a channel for soliciting approval and external performance evaluations (Jung et al. 2010; Zuckerman and Gal-Oz 2014; Hildebrand et al. 2012) Such feedback usually promotes social reciprocity (Hamari and Koivisto 2015a; Munson and Consolvo 2012), and is considered a reason why social designs may be motivating in goal pursuit (Hamari and Koivisto 2015; Hildebrand et al, 2012; Petkov et al. 2011).

Goal-setting foci. Individuals' with a *process* focus to goal-setting as discussed mostly intend to enjoy the process of goal attainment (Burnette et al, 2013; Freund et al, 2010; Latham, 2003; Locke and Latham, 2002; Mann et al, 2013). It may thus be expected that they would attempt to enjoy the process by sharing their updates, thus earning themselves cheers, and the support of a community as discussed. On the other hand, social comparison is also associated with negative emotions such as envy and inadequacy (Krasnova et al. 2013; Krasnova et al. 2015; Tandoc et al. 2015). Individuals with a process focus to goal-setting may thus avoid social networking features if they tend to experience such negative emotions. It is consequently difficult to hypothesize on the relationship between process-focused goals and perceptions of social networking designs.

Individuals with *outcomes* focus to goal-setting on the other hand may draw benefits from the use of social networking features due to the ability of these features to inspire social reciprocity, comparison, and recognition. Cheers individuals receive in response to their achieved outcomes, revalidate to them the importance of reaching these outcomes, thus resonating with their outcomes orientations. Additionally, the cheers would push these individuals more towards a focus on reaching outcomes in order to collect more cheers. On the other hand, if the outcomes individuals wish to achieve do not match the values of their social networks or if these networks are not vibrant enough to cheer the achievement of these outcomes, then it is also likely that individuals with outcome-focused goals would draw little use from social networking features, thus negatively affecting their perception of these designs. Beyond that, social networking can also be negatively correlated with goal commitment when social feedback emphasizes personal shortcomings (Kim et al. 2016; Zuckerman and Gal-Oz 2014), or when individuals pursue goals scarcely appreciated by their social group (Latham 2003). Such situations that can lead to

unfavorable evaluations of one's self or cause a disturbance to one's publicly projected image are considered Ego Threats that individuals are thought to avoid (Dijkstra 2014; Burnette et al. 2013), they can also lead to envy, and decreased emotional wellbeing (Krasnova et al. 2013; Krasnova et al. 2015; Tandoc et al. 2015). In such conditions, the social networks individuals have no longer provide them with favorable social support and hence the network may potentially lose its perceived value by the individual. These conditions may therefore become a reason why individuals with an outcome focus to goal-setting may eventually avoid the use of social networking features even if these features afford them a channel to support their goal attainment. It is thus hard to finally hypothesize the extent to which individuals with an outcome focus to goal-setting would weight potential benefits from social networking designs against their potential drawbacks.

Goal-setting orientations. Proving as an orientation to goal-setting, relies by definition on social communities in order for one to prove one's competences to others. Individuals with a proving orientation utilize social measures in the evaluations of their goals (Capa et al. 2008**;** Hackel et al. 2016; Hamari & Koivisto 2015a; Locke and Latham 2002; Roskes et al. 2014). It could thus be expected that individuals with a proving orientation to goals would positively perceive social networking designs and intend to utilize their features. Online social games and gamified applications from Farmvile [11]to PokemonGo[12], indicate that social sharing, competition and social comparison are some of the possible ways individuals perceive and communicate their achievements through a network of friends to whom they wish to prove competence. However, individuals are not always inclined to disclose their serious goals from the use of an application or their goal-related progress due to fears of over sharing, boring their community (Munson and Consolvo 2012), or fears of revealing too much of their private information (Swan 2009).

Individuals with an *avoidance*-orientation to goal setting are scarcely expected to have goals to communicate with their network in the first place, let alone positively perceive these social

[11] https://www.zynga.com/games/farmville
[12] https://www.pokemongo.com

designs or intend to continue using a service for their features. Social recognition has a positive influence on attitudes towards motivational services employing social features only when the received feedback or social recognition is considered beneficial (Hamari and Koivisto 2015a; Loock et al. 2013; Jung et al. 2010). In situations where the recognition received is negative or deemed less beneficial (possibly due to the lack of achievements or goals to communicate in the first place) (Munson and Consolvo 2012) avoidance of social networking features may be expected especially by avoidance oriented individuals who tend to prefer avoiding embarrassment, or negative social judgment (Capa et al. 2008). Thus, it is likely that individuals specifically with avoidance orientations would prefer to avoid social features altogether.

Individuals with a *mastery*-orientation to goal-setting could be thought of as individuals whose main focus is on themselves and on improving their skills (Burnette et al. 2013; Elliot and Harackiews 1994; Freund et al. 2010). These individuals may hence pay little attention to their social network or how external individuals perceive their goal-related performance. What would be expected to mater more to them is mainly how they themselves perceive and evaluate and their own progress towards the mastery of the skills they wish to master. Accordingly, it is thus hard to expect that these individuals would draw much benefit from social networking designs and thus we expect that they would not positively perceive its features or intend to continue to use a motivational service because of the presence of these features.

Goal attributes. Social groups provide individuals with behavioral directions based on the values the social groups perceive positively (Cialdini and Goldstein 2004; Cialdini and Trost 1998; Hamari and Koivisto 2015a; Jung et al. 2010). At times, these directions may not be specific enough for effective self-regulation (Nahrgang et al. 2013) and thus provide little assistance for individuals who appreciate goal-*specificity*. For example; goals to “work hard”, or to “work harder than last quarter”, or to “increase output by 5%” have different levels of specificity and thus would be appreciated differently by different individuals. We could expect that a mismatch between the goals specificity degree that individuals and their social group respectively appreciate, would influence the extent to which individuals positively or negatively perceive

social networking with these groups and the features that facilitate it. On the other hand, this mismatch possibly when the individual has a specific goal the achievement of which could be easily communicated, may lead the larger social groups with unspecific or hardly quantifiable goals, to exaggerate the individual's goal achievement, thus making the individual appreciate the social features of a motivational service. It is thus hard to determine with certainty whether individuals with specific goals would perceive more benefits from the use of social networking features than drawbacks.

With regards to the *difficulty* attribute of goals, generally, the more individuals lean towards perceptually difficult goals regardless who set them for the individual, the greater the energy and motivation needed for its attainment (Drach-Zahavy and Erez 2002; Locke and Latham 2013; Presslee et al. 2013). Individuals who lean towards goals perceived as difficult may find that social cheers are motivational and assistive with goal attainment. They may however on the other hand avoid the use of these features for fears of failures due to the difficulty of their goals. As previously was the case with avoidance-oriented individuals, we expect that individuals with difficult goals would lean towards the avoidance of social designs.

2.2.3. Quantified-self

The last few years witnessed a rise in the adoption of devices such as smart watches, activity trackers, and sleep monitors, coupled with an increase in the use of Quantified-Self (QS) software and features (Castillejo et al. 2013; Gurrin et al. 2014; Rawassizadeh et al. 2015; Swan 2009; Lupton 2016; op den Akker et al. 2014) as well as increased use of quantification sensors, GPS tracking, and visualization software (Choe et al. 2014; Lupton 2016; Mehta 2011). Quantified-self hardware and software automatically track changes in certain variables that individuals are interested in as measures of their performance in a certain area of interest such as health (see op den Akker et al. 2014 for a review), work productivity, or self-development (Swan 2009). This has given rise to the quantified-self movement (Choe et al. 2014; Mehta 2011; Munson and Consolvo 2012; Zuckerman and Gal-Oz 2014), which emphasizes the importance of the regular collection, processing, and presentation of data on behavioral indicators,

environmental indicators or biological indicators etc. as measures to evaluate personal performance so that individuals can better achieve progress in their areas of interest (Lupton 2016; Swan 2009), Such tracking of variables of interest is also of societal benefit as it might help individuals remain healthy and productive, lowering health care costs for a society while possibly increasing productivity levels (op den Akker et al. 2014). Typically, QS designs employs features such as logs, diaries, performance graphs and other statistical analyses.

Quantified-self measurements have been experimentally (Munson and Consolvo 2012), and observationally (Mehta 2011) linked to increases in performance towards goal attainment. Additionally, it is thought to be important to support goal-setting, in general and self-regulation in specific (Choe et al. 2014; op den Akker et al. 2014; Zuckerman and Gal-Oz 2014), and thus has been adopted in the design of several information systems such as with Nike+[13], MyFitnessPal[14], Habitica[15] and many others. It is thus expected that individuals who focus on the outcomes of goal-settings would use QS as a mechanism to ensure regulation of their performance. However, while QS certainly does offer individuals many benefits that could help in the pursuit of outcomes, attitudes towards quantification are negative and quantification has been judged by its users as ineffective in reaching outcomes, although their performance data may indicate otherwise (Zuckerman and Gal-Oz 2014). Such dissonance between the perceived and actual benefits from quantified-self features in terms of outcomes attainment support may be due to several cognitive, affective, and behavioral barriers to the adoption and use of quantification as a motivational mechanism.

Goal-setting foci. Keeping track of variables of interest is considered time consuming as collected data is subject to fragmentation across several applications, and extensive cognitive skills are required for comprehending and benchmarking the collected data, let alone to draw behavioral conclusions based on it (Choe et al. 2014). Additionally, qualitative aspects of performance such as quality, or personal conditions such as moods are not easily trackable

13 http://www.nikefuellab.com
14 www.myfitnesspal.com/
15 https://habitica.com/

through most quantitative measure of performance (Swan 2009), hence certain outcomes are not always best reflected through QS features. It is thus hard to draw final conclusions on the perceptions of QS features by user with *outcome*-focused goals. On the other hand, individuals who focus on the *process* of goal-setting may appreciate a stream of details as to how their process is proceeding. Their focus on the process may additionally instill in them the drive to acquire the needed skills to comprehend QS data and to use it as a continuous, precise measure of a process that extends overtime.

Goal-setting orientations. As discussed, individuals with a *proving* orientation utilize social measures in the evaluations of their goals (Capa et al. 2008**;** Hackel et al. 2016; Locke and Latham 2002; Mann et al. 2013; Roskes et al. 2014), since the interpretation of the quantified-self data is reportedly challenging for self-quantifiers themselves (Choe et al. 2014; Gurin et al. 2014), let alone for individuals outside of this interest circle. It is unrealistic to expect all individuals to have the ability to interpret and evaluate QS features and output or to be aware of the benchmarks against which to evaluate the data it provides. Thus, individuals with a proving orientation to goals would unlikely be able to prove themselves through QS features as their social circles may lack the skills needed to evaluate the QS data. It is however still possible that individuals with a proving orientation might be able to meaningfully select, summarize and interpret their data in ways that demonstrate their achievement to their circles without requiring such external evaluators to possess data interpretation skills. Additionally, individuals with a proving orientation may seek membership in communities that have the ability to interpret their performance and celebrate them for it. Empirical studies so far do not support such an assumption as self-quantifiers are hesitant to share their performance even to potentially an interested community (Barrett et al. 2013; Choe et al. 2014). Thus, the extent to which quantified-self-ers would positively perceive QS features and intend to use it could not be definitely determined from the available theoretical base.

With regards to individuals with an *avoidance* orientation to goal-setting; it is likely that their lack of goals could make them perceive QS features positively as these features would provide

them with a tracking mechanic of their activity regardless of a final evaluation of it that these individuals general tend to wish to avoid as communicated by Hackel et al. (2016); Mann et al. (2013); Zimmerman (2013). In this sense, the use of QS features does not necessarily require the pre-hand existence of goals and hence they could be appreciated by individuals with avoidance orientation. On the other hand, quantification is instrumental to self-knowledge and development (Munson and Consolvo 2012; Zuckerman and Gal-Oz 2014). Individuals with a *mastery* orientation are above all interested in developing their skills and thus they may perceive QS as a method to regularly and accurately measure and evaluate their performance towards mastery. It is thus expected that individuals with a mastery-orientation to goal-setting would perceive QS positively.

Goal attributes. Quantified-self designs support self-regulation through provision of performance data that allows for detecting and correcting discrepancies between intended and actual outcomes (Swan 2009; 2013; Whitson 2013). Quantified-selfers recommend the development of specific goals for the successful collection and interpretation of quantification data (Gurrin et al. 2014): the more specific the goal, the more effective QS features are. It is thus expected that individuals who set *specific* goals would appreciate QS features, perceive it more positively, and draw greater benefits from it.

Generally, the more individuals lean towards perceptually *difficult* goals regardless of the source of the goal, the more likely they could be expected to appreciate a stream of data that would allow them to detect discrepancies between intended and actual performance early on. On the other hand, if individuals do not possess the abilities and resources to use QS features, the use of such tools may make difficult goals seem more challenging and individuals would thus prefer to avoid their use and instead adopt more intuitive features to support their difficult goals. Consequently, no definite conclusions could be made as to the relationship between difficulty of goals and perception of QS features.

2.3. Research model

This study set the following research question: "*how different goal foci (outcome and focus), goals orientation (mastery, proving, and avoiding), and goal attributes (specificity and difficulty) are associated with perceived importance of gamification, social networking and quantified-self -features"* with the aim of producing knowledge for understanding which of the motivational design are better suited for users with different goal focus, orientation and goal attributes. While we have extensively discussed the possible relationships between the dimensions of goal-setting and the motivational design classes there still remains ambiguity on what can be expected and hypothesized about these relationships. Table 1 presents a summary of the concepts and expected associations of these design and their relationships with various goal-setting variables.

Table 1 Summary of concepts

		Gamification design	Social networking design	Quantified-self design
Affects motivation through		Users' psychological needs which are commonly related to the ones connected with game experiences e.g. autotelicy, mastery/competence, immersion, flow etc. (See e.g. Deterding 2015; Huotari and Hamari 2017; Zhang 2008).	Users' social psychological needs e.g. social support and feedback (Hamari and Koivisto 2015a), social comparison (Festinger 1954), relatedness (e.g. Deci and Ryan 2000) and the sense of community (e.g. Hernandez et al. 2011; Morschheuser et al. 2017).	Users' cognitive needs for information about their activity (Swan 2009; Swan 2013; Zhang 2008)
Common design features		Points/score/XP, Challenges/quests/missions/tasks/goals, badges/achievements/medals/trophies, leaderboards/ranking, progress, quizzes, timers, avatar/character, narrative/stories, roleplaying (See e.g. Hamari et al. 2014a; Hamari et al. 2014b; Morschheuser et al. 2016; Seaborn and Fels 2015; Koivisto & Hamari 2017).	Social feed, bragging, messaging, social networking/friending, teams/collaboration, customization/personalization, cheers/praise and comments (Hamari & Koivisto 2015a; Koivisto & Hamari 2017; Ling et al. 2005; Morschheuser et al. 2017; Zhang 2008)	Self/activity-quantification features related to tracking such as logs, statistics, diaries, visualization of data, benchmarks, forecasts (Choe et al. 2014; Lupton 2016).
Relationship with goal-setting (based on prior literature)	**Goal Foci** (outcome, process)**:**	Importance of gamification features is more likely to be positively associated with outcome focus rather than process focus as gamification commonly rewards (intermediary)outcomes of behaviour (e.g. points, badges etc.).	No clear enough expectation related to the association or direction (positive or negative) can be ascertained between social networking design and goal focus.	Importance of QS design is more likely to be positively associated with process focus rather than outcome focus as QS design is more geared towards tracking the entire process of the activity rather than evaluating the outcome. However, QS design can also

				provide information about the fulfilment of goals, and therefore, may also be positively associated with the outcome focus
	Orientations towards goal-setting (proving, mastery, avoidance)**:**	Importance of gamification features is more likely to be positively associated with the proving and mastery orientation rather than avoidance orientations as gamification commonly aims at showcasing user's achievements and the progress leading to these achievements.	Importance of social networking design is likely to be positively associated with the proving orientation as it affords sharing (and thus proving) achievements, as well as be negatively associated with avoidance orientation as social networking design would also afford showcasing subpar goal progress and thus can strengthen the fear of failure.	Importance of QS design is likely to be positively associated with the mastery orientation as it affords accurate tracking of the activity, and therefore, provides important feedback for self-development
	Goal attributes (specificity, difficulty)**:**	No clear enough expectation related to the association or direction (positive or negative) can be ascertained between gamifications and goal attributes.	No clear enough expectation related to the association or direction (positive or negative) can be ascertained between social networking design and goal attributes.	Having specific goals is likely to be positively associated with the perceived importance of QS design since having specific goals affords a more purposeful and relevant use of tracking and metrics

In the empirical portion of the study we investigate the relationship between all the goal-setting related constructs and the importance of all of the three principle classes of motivational designs for users. Figure 1 depicts the research model investigated.

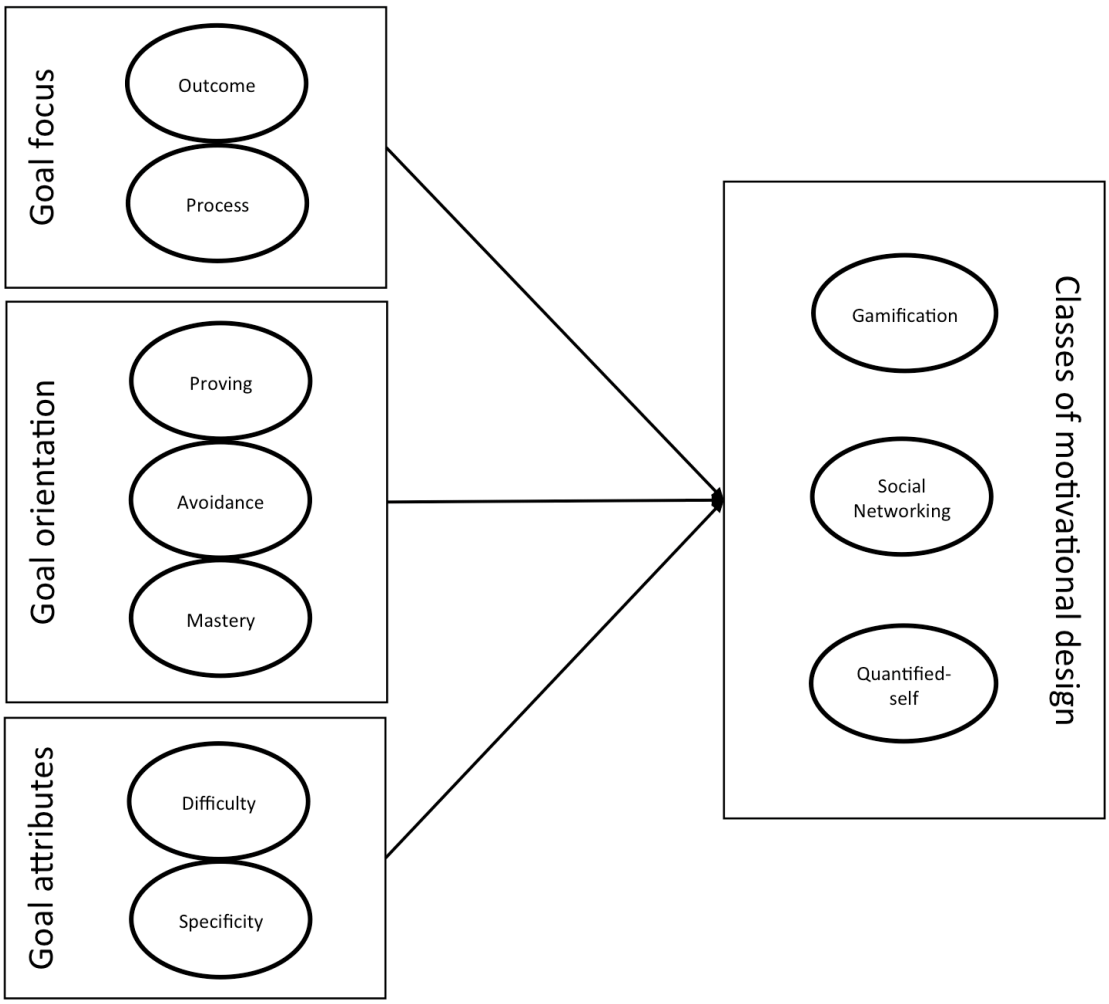


Fig 1 Research model

3. Empirical study

3.1. Participants

One hundred sixty-seven (N=167) users of a Finnish-based major exercise encouragement app called HeiaHeia that was launched in 2010 on the App stores of Apple, Android and Microsoft successfully completed an online survey. Users of HeiaHeia were selected as HeiaHeia simultaneously incorporates features of gamification, quantified-self and social networking – the main classes of motivational design, meaning that its users and the participants of the study would have experience with the three types of designs, allowing for comparative study of the perceptions of these designs. Please refer to Table 2 for demographic details of the respondents. About 72.5% of respondents were female, 60% were between 30 and 49 of age, 90% had a college or university degree, 70% of respondents are fully employed, while students amount to 13.3%. 63% have been using the service for 2 or more years and an additional 17% have used it for over a year (Table 2). Most visit the service daily or several times a week (79.5%). Almost all (94%) exercise at least 3 times a week (see Table 2). 97% of users declared to log all or most of their physical exercise in the service.

Table 2 Demographic details of respondents

	N=167	Frequency	Percent			Frequency	Percent
Age	Under 20	3	1.8	**Weekly visits to the service**	More than once a day	10	6
	20-29	34	20.4		Daily	46	27.5
	30-39	53	31.7		Several times	87	52.1
	40-49	47	28.1		1 or 2 times	20	12
	50-59	22	13.2		Rarely	4	2.4
	60 or older	8	4.8	**Weekly Exercise**	More than once a day	6	3.6
Gender	Male	46	27.5		Daily	29	17.4
	Female	121	72.5		Several times	122	73.1
Tenure	< 1 year	34	20.4		1 or 2 times	10	6
	1-2 years	28	16.8		Rarely	0	-
	2+ years	105	62.9		-	-	-

3.2. Materials and measurement

Users of HeiaHeia can either use the app individually or as a part of a group e.g. their company fitness group as the app encourages. Upon signing up, users are asked to log their exercise related information in terms of height, weight and target weight or similar goal (or none) that they want to achieve from the use of the app. They then proceed to log in their activity in terms of exercise type, length, vigorousness or non-performed exercise because of sickness. Users can also log qualitative aspects of exercise in a diary such as for example how they felt or other remarks about the activity they performed. Users can check the activities of other users or friends they are connected to through the app, cheering them on their activity or communicating with them as they please and leaderboards are used to rank them in terms of exercise-related point earned during a week. The app could optionally be connected to a fitness wearable so that the exercise info is automatically logged. Gamification features present on HeiaHeia include medals, levels and leaderboards. Social networking -features include cheering, commenting and friends'

activity, as displayed on one's own newsfeed. Quantified-self features include manual and automatic logs, and activity tracking of exercise, sick days and performance indicators. While most of the features of the service are prominently displayed in the service and may be nearly impossible to ignore, their use is mostly volunteer, with the exception of medals and levels. These are awarded to users in accordance to predefined milestones (e.g. medal badges at 10, 25 or 50 times of each exercise) or less (levels) known points. Figure 2 provides several screenshots from HeiaHeia, depicting some of its key features.

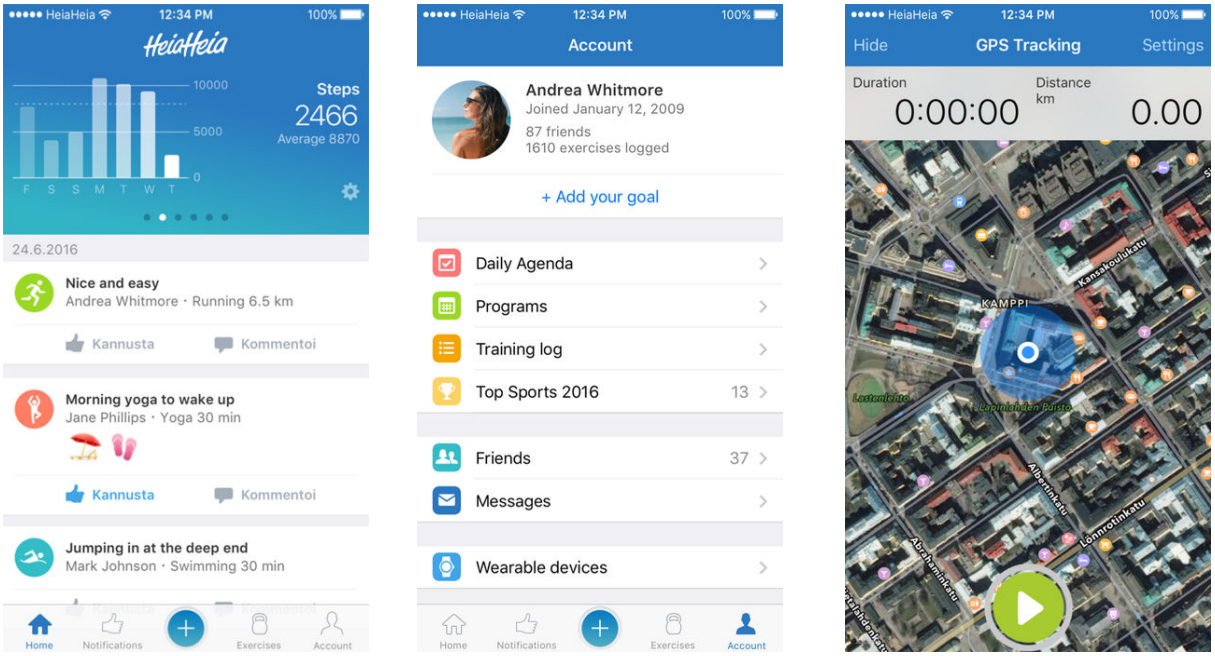


Fig 2 HeiaHeia screenshots

A questionnaire was implemented through Webropol; an online surveying tool. Questionnaires are a standard approach when a study is measuring latent (psychometric) variables such as traits, attitudes, beliefs and experiences (e.g. Nunnally 1978). They allow access to the respondents' individualized perception of their reality as is rarely allowed by other measurement technique (Barker & Pistrang 2015; Bouvier et al. 2014; Fransella 1981). The link to the questionnaire was placed inside the service by its operators for a duration between 24th of November and 18th of December 2014, visible only to registered users to ensure that potential respondents have been exposed to the service before their participation in our study. The questionnaire employed 7-point scales in measuring users' perceptions of the importance of features of gamification, social

networking and quantified-self ("On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?") as well as users goal-setting related factors in terms of foci (outcomes, process), orientations towards goals (proving, mastery, avoidance) and goal attributes (difficulty and specificity) ("Consider the following statements regarding your exercise" 1 – strongly disagree – 7 – strongly agree): (See Table 3 for measurement items as well as how each load on their corresponding variable they measure).

Table 3 Survey constructs and measurement items

Construct	Item	Loading	Source
	"Consider the following statements regarding your exercise" 1 – strongly disagree, 7 – strongly agree		
Goal focus: Outcome	I often compare my current condition to the condition I want to attain in future.	0.856	Adapted from definitions and description-based measure in Freund et al. 2010
	I often think what will it be like to attain/reach my exercise goals	0.846	
	I often dream about the day I will reach my goals	0.759	
	I often compare my current condition with a past condition	0.801	
	I often think of the distance between my current physical condition and my goals.	0.817	
Goal focus: Process	I often think of what I can do to pursue my exercise goals	0.803	
	I often think about how I could optimize my exercise sessions	0.782	
	While exercising, I pay attention how my exercise is going	0.815	
	When exercising, I am very focused on the exercise itself	0.664	
Goal orientation: Proving	It's important for me to prove that I am better than others	0.665	Adapted from Elliot & Mcgregor 2001; VandeWalle 1997;
	It's important that others know how well I	0.831	

	am doing		VandeWalle et al. 2001
	To be honest, I really like to prove my abilities to others	0.822	
	I think that it's important to do well to show how good you are	0.804	
Goal orientation: Mastery	I'm willing to take on a difficult challenge if it helps me reach my goals	0.733	
	I like challenges that really force me to put on a hard effort	0.879	
	I prefer challenging goals so that I'll improve a great deal	0.773	
	I truly enjoy challenges for the sake of mastering them	0.782	
Goal orientation: Avoidance	I prefer to avoid challenges where I could risk performing poorly	0.784	
	I am more concerned about avoiding failure in exercise than I am about doing well	< 0.600	
	I would rather drop a difficult challenge than fail	0.879	
	I would rather take on a challenge that I am familiar with so that I can avoid doing poorly	0.653	
	I would rather take on challenges that I feel that I will probably do well in	0.653	
Goal attribute: difficulty	My goals in [the service] require a great deal of effort	0.869	Adapted from Wright 2004
	My goals in [the service] are very challenging	0.892	
	Goals like mine in [the service] are quite demanding day after day	0.796	
Goal attribute: Specificity	I understand exactly what I am supposed to do to achieve my goals in [the service]	< 0.600	Adapted from Lee et al. 1991; Locke &

	If I have more than one goal to accomplish with [the service], I know which ones are the most important and which are the least important	0.850	Latham 1984; Wright 2004
	When using [the service] I feel that my goals related to exercise are clear	0.643	
	I have very specific, clear outcomes to aim for in [the service]	0.699	
Gamification	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Medals	0.899	
	Your top sports list	0.760	
	Levels (bronze, silver, etc.)	0.796	
Social networking	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Cheering	0.848	
	Commenting	0.831	
	Friends' logs	0.872	
	Top friends	0.827	
Quantified-self	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Advanced tracking features	0.680	
	Log	0.767	
	Sick days	0.800	

3.3. Procedure

Both the measurement model (validity and reliability) and structural model (results) were assessed using the component-based PLS-SEM of SmartPLS 3 (Ringle, Wende, and Will, 2005). The use of structural equation modelling (SEM) is a standard approach in studies that investigate several dependent relationships simultaneously especially when analyzing complex multivariate

structural models containing both the measurement model (confirmatory factor analysis of constructs (see e.g. Nunnally 1978 on latent psychometric variables)) and the structural model (multiple regression models investigating the relationship between constructs) (Hair et al. 2010; Hair et al. 2016).

The advantage of the component-based PLS-SEM estimation in particular, when compared to co-variance based structural equation methods (CB-SEM), is that it is non-parametric and therefore makes no restrictive assumptions about the distributions of the data. Secondly, PLS-SEM better tolerates smaller samples. Thirdly, PLS-SEM is considered to be a more suitable method for prediction-oriented studies, whereas co-variance based SEM is better suited for testing which models best fit the data (Anderson & Gerbing 1988; Chin et al. 2003). Fourthly, PLS-SEM can provide a more accurate measurement of the path coefficient in the model, whereas it has been demonstrated that CB-SEM can inflate path coefficients (Chin et al., 2003). For these reasons, we selected PLS-SEM estimation over CB-SEM (Anderson & Gerbing 1988; Hair et al. 2011; Hair et al 2016; Lowry & Gaskin 2014).

3.4. Results

3.4.1. Measurement model: validity and reliability

Convergent validity of the measurement (see Table 4) was assessed through Average Variance Extracted (AVE) and Composite Reliability (CR) of the construct's (AVE should be > 0.5, CR > 0.7 (Fornell and Larcker 1981). Moreover, we omitted two items that loaded onto their corresponding constructs below 0.6 (Goal orientation: avoidance item 2 and Goal attribute specificity item 1). As the employed measure of convergent validity are above the indicated thresholds, we can conclude that the convergent requirements of validity and reliability for the model were met. Discriminant validity was assessed, firstly, through the comparison of the square root of the AVE (diagonal line, Table 4) of each construct to all of the correlations between it and other constructs (see Fornell and Larcker 1981), where all of the square root of the AVEs should be greater than any of the correlations between the corresponding construct and

another construct (Chin 1998). Secondly, we assessed the discriminant validity by confirming that each item had the highest loading with its corresponding construct. All three tests indicated that the discriminant validity and reliability were acceptable.

The sample size satisfies different criteria for the lower bounds of sample size for PLS-SEM: 1) ten times the largest number of structural paths directed at a particular construct in the inner path model (Chin, 1998), and 2) according to Anderson and Gerbing (1984; 1988), more than 150 respondents as the model is comprised of more than three. 3) The sample size also satisfies stricter criteria relevant for variance-based SEM: for example, Bentler and Chou (1987) recommend a ratio of 5 cases per observed variable.

Table 4 Validity and reliability (Fornell and Larcker -criterion)

	AVE	CR	GFO	GFP	GOP	GOA	GOM	GAD	GAS	G	S	Q
GFO	0.667	0.909	**0.816**									
GFP	0.590	0.863	0.703	**0.768**								
GOP	0.614	0.833	0.239	0.179	**0.784**							
GOA	0.560	0.871	0.089	0.002	0.134	**0.748**						
GOM	0.630	0.889	0.258	0.502	0.271	-0.262	**0.793**					
GAD	0.728	0.793	0.379	0.404	0.268	-0.202	0.476	**0.853**				
GAS	0.564	0.860	0.463	0.460	0.156	-0.186	0.346	0.524	**0.751**			
G	0.674	0.909	0.345	0.308	0.208	-0.064	0.135	0.066	0.234	**0.821**		
S	0.714	0.794	0.158	0.094	0.249	-0.256	0.151	0.060	0.179	0.425	**0.845**	
Q	0.564	0.851	0.384	0.376	0.241	0.008	0.316	0.255	0.342	0.442	0.357	**0.751**

Bold = square root of the AVE of a given construct
AVE = Average variance extracted, CR = Composite reliability
GFO = Goal Focus: Outcome, GFP = Goal Focus: Process, GOP = Goal Orientation: Process, GOA = Goal Orientation: Avoidance, GOM = Goal Orientation: Mastery, GAD = Goal Attribute: Difficulty, GAS = Goal Attribute: Specificity, G = Gamification, S = Social networking, Q = Quantified-self

3.4.2. Structural model: results

The structural equation modelling results obtained from the data gathered among HeiaHeia users showed that the path model accounted for 18.7% of the variance of the perceived importance of the gamification design, 18.6% of the perceived importance of the social networking design, and 23.1% of the perceived importance of the quantified-self design.

As per the relationship between goal orientation and the importance of motivational features: the results reveal that being outcome-focused is positively associated with perceived importance of gamification (β[16] = 0.233, p = 0.031), and we can observe a similar trend for quantified-self (β = 0.196, p = 0.065). Process focus did not have any significant association with the perceived importance of any of the design classes.

As per the relationship between goal orientation and the importance of motivational features: Proving-orientation was positively associated with the perceived importance of gamification (β = 0.192, p = 0.025) and social networking designs (β = 0.283, p < 0.000). Goal avoidance-orientation was negatively associated with the perceived importance of social networking designs (β =-0.321, p < 0.000). There was a positive trend between mastery-orientation and perceived importance of quantified-self designs (β = 0.174, p = 0.066).

As per the relationship between goal attributes and the importance of motivational features: there was a negative association between the perceived difficulty of goals and the perceived importance of gamification design (β = -0.213, p = 0.044) as well as a weaker negative trend between it and social networking design (β = -0.200, p = 0.051), as well as between goal specificity and perceived importance quantified-self design (β = 0.173, p = 0.051). Figure 3 shows these meaningfully significant paths of the research model. For full results, please refer to Table 5.

[16] β represents the standard regression coefficient.

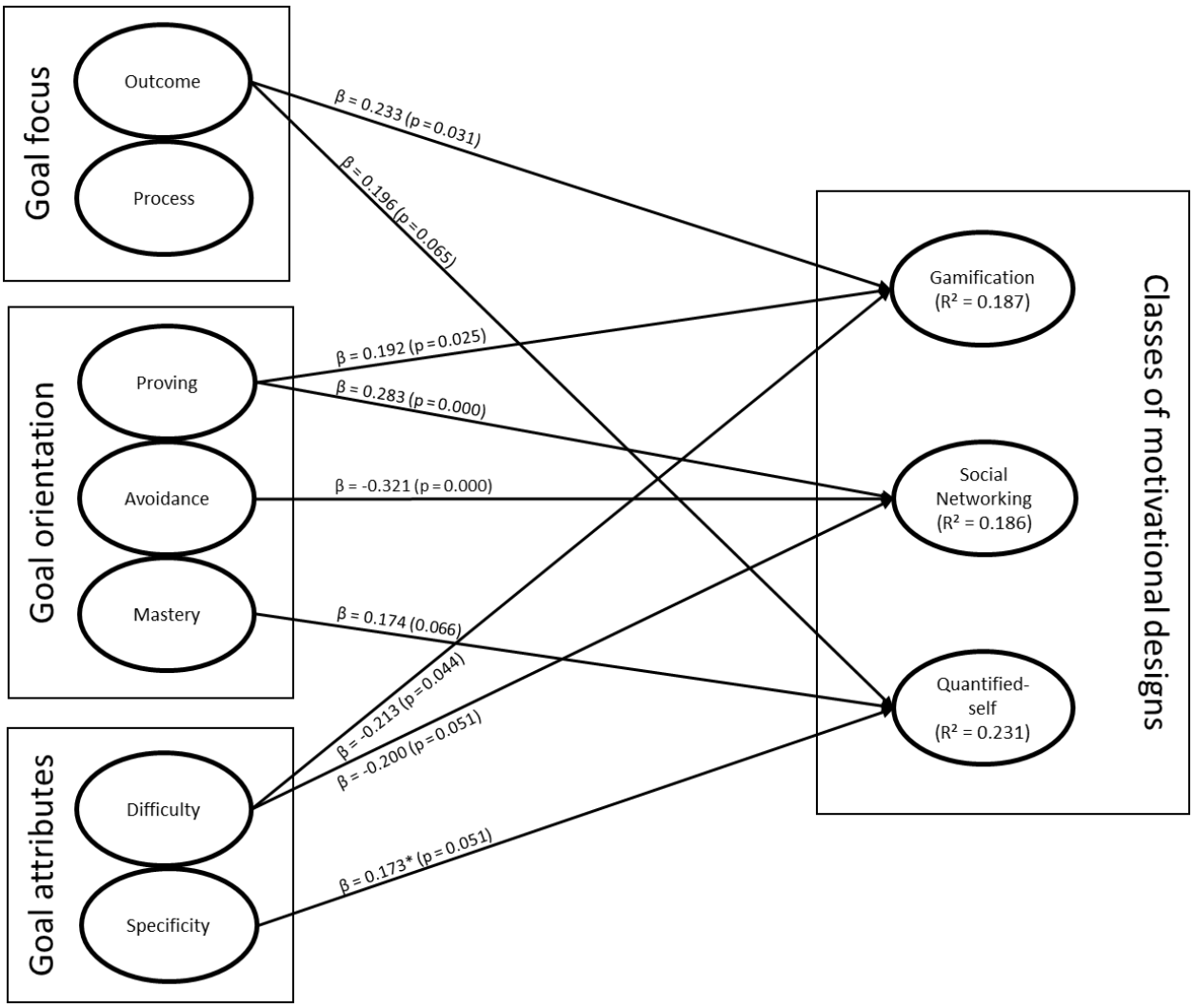


Fig 3 Results (only meaningfully significant path coefficients are shown for clarity (largest p-value 0.066), please refer to Table 5 for full results)

Table 5 Full results

		β	p	95% CI	
Gamification (R^2 = 0.187)					
Goal focus	Outcome	0.233	0.031	0.018	0.440
	Process	0.156	0.170	-0.072	0.373
Goal orientations	Proving	0.192	0.025	0.025	0.357
	Avoidance	-0.140	0.156	-0.328	0.061
	Mastery	-0.033	0.758	-0.239	0.177
Goal attributes	Difficulty	-0.213	0.044	-0.416	-0.004
	Specificity	0.121	0.282	-0.101	0.338
Social networking (R^2 = 0.186)					
Goal focus	Outcome	0.185	0.108	-0.047	0.403
	Process	-0.079	0.547	-0.332	0.184
Goal orientations	Proving	0.283	0.000	0.144	0.416
	Avoidance	-0.321	0.000	-0.459	-0.162
	Mastery	0.023	0.824	-0.183	0.225
Goal attributes	Difficulty	-0.200	0.051	-0.391	0.011
	Specificity	0.122	0.245	-0.080	0.329
Quantified-self (R^2 = 0.231)					
Goal focus	Outcome	0.196	0.065	-0.008	0.410
	Process	0.067	0.581	-0.177	0.293
Goal orientations	Proving	0.113	0.153	-0.034	0.270
	Avoidance	0.041	0.675	-0.157	0.226
	Mastery	0.174	0.066	-0.014	0.364
Goal attributes	Difficulty	-0.043	0.655	-0.224	0.154
	Specificity	0.173	0.051	0.001	0.352

β = standard regression coefficients, CI = Confidence interval

4. Discussion

In summary, the results of the present study pertaining to the relationships between goal-setting and motivational design (in an exercise app) revealed that 1) *gamification* features are perceived to be more important by users who have easier goals, are outcome-focused and who are more

inclined to prove themselves to others. 2) The perceived importance of *social networking* features is similarly associated with being proving-oriented and having easier goals. Moreover, the importance of social networking features is strongly associated with avoidance orientation towards goals.3) The perceived importance of *quantified-self* features appears to be associated with being outcome-focused and with being oriented towards mastery as well as with having specific goals. This section discusses the implications of these results from a goal-setting perspective.

4.1. Goal foci

Regarding goal foci, our results clearly answer a question posed at the outset of this study on whether motivational technologies can provide goal support either in the form of making the goal attainment process more pleasant or by increasing the perceived value of the outcomes achieved when goals are attained and thus affording support for individuals with both outcome- or process-focused goals. The results indicate that being outcome-focused was positively associated with the features of gamification and Quantified-self designs, whereas being process-focused had no significant association with any of the motivational designs. A weaker trend was observed between social network features and focus on outcomes.

These results connect to a prevailing debate across the different motivational design literature spheres. The literature is split between whether the effects of these designs stem from either their ability to make activities more self-purposeful and intrinsically meaningful (see e.g. Deterding et al. 2011; Dijkstra 2014; Hamari et al. 2015; Lieberoth 2015; McGonigal 2011; Vesa 2017) or from providing extrinsic rewards for outcomes of behavior rather than making the behaviors themselves more enjoyable (see e.g. Christy and Fox 2014; Cruz et al. 2015; Hamari 2013; Hamari et al. 2014b; 2015; Hamari and Koivisto 2015b; as examples of studies on rewards). One interpretation of our obtained results is that these motivational designs do afford more goal-setting support via rewarding achieved goals (e.g. badges and points in gamification, likes and comments, from social features or activity reports and performance visualization in quantified-self), rather than through making the goal attainment process more self-purposeful (e.g. through

making the experience more engaging or immersive). This suggests that the rewards these technologies afford (e.g. earning of badges, social status, or performance quantification) may be better aligned with outcome-focused users. This explanation partly, therefore, lends support to the prevailing criticism of these motivational technologies that canonically indicate that motivational design is commonly too superficial and simple in that it does not necessarily change the activity itself (Bogost 2015; Christy and Fox 2014; Cruz et al. 2015; Hamari et al. 2014b; 2015; Hamari and Koivisto 2015b; Landers et al. 2017).

Outcome-focused designs may be easier to design and implement since completion and concrete achievements are more easily quantifiable and rewardable, whereas process-oriented design might require a more holistic design palette (Deterding 2015; Hamari et al. 2014b; Nicholson 2012). Such design that attempts to make the process of goal attainment more self-purposeful and enjoyable are present for example in the case with "Zombies, run[17]", where narratives and audio stimuli are used to during the exercise instead of only rewarding final outcomes such as finishing an exercise episode, being healthier or weight-loss.

Both in the discussion around motivational technologies (Nicholson 2015; Nicholson 2012; Rigby 2015; Wang et al. 2015) as well as in the literature on goal-setting (Corpus et al. 2009; Freund et al. 2010; Latham 2003; Locke and Latham 2002), these issues have been connected to the self-determination theory (Baard et al. 2004; Deci et al. 1999) and specifically to the dichotomous conception of intrinsic and extrinsic motivation[18]. Generally within this literature, it is thought that the use of motivational design that provides the so called extrinsic rewards or rewards that are not seamlessly integrated into the activity itself may be detrimental to the autotelicy of the activity in the long run since they may shift the focus from the process to the outcomes (Deci et al. 1999; Elliot and Harackiewsicz 1994; Ng et al. 2012) whereas the

[17] https://zombiesrungame.com

[18] Intrinsic motivation is usually understood as a drive to pursue a behaviour for the sake of the autotelic aspects of the behaviour itself (e.g. enjoyment, relaxation, skill development). Extrinsic motivation on the other hand occurs when a behaviour is pursued for an extraneous reward or to avoid a consequence related to the performance of the behaviour but not for the sake of the behaviour itself e.g. earning income, avoiding imprisonment (Baard et al. 2004; Deci et al. 1999)

motivation that emerges from the enjoyment of the activity itself is often considered more appropriate. To counter these effects, self-determination theory (e.g. Deci et al. 1999) would indicate that motivational designs that supported users' autonomy, purpose, mastery, and relatedness may be most successful. Such designs would foster long term engagement with the goals individuals have and allow users the autonomy to choose between an outcome or a process focus without them inferring some preferred foci from the design of the motivational system.

This theme of discussion is also connected to perhaps the most prevalent theoretical development in information systems sciences: technology acceptance (e.g. Taylor and Todd 1995; Venkatesh and Davis 2000; Venkatesh et al. 2003). In the respective literature, it is commonly conceived that utilitarian systems (Davis 1989) are used for extrinsic reasons in the pursuit of extraneous outcomes, whereas hedonic systems are used for the enjoyment of the system use - the process (Agarwal and Karahanna 2000; van der Heijden 2004); thus connecting outcome- and process foci (Corpus et al. 2009; Freund et al. 2010; Latham 2003; Locke and Latham 2002) to technology acceptance (e.g. Hamari and Koivisto 2015b; van der Heijden 2004). If we follow this reasoning, the results of this study may suggest that it is those users who are focused on extraneous goals who still regard both gamification and quantified-self as important features. Perhaps this is exactly because they feel they need motivational support. This might not be surprising since, in the end exercise, education etc. often include extraneously evaluated goals that people are attempting to attain. Additionally, a focus on the process of goal attainment is already thought to engender engagement and enjoyment of goal attainment, making the pursuit in itself motivational and enjoyable enough (Locke and Latham 2002). Thus, individuals with process focused goals may not have recognized the need or the potential benefit of the use of a hedonic motivational system.

4.2. Goal orientation

Concerning goal-orientation of users, the present study found intriguing results. Perhaps the most clear and interesting finding is the rather strong negative relationship between avoidance-orientation and the importance of social networking features. This is understandable as

avoidance-oriented users are afraid of failure and having others informed about their failures. Therefore, social networking design is viewed negatively. When users are afraid of failure in the pursuit of their goals, they may become wary of comparing and sharing their accomplishments (or failures for that matter) with others. Understandably, the perception of the magnitude of failure might become much larger if the sub-par performance is shared with others and compared with the possibly better performance of others (see e.g. Krasnova et al. 2015; Krasnova et al. 2013; Tandoc et al. 2015 on envy on social networks).

In the same vein and in contrast, those users who are proving-oriented show an opposite preference towards social networking features; those who are oriented towards proving themselves to others, were more likely to perceive social networking features important. These findings are canonical with prior studies that investigated the relationship between getting recognized and the use of SNSs and related services (Hamari and Koivisto 2015a; Hernández et al. 2011; Lin and Lu. 2011; Mäntymäki and Islam 2016).

The importance of gamification was positively associated with the proving orientation of users. Although, gamification itself does not facilitate proving oneself to others in the same manner as social networking features do, gamification features (badges, levels and medals) are visible signifiers of achievement (Hamari and Eranti 2011; Lehdonvirta 2009) on users' profiles, which can increase the perceived prestige of a user to others, and thus, increase the ability of a user to prove themselves to others (Hamari and Koivisto 2015a; Lehdonvirta 2009). Quantified-self features, however, do not seem to provide similarly direct prestigious indicators since its provided feedback in terms of for example activity logs may not be always public and rather resemble raw statistics of activities, and therefore, have less direct provenance value in themselves. This may explain why quantified-self features were not significantly more important for proving-oriented users.

The importance of quantified-self design appears positively associated with mastery-orientation of users. QS as a design class provides continuous, precise measures of performance that can be

used to evaluate one's progress and skill development which are useful indicators for self-regulation of progress towards the achievement of mastery focused goals. Therefore, it can be said that users who are orientated towards learning from and mastering challenges are perhaps more interested in accurate data and quantified feedback rather than emotional or social support.

4.3. Goal attributes

With regards to goal attributes: users' goal specificity appears to be positively associated with the perceived importance of quantified-self design. This is possibly because users with higher goal specificity have a pre-determined criterion for performance evaluations and regulation (Landers et al. 2017; Latham 2003; Locke and Latham 2002), and therefore, quantified-self features may provide feedback that is more suitable for such users for steering their goal-setting, progress and behavior - a quality that is often encouraged by self-quantifiers (Choe et al. 2014). Vice versa, users with less specified goals may not find quantified-self features as useful perhaps because the actionability of data they receive through these features is lower.

The more difficult the goals are, the better individuals would be motivated towards their achievement up to the ceiling of their skill set (Capa et al. 2008; Landers et al. 2017; Locke and Latham 2002; Lunenburg 2011). Surprisingly, however, our results showed a negative association between goal difficulty and importance of gamification as well as social networking design. We believe this may be because both gamification and social networking designs are designed to rather similarly reward tasks regardless of how skilled the user is in the activity. Both beginners and experienced athletes can receive badges and are able to post their exercise to others regardless of the difficulty level of the task/goal. Therefore, it can be conceived that users with less difficult goals can benefit from gamification and social networking designs more. They categorically receive more attention from others and get more badges per exertion unit. However, this calls upon a wider issue with performance measurement; "you get what you measure" and "gaming the system". Therefore, it may be important to ensure that any rewarding schemes are as accurately as possible based upon the metrics that realistically represent progress and personal development.

4.4. Practical implications

Important aspects of system development, among others, are cost efficiency and suitability of features for users and their needs. While it might be believed that offering more features increases the likelihood that a single comprehensive design would cater to the differentiated needs of users, research into consumer and social psychology has shown that the abundance of features overwhelms users and may result in a dissatisfaction with a service (Willemsen et al. 2016) as well as poses a threat to the economic feasibility of development. User modelling and user-adapted interaction are key methods by which to address these aspects. Research indicates that tailored designs (Bouvier et al. 2014; op den Akker et al. 2014) and a certain degree of personalization in design (Dijkstra 2014) are usually more impactful compared to generic designs for a wide user base in terms of motivational effects and sustained behavioural change. In this paper, we have investigated the fit of motivational design with users' goal-setting related aspects.

The findings of the present study provide encouraging practical implications to designers of services and information systems, who employ motivational designs: the results suggest that the combination of gamification, social networking and quantified-self can support almost all the different aspects of goal-setting (investigated in this study); goal focus and orientation of users as well as goal attributes of users. This implies that by employing these three classes of motivational design (and executing them well), designers can rest assured that they are providing a meaningful motivational design to a wide range of audience. For users who seek to strive in an activity for the sake of the activity itself and users who take on specific challenges, quantified-self features are important, whereas users who are more concerned with the outcomes of their activities, have easier challenges and who are concerned with proving themselves to themselves and others, gamification and social networking can address their goal-setting -related needs. An interesting exception, however, concerned the relationship between having process focused goals and the different motivational designs: being less or more process oriented did not seems to make any of the motivational designs more important for users.

Moreover, while not the core contribution of the study, we have set one example of how to measure the goal-setting aspects of the users of a software. The same or similar measurement could be employed amongst the user base of any software or system with the possible addition of other variables of interest for the developer. These tools add to the repertoire of more classical practices such as market segmentation, user analysis, product analysis etc. (Jonker et al. 2004). User centric approaches to systems design (Norman & Draper 1986) emphasize the importance of understanding user needs and goals from the use of a system and service and to use this understanding as a guideline for design. In light of our results, we would recommend designers to determine the expected foci, orientations to goal-setting and goal attributes of their target audience.

Determining user goals could possibly also take place through participative design, pilot testing, workshops focus groups and initial interviews with potential users carried out with the objective to develop a profile of their goals. Once an initial understanding of user goals is obtained, designers could next proceed to select design features according to an intended fit between design features and user's perceptions of the features. This requires the derailment of design guidelines based on user goals. The results of this study provide such an initial understanding as has been summarizing in the introduction of this work. A fit is expected between users with goals identified as outcomes focused and gamification and quantified-self motivational design classes. A fit is expected between users with a high proving-orientation and gamification and social networking motivational design classes. Avoidance-orientation to goal setting is expected to negatively fit with social networking design, a mastery-orientation would be expected to fit within quantified-self motivation design. A misfit is expected between users with difficult goals and gamification and social networking motivational design, while goal specificity is expected to fit with quantified-self motivational design. While we believe that these guidelines to the personalization of motivational design are one of few currently reported in the literature, more work is needed before detailed customization guidelines are available for motivational design guided by user goals' characteristics.

4.5. Limitations and future research

The data employed in this study was collected from a motivational service geared towards exercise. We believe this context provided one of the best possible avenues for this study as it is an area of interest for a wide range of users with different goal-setting behavior and we identified an application in that context that uses all three classes of motivational design, allowing for a comparison across their features. However, further studies should be conducted in other contexts such as in the context of intra-organizational systems in order to investigate whether contextual factors have an effect on how the goal-setting related aspects translate into perceived importance and appreciation of motivational design classes. Future research could also explore the interdependencies between the goal-setting aspects explored by this study (foci, orientations towards goals and goal attributes) and the influence of these interdependencies on the perception of classes of motivational design.

The data is based on a survey which implies that the data is cross-sectional and self-reported. Naturally, it is likely that the reported measures do not necessarily reflect how much the respondents actually use the different motivational features, but on the other hand, actual use does not necessarily indicate how important or how much of an effect the features of the design classes might have on the user. Therefore, the self-reported measure of importance is not necessarily inferior relative to others but is rather one that offers a different vantage point on the phenomenon under study. Future studies are recommended to expand this enquiry through employing other measures to provide complementary results such as analyses of behavioral data, net ethnography or other qualitative techniques such as focus groups and user interviews. Moreover, studies pursuing similar research questions could conduct experiments where users were randomly assigned into version of a software including varying sets of features and where the users' goal setting related attributes were separately surveyed. While the study did not measure adoption, perceptions of important features give insight into what features users value the most and the likely subsequent adoption behavior. Future researchers are encouraged to further investigate these variables of motivational services use.

Further research could investigate whether there are more fine-grained aspects of goal-setting such as goal commitment, self-efficacy, performance anxiety, individual differences such as gender or appreciated forms of feedback, may mediate the relationship between goal-setting and perception and adoption of the classes of motivational design. The study of these variables may allow for the uncovering of more complex relationships between goal-setting and motivational design classes or may provide further explanation or qualifications for the relationships uncovered by this study. Such detailed research is expected to lead to the development of fine grained design guidelines that guide designers as to the development of motivational services that provide a fit between characteristics of user goals and motivational features.

Future research could also investigate whether the relationship between goal-setting and perception of motivational design is moderated by factors related to individual characteristics and personality types outside of goal orientation. For instance, as motivational technology is strongly related to gamefulness (Deterding 2015; Hamari and Koivisto 2015b; Huotari and Hamari 2017) and social networking (Boyd and Ellison 2007; Chen et al. 2014; Krasnova et al. 2015), aspects of users orientation towards gameful interactions (Hamari and Tuunanen 2014; Kallio et al. 2011; Yee 2006; 2012) or different attitudes towards social interaction online (Butler and Wang 2012; Chen et al. 2014; Jung et al. 2010) may have an additional impact on the perceived importance or adoption of these features by users. Moreover, it should be noted that the different goal-related variables only explained between 18.6%-21.3% of the variance of the importance of motivational technologies. Therefore, there remain more aspect that explain the importance of these features to users.

5. Conclusion

In this paper, we investigated how the different goal-orientations (mastery, avoiding, and proving), goal foci (outcome and process) and goals attributes (specificity and difficulty) affect a user's perceived importance of the features of the three principle design classes (gamification, quantified-self and social networking). The study relied on a survey of HeiaHeia a popular exercise encouragement application. In summary, the results of our study revealed that 1)

gamification features are perceived to be more important by users whose goals are easy, outcome-focused and who are more inclined towards proving themselves to others. 2) The perceived importance of *social networking* features is mainly driven by the same factors, however, with the addition that users with an avoidance orientation to goals, seem to be reluctant to share their goals, progress, and achievements with others, and thereby, are less likely to appreciate social networking features. 3) The perceived importance of *quantified-self* features is similarly driven by users with outcome-focused goals, and users with mastery-oriented goals. Being specific about one's goals increases the likelihood of positively perceiving the importance of quantified-self features. These findings help to design personalized motivational systems, which can adapt the motivational techniques to use depending on the user's goal characteristics. There are many limitations to the study presented here (see previous sections), and naturally more research will be needed to extend the level of certainty in which we can safely generalize the results of this singular study across domains beyond the context of the gamified exercise application under investigation in the present study.

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