

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/274735768>

"Working out for likes": An empirical study on social influence in exercise gamification

Article in *Computers in Human Behavior* · September 2015

DOI: 10.1016/j.chb.2015.04.018

CITATIONS

23

READS

2,064

2 authors:



Juho Hamari

Tampere University of Technology

49 PUBLICATIONS 1,373 CITATIONS

[SEE PROFILE](#)



Jonna Koivisto

University of Tampere

13 PUBLICATIONS 668 CITATIONS

[SEE PROFILE](#)

All content following this page was uploaded by [Juho Hamari](#) on 24 April 2015.

The user has requested enhancement of the downloaded file. All in-text references [underlined in blue](#) are added to the original document and are linked to publications on ResearchGate, letting you access and read them immediately.



“Working out for likes”: An empirical study on social influence in exercise gamification



Juho Hamari, Jonna Koivisto*

Game Research Lab, School of Information Sciences, FIN-33014 University of Tampere, Finland

ARTICLE INFO

Article history:

Keywords:

Gamification
Social networking
Social influence
Continued use
eHealth
mHealth

ABSTRACT

Today, people use a variety of social and gameful (mobile) applications in order to motivate themselves and others to maintain difficult habits such as exercise, sustainable consumption and healthy eating. However, we have yet lacked understanding of how social influence affects willingness to maintain these difficult habits with the help of gamification services. In order to investigate this phenomenon, we measured how social influence predicts attitudes, use and further exercise in the context of gamification of exercise. Our results show that people indeed do “work out for likes”, or in other words, social influence, positive recognition and reciprocity have a positive impact on how much people are willing to exercise as well as their attitudes and willingness to use gamification services. Moreover, we found that the more friends a user has in the service, the larger the effects are. Furthermore, the findings of the empirical study further provide new understanding on the phenomenon of social influence in technology adoption/use continuance in general by showing, in addition to subjective norms, how getting recognized, receiving reciprocal benefits and network effects contribute to use continuance.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

In their daily lives, people are often ridden with a tendency to favour short-term rewards instead of long-term rewards. This cognitive bias, titled hyperbolic discounting (Ainslie, 1975), leads us to sometimes neglect behaviours that would be beneficial to us and consequently causes us to, for example, procrastinate, skip exercise, smoke, and overconsume. When trying to break these cycles, a strong willpower is not always enough, and therefore, people are constantly seeking for novel ways to motivate themselves. During the last couple of years, new technological approaches for these motivational problems have been introduced. For example applications for fitness (Fitocracy; Zombies, Run!), housekeeping (Chore Wars), and even keeping up with one's aspirations in life (Mindbloom) all attempt to motivate people by restructuring relatively long-term goals by providing the users with short-term goals, activities, rewards and social support.

This emerging technological approach for motivating people toward different types of beneficial behaviours draws from the design of social network services as well as games and has commonly been titled as gamification which refers to implementation of elements familiar from games to create similar experiences as games commonly do (Deterding, Dixon, Khaled, & Nacke, 2011;

Hamari, Huotari, & Tolvanen, 2015). Such features have thus far been implemented in various contexts (Hamari, Koivisto, & Sarsa, 2014). Furthermore, very positive views and perhaps even unwarranted expectations regarding gamification have been expressed (see e.g. IEEE, 2014). However, doubts have also been cast on the concept and its effectiveness in truly motivating people (Gartner, 2012). Thus far, meta-studies indicate that most studies do report positive findings from gamification implementations. However, understanding over what kind of gamification works, which psychological aspects mediate the effects, and in which contexts the approach can be beneficial is not yet sufficient (Hamari et al., 2014). Nevertheless, the amount of research on the topic is rapidly increasing (Hamari et al., 2014), and to further highlight the timeliness of these developments, business analyses by Gartner (2011) and IEEE (2014) have reported predictions that the number of gamification endeavours will be increasing considerably in the coming years.

Moreover, common to many such motivational applications is the attempt to employ social influence through a user community in order to entice people to maintain their sustainable behaviour. The generally increased use of social features in technologies can also be observed elsewhere. People adopt technologies increasingly through word-of-mouth (Cheung & Thadani, 2012) or different kinds of recommendation systems (Li, Wu, & Lai, 2013; Stibe, Oinas-Kukkonen, & Lehto, 2013; Xiao & Benbasat, 2007) as well as consume socially (Zhou, Zhang, & Zimmermann, 2013).

* Corresponding author. Tel.: +358 50 318 73 63.

E-mail address: jonna.koivisto@uta.fi (J. Koivisto).

Moreover, social networking services frequently expose people to opinions and attitudes of others, which may further influence the behaviour of the participants (see e.g. [Zhou, 2011](#)). While the number of technological approaches invoking social influence and related psychological phenomena for steering human behaviour towards sustainable, healthy, and otherwise beneficial behaviours is growing, research-based knowledge on whether these technological solutions with social features are able to actually motivate people to pick up and continue with the encouraged behaviours is still somewhat scarce.

Therefore, in this study we investigate how social influence aids people in continuing and maintaining the beneficial behaviours promoted by the gamification technology. We specifically focus on one category of beneficial behaviour; namely physical exercise and the gamification service devised to encourage such behaviour. In particular, in this study we seek to magnify 'social influence' and investigate how several social factors work in parallel to increase willingness to use gamification and continue exercising. We compose the social influence from four factors: (1) subjective norms, (2) recognition from accepting the social influence, and (3) perceived reciprocal benefits. As an antecedent to social influence we measure (4) network effects (in order to investigate on which aspects of social influence having a larger network affects). The theorization expands upon the traditional measurement of social influence by extending the widely employed models, the theories of reasoned action (TRA) and planned behaviour (TPB). The study employs data gathered through an online survey from the users of an exercise-related gamification service.

2. Theory and background

2.1. Gamification

So far, the gamification approach ([Deterding et al., 2011](#); [Hamari et al., 2015](#)) has been harnessed and studied, for example, in the domains of education (e.g. [Bonde et al., 2014](#); [Christy & Fox, 2014](#); [de-Marcos, Domínguez, Saenz-de-Navarrete, & Pagés, 2014](#); [Denny, 2013](#); [Domínguez et al., 2013](#); [Farzan & Brusilovsky, 2011](#); [Filsecker & Hickey, 2014](#); [Hakulinen, Auvinen, & Korhonen, 2013](#); [Simões, Díaz Redondo, & Fernández Vilas, 2013](#)), commerce ([Hamari, 2013, 2015](#)), intra-organizational communication and activity ([Farzan et al., 2008a, 2008b](#); [Thom, Millen, & DiMicco, 2012](#)), government services ([Bista, Nepal, Paris, & Colineau, 2014](#)), public engagement ([Tolmie, Chamberlain, & Benford, 2014](#)), environmental behaviour ([Lee, Ceyhan, Jordan-Cooley, & Sung, 2013](#); [Lounis, Pramatur, & Theotokis, 2014](#)), marketing and advertising ([Cechanowicz, Gutwin, Brownell, & Goodfellow, 2013](#); [Terlutter & Capella, 2013](#)), and activities such as crowdsourcing ([Eickhoff, Harris, de Vries, & Srinivasan, 2012](#); [Ipeirotis & Gabrilovich, 2014](#)), to name a few.

In addition to the above mentioned domains, several studies have examined gamification in the context of this study: health and exercise. [Table 1](#) outlines findings made in the area of gamification of exercise and health. The results of the studies indicate positive effects from gamification, for example, on physical activity (e.g. [Chen & Pu, 2014](#); [Chen, Zhang, & Pu, 2014](#)), healthy eating habits (e.g. [Jones, Madden, & Wengreen, 2014](#)), as well as willingness to continue using the health-related system (e.g. [Cafazzo, Casselman, Hamming, Katzman, & Palmert, 2012](#); [Elias, Rajan, McArthur, & Dacso, 2013](#)). However, some studies suggest that novelty effects might affect the perceptions of benefits from the gamification approaches ([Koivisto & Hamari, 2014](#)). Furthermore, the findings from studies conducted in the domain of gamification of health and exercise are somewhat in line with the results from literature examining the use video games for health benefits. A

review by [Biddiss and Irwin \(2010\)](#) reported that inconclusive results were found in terms of significantly increasing physical activity. However, potential for effects from short-term interventions was noted indicating that, similarly to gamification implementations, benefits may be derived especially in the short-term due to novelty factors, but indications of long-term benefits are still scarce.

Regarding social aspects in gamification of health and exercise particularly, for example, [Chen and Pu \(2014\)](#) and [Chen et al. \(2014\)](#) studied social features in an exercise gamification context with the aim of increasing physical activity. They experimented with social conditions of cooperation, competition and a hybrid setting with features of both of the previous. In their studies, the social conditions did increase physical activity when compared to exercising alone. Of the conditions, the cooperation setting lead to most positive effects. Furthermore, the findings of the controlled trial study by [Allam, Kostova, Nakamoto, and Schulz \(2015\)](#) indicated that a combination of gamification and social support features implemented in their web-based intervention increased physical activity. Therefore, the studies by [Chen and Pu \(2014\)](#), [Chen et al. \(2014\)](#), and [Allam et al. \(2015\)](#) suggest that social aspects and especially supportive social interactions could have an important effect in motivating users towards behaviours with gamification.

2.2. Social influence in social psychology

Human beings have a psychological need for experiencing relatedness ([Deci & Ryan, 2000](#); [Ryan & Deci, 2000](#)), which refers to the needs of belonging and being connected with others. When these needs are fulfilled in a given context, the experienced relatedness may increase intrinsic motivations toward activities related to that context ([Ryan & Deci, 2000](#); [Zhang, 2008](#)). In other words, for example in the information technology context, experiencing relatedness through the use of a system potentially makes the user more willing to engage with the system and continue using it ([Zhang, 2008](#)).

One method for creating such senses of relatedness is by organizing into groups. Groups form around mutual goals and through different stages of group formation usually develop to share mutual norms which are an important antecedent for group cohesion ([Tuckman, 1965](#)). The process of group cohesion is revealed in the tendency of a group of people to stay together and pursue some instrumental objectives, and thus, reciprocally benefit from the social community ([Carron & Brawley, 2000](#)).

Becoming a member of a social community may thus lead to individuals being affected by the social influence from others. Depending on whether the individual wishes to become part of the social community, he or she may accept the social influence, for example, the diffusion of the behavioural norms of the community that are communicated through the process of signalling the norms ([Ajzen, 1988, 1991](#); [Fishbein, 1979](#)). Depending on whether the individual accepts the norms, the social community provides feedback to the individual on his or her behaviour ([Hernandez, Montaner, Sese, & Urquiza, 2011](#); [Lin, 2008](#)). In case the individual has accepted the social influence and has received positive feedback from the relevant community, this may further lead to satisfaction for the individual who is conforming and complying with the norms ([Kelman, 1958](#); [Lin, 2008](#); [Lindenberg, 2001](#)).

Theories on group formation ([Tuckman, 1965](#)), relatedness regarding emergence of intrinsic motivations ([Ryan & Deci, 2000](#)) and social influence ([Cialdini, Green, & Rusch, 1992](#); [Kelman, 1958](#)) suggest that social influence also includes the *affective experience* derived from gaining *recognition* from accepting and conforming with the social influence. The fulfilment of needs of relatedness essential to intrinsic motivation requires a supportive

Table 1

Works on gamification in the health and exercise domain.

Work	Domain	Context	Results
Allam et al. (2015)	Exercise/health	Web-based intervention with gamification and social features for rheumatoid arthritis patients	<ul style="list-style-type: none"> – Compared to control group, physical activity increased over time for experimental group with access to social support sections and gamification – Compared to control group, health care utilization decreased significantly for experimental group with access to social support features and group with access to both social support features and gamification – Compared to control group, experimental group with access to either social support or the gamification gained more empowerment – Compared to control group, experimental group with a gamified experience used the website more often than the ones without gamification
Brauner, Calero Valdez, Schroeder, and Ziefle (2013)	Exercise	Kinect-based exergame	<ul style="list-style-type: none"> – Game performance not affected by performance motivation, but by gamer type – Positive effect on perceived pain
Cafazzo et al. (2012)	Health	Gamified mHealth application for diabetes	<ul style="list-style-type: none"> – Increase of 50% in daily average frequency of blood glucose measurement – 88% (14/16 participants) stated that they would continue using the system
Chen and Pu (2014)	Exercise	Gamified mobile fitness application	<ul style="list-style-type: none"> – 15% increase in physical activities when using the application compared to exercising alone – Cooperation and hybrid conditions in the group setting outperformed competition – More messages sent in cooperation condition – Positive correlation between physical activities and number of messages exchanged
Chen et al. (2014)	Exercise	Gamified mobile fitness application	<ul style="list-style-type: none"> – The social settings (competition, accountability and hybrid) help users to persist more in physical activity compared to baseline – Hybrid setting more likely to motivate users to walk more and actively help others
Elias et al. (2013)	Health	Gamified mobile application for asthma-care	<ul style="list-style-type: none"> – Survey of children with asthma ($N = 9$) indicated they would play games as the one studied if they involved breathing into a spirometer – 6/9 preferred the game-based system over a spirometer alone, while 3/9 preferred having both
Hamari and Koivisto (2014)	Exercise	App/web-based gamification service for exercise	<ul style="list-style-type: none"> – Components of flow pertaining to autotelic experience, clear goals, feedback, control and challenges were most important
Hamari and Koivisto (2015)	Exercise	App/web-based gamification service for exercise	<ul style="list-style-type: none"> – Utilitarian and social motivations have a positive direct association with attitude towards exercise gamification – Utilitarian motivations' association with continued use of exercise gamification is mediated by attitude towards it – Hedonic motivations have a positive direct association with continued use of exercise gamification
Jones et al. (2014)	Health	Gamification of fruit and vegetable consumption	<ul style="list-style-type: none"> – Significant increase in fruit and vegetable consumption on intervention days
Koivisto and Hamari (2014)	Exercise	App/web-based gamification service for exercise	<ul style="list-style-type: none"> – Perceived enjoyment and usefulness of gamification decline with use – Women found to report greater social benefits from the use of gamification
Riva, Camerini, Allam, and Schulz (2014)	Health	Internet-based self-management with interactive sections for chronic back pain	<ul style="list-style-type: none"> – Availability of interactive sections significantly increased patient empowerment and reduced medication misuse in the intervention group – Decrease in frequency of physical exercise and pain burden was reported, but the decrease was equal in control and intervention groups
Thorsteinsen, Vittersø, and Svendsen (2014)	Exercise	Online, interactive physical activity intervention	<ul style="list-style-type: none"> – Intervention group had significantly more minutes of physical activity on registration weeks – Intervention group had more intense physical activity on one registration week – No significant differences between control and intervention groups at the end of the study
Watson, Mandryk, and Stanley (2013)	Exercise	Classroom exergame	<ul style="list-style-type: none"> – Exercise and game components improved enjoyment and player experiences of classroom activities – Game elements improved proportion of correct answers on a retention test

environment, where the individual becomes recognized and accepted (Ryan & Deci, 2000). Furthermore, the recognition by the social community emerges from acceptance, which may motivate an individual to conform to the community's expectations.

Moreover, recognition as a form of acceptance may increase the cohesiveness of the group by, for example, increasing the attractiveness of the group or other group members (Lott & Lott, 1965; McCauley, 1989), i.e. the positive attitudes the group members have toward each other (Lott & Lott, 1965). A positive attitude toward the group and its members evidently makes it more pleasant to be part of the group, and in case of groups or communities formed around a common interest, some level of attraction can

be expected to exist between the members of the group (Bonner, 1959; Lott & Lott, 1965). Members of cohesive groups, who have positive attitudes toward each other, tend to conform to group standards and produce uniform conduct with the other group members (Hogg, 1992).

Consequently, positive attitudes toward other group members may be strengthened by the received recognition (Cialdini & Goldstein, 2004; Hogg, 1992), which can further lead to willingness to reciprocate, to signal appreciation and acceptance toward others in the group (Cialdini & Goldstein, 2004). Reciprocity, that is, returning a favour or a positive action with another (Cialdini & Goldstein, 2004; Cialdini et al., 1992), is a social drive, which has

Table 2

Works on social influence in technology adoption literature.

Work	Context	Variables of social influence	Outcome variables
Several studies of studies (e.g. Bock et al., 2005; Çelik, 2011; Hsieh et al., 2008; Lewis et al., 2003; Pavlou & Fygenson, 2006; Venkatesh & Davis, 2000; Venkatesh et al., 2003) Cheung et al. (2011)	Various	Subjective norms/social influence	Attitudinal/behavioural outcomes
Cheung and Lee (2010)	Online social networks	Subjective norm, group norm, social identity	We-intention
Shen, Cheung, and Lee (2013)	Online social networking site	Subjective norm, group norm, social identity (SI), cognitive SI, affective SI, evaluative SI	We-intention to use an online social networking site
Baker and White (2010)	Instant messaging	Subjective norm, group norm, social identity	We-intention
Hernandez et al. (2011)	Social networking site	Subjective norm, group norm	Engagement in frequent social networking site use
Hsu and Lin (2008)	E-learning	Sense of community, social influence, altruism, recognition by peers, recognition by the instructor	Attitude toward, usage of, and continuance intention to use ICT interactive tools
Hamari (2013)	Blog	Social norms, community identification	Intention to blog
Lin (2008)	E-commerce	Social comparison	Service use
Zhou (2011)	Virtual communities	Trust, social usefulness	Sense of belonging, member loyalty
Dholakia et al. (2004)	Online community	Subjective norm, social identity (SI), cognitive SI, affective SI, evaluative SI, group norm	Participation intention, participation behaviour
Hsu and Lu (2004)	Virtual communities	Group norms, mutual agreement, mutual accommodation, social identity (SI), cognitive SI, affective SI, evaluative SI	Desires, we-intentions, participation behaviour
Hsu and Chiu (2004)	Online game	Social norms, critical mass	Attitude toward playing an online game, intention to play an online game
Hsiao and Chiou (2012)	World Wide Web	Interpersonal norm, social norm	Intention, e-service usage
Mäntymäki and Riemer (2014)	Virtual community	Social norms, trust, social capital	Intention to stay in a group
	Social virtual world	Interpersonal influence, secondary sources of info, perceived network size	Continuous use intentions

been argued to exist in all human cultures (Burger, Sanchez, Imber, & Grande, 2009; Gouldner, 1960). When receiving positive feedback, people often feel obligated by the social norms to return the favour and reciprocate. Therefore, reciprocal benefits may arise from group interactions, when receiving recognition is reciprocated by providing recognition. Through this type of process the shared norms of a group may be further diffused and strengthened.

In addition to the processes of recognition and reciprocity, the size of the relevant community (see e.g. Lin & Bhattacharjee, 2008) is likely to be an important factor for social influence, since it is proportional to the amount of influence a person can be exposed to. According to the theory of network externalities, the network effects (i.e., the value from the network) arise when the benefits from using the service depend on the number of relevant other users (Katz & Shapiro, 1985; Lin & Bhattacharjee, 2008).

In sum, based on the theorizations in social psychology regarding social influence, we propose conceptualizing the social influence via three main factors: (1) subjective norms, (2) recognition, and (3) the resulting further reciprocal benefits. Further, the social influence can be positively influenced by the proportion to which the individual is exposed to other people in the relevant community.

2.3. Social influence in technology adoption

Theories applied in studies investigating technology adoption, use and attitudes towards systems, commonly employ social influence as one of the predictors for the outcome behaviour or behavioural intention. Such theories are, for example, the theory of reasoned action (TRA) and the theory of planned behaviour (TPB) which was developed from the TRA. In the basic structures of the TRA and TPB, the behavioural intentions to engage in a behaviour

are investigated by measuring determinants for the intentions: attitude toward the behaviour, and subjective norms.¹ Using these theories, research into social influence in technology adoption has often operationalized this influence as subjective norms. These norms refer to the beliefs and perceptions of how important the relevant others of an individual regard a given behaviour and whether they expect one to perform it (Ajzen, 1988, 1991; Fishbein, 1979; Fishbein & Ajzen, 1975). The attitude toward the behaviour refers to the behavioural beliefs of the outcomes or other features of the behaviour that the individual attributes to it (Ajzen, 1991). These outcomes are evaluated as positive or negative. Together, the beliefs and their evaluations form the attitude, either positive or negative, that the individual projects on the performance of the behaviour (Ajzen, 1991).

Prior information systems literature has investigated the social influence in a variety of contexts, such as organizational knowledge sharing (Bock, Zmud, Kim, & Lee, 2005; Lewis, Agarwal, & Sambamurthy, 2003), social networking services (Cheung, Chiu, & Lee, 2011; Cheung & Lee, 2010), e-learning (Hernandez et al., 2011), blogs (Hsu & Lin, 2008), and e-commerce (Hamari, 2013). Table 2 reviews studies on social influence in technology adoption. While most of the studies have employed the basic TRA/TPB models, some studies have also extended the social influence with additional variables. Most of these extensions have enhanced the measurement of mere subjective norms with variables concerned with

¹ The TPB includes also measurement of perceived behavioural control. Gamification may be implemented in both, non-organizational or organizational contexts. Use of gamification in a non-organizational context, which is investigated in this study, is most likely a volitional act and not considered to be affected by control issues to a significant degree (Ajzen, 1988, 1991). Thus, in this study, the control beliefs are not included. Instead, the research model builds upon the subjective norm and attitude as antecedents for behavioural intentions.

social identity and/or group norms. Social identity variables are most often used to examine identification with the group, whereas group norm variables investigate the sharing of common goals within the group (e.g. [Cheung & Lee, 2010](#); [Cheung et al., 2011](#); [Dholakia, Bagozzi, & Klein Pearo, 2004](#)). These extensions consider social influence from the point of view of group formation processes. Some studies have shown that social identity (e.g. [Cheung & Lee, 2010](#); [Zhou, 2011](#)) and group norms (e.g. [Cheung et al., 2011](#); [Dholakia et al., 2004](#); [Zhou, 2011](#)) positively predict, for example, we-intentions and intentions to participate in the services.

As the effects of social influence towards the target behaviour are of interest in this study, the core of the research model draws from the TRA/TPB ([Ajzen, 1988, 1991](#); [Fishbein, 1979](#)) similarly to several previous works on social influence in information systems. In this study, however, we theorize that the phenomenon of social influence should also capture the processes that are induced by being exposed to the subjective norms. These are especially relevant in the context studied here: technologies that aim at motivation of the users (e.g. gamification), in which the social dimension is heavily utilized.

Consequently, we extend the social influence by inclusion of the effects and benefits an individual may derive from the community and social activity, regardless of the state of identification with the group. These derived benefits such as feedback in the form of recognition as well as reciprocity have not been examined in the previous studies in a concise manner. Therefore, the theoretical development in this study consists of 3 main refinements: (1) recognition as an indicator of feedback from conforming to social influence, (2) perceived reciprocal benefit obtained from the process of conforming and the feedback received on it, and (3) the effect of the size of the community on the factors of social influence (see [Fig. 1](#)).

2.4. Hypotheses for the extended social influence

When considering social influence in the context of technology use, subjective norms reflect the user's perceptions of how other users perceive the use of the service ([Ajzen, 1991](#); [Fishbein, 1979](#)). By participating in the community in the service, a user is likely to become exposed to the influence of others. Furthermore, in services that incorporate social interaction, e.g. “liking” and commenting, a user can receive recognition on his or her activities from other users. In the context of an information technology with social elements, such recognition could be considered to represent the social feedback a user receives on their behaviour ([Cheung & Lee, 2010](#); [Cheung et al., 2011](#); [Lin, 2008](#)) or on accepting the social influence and the normative expectations of the community.

Based on the discussions on subjective norms and recognition, we hypothesize that the more strongly a person believes others to expect and support a certain behaviour, the more positively the recognition from conducting the behaviour and thus conforming to those expectations will be perceived by the individual (see e.g. [Kelman, 1958](#)). In line with [Bock et al. \(2005\)](#), [Lewis et al. \(2003\)](#), and [Venkatesh and Davis \(2000\)](#), we propose that the subjective norm affects attitude directly as well as behavioural intentions mediated by attitude.

Accordingly, we hypothesise the following pertaining to the influence of subjective norms.

H1a. Subjective norms positively influence the impact of recognition received from conforming to subjective norms.

H1b. Subjective norms positively influence the attitude toward the technology.

Furthermore, receiving recognition from relevant others can create reciprocal behaviour ([Cialdini & Goldstein, 2004](#); [Cialdini et al., 1992](#)). The reciprocal interaction can promote a form of social usefulness of the system – i.e., receiving benefit from and, in turn, contributing to the social community ([Lin, 2008](#); [Preece, 2001](#); [Wellman & Wortley, 1990](#)). In other words, receiving recognition potentially increases the perceived mutual benefits received from the use of the system (see e.g. [Chiu, Hsu, & Wang, 2006](#)). We operationalize the measurement of this construct as reciprocal benefits (see e.g. [Hsu & Lin, 2008](#); [Lin, 2008](#)) and hypothesize that a positive relationship can be expected to exist between receiving recognition and perceived reciprocal benefits derived from the system use. Furthermore, we hypothesise that simply receiving recognition has also a direct positive effect on attitude towards the use of the service, since receiving positive recognition in general is considered a positive experience, and thus, is likely to have a positive relationship with attitude. Similarly, as the reciprocal activities are expectedly regarded as positive, they are likely to create further positive attitude towards the service as well (see e.g. [Cialdini et al., 1992](#)). Consequently, we hypothesize a positive relationship to exist also between reciprocal benefits and attitude towards the system use.

In conclusion, the following hypotheses are suggested pertaining to receiving recognition and reciprocal benefits:

H2a. Getting recognition positively influences the experience of reciprocal benefits within the system.

H2b. Recognition positively influences attitude toward the system.

H3. Perceived reciprocal benefits positively influence the attitude toward the system.

In previous studies, network exposure has occasionally been considered interchangeable with subjective norms ([Hsieh, Rai, & Keil, 2008](#)). However, the number of peers in a system is conceptually distinct from the norms or the expectations one believes others to share and hold ([Hsieh et al., 2008](#); [Lin & Bhattacharjee, 2009](#)). Specifically, the network exposure considers one's perceptions of the size of the relevant network ([Hsieh et al., 2008](#); [Lin & Bhattacharjee, 2009](#)). Therefore, we measure the size of the relevant peer-group within the system with the construct of network exposure (see [Lin & Bhattacharjee, 2008](#)).

In the context of information technology with social elements, the size of the relevant network of an individual within a system is likely to affect the amount of social activity the individual can partake. Furthermore, the number of people using a service has, indeed, been deemed important for services that are centred on social interaction ([Baker & White, 2010](#); [Lin & Lu, 2011](#); [Sledgianowski & Kulviwat, 2009](#)). Many studies have investigated the role of network exposure in the information technology

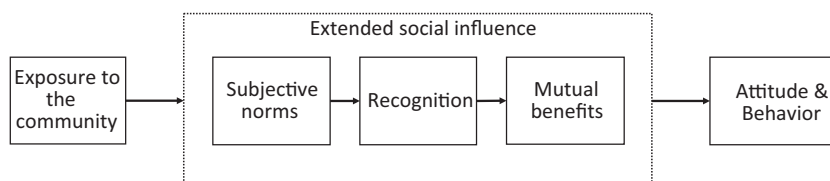


Fig. 1. Conceptual model.

context, however, the studies have not considered that the effect would in fact be mediated through other social factors (see Table 2). However, we argue that the effect of network exposure to attitude and use intentions is not direct, since the mere number of users has no intrinsic value. Instead, we hypothesize that the network effects on attitude are (fully) mediated by social factors operationalized in this study: subjective norms, recognition and reciprocal benefits. Through the social interaction and benefits derived from it, the network exposure can translate into socially valuable content (see e.g. Lin, 2008; Preece, 2001), and consequently, further affect attitude towards the system as well as its use. The more relevant others there are in the system, the more normative information the user is likely to be exposed to. In the same vein, the more users a person is exposed to, the more recognition and reciprocal benefits he or she is likely to be exposed to. Therefore, also the network exposure is partially mediated through social influence to recognition and further reciprocal benefits.

We propose that all of the factors within our extended social influence (subjective norms, recognition and reciprocal benefits) mediate the effects of network exposure. Therefore, we hypothesise the following:

H4a. Network exposure positively influences subjective norms.

H4b. Network exposure positively influences perceived recognition.

H4c. Network exposure positively influences perceived reciprocal benefit.

H4d. The influence of network exposure on attitude is fully and positively mediated by the extended social influence (NEXP has a positive direct association with SUBJN, RECOG and RECIPIB but not with ATT).

H4e. The influence of network exposure is partially and positively mediated within the causal chain of social factors (NEXP → SUBJN → RECOG → RECIPIB).

In this study, attitude towards system use refers to the overall evaluation of the system's usage, be it favourable or unfavourable (Ajzen, 1991; Fishbein & Ajzen, 1975). A strong relationship

between attitude and use intentions has been confirmed in several studies (see, e.g. Baker & White, 2010; Bock et al., 2005; Lin & Bhattacharjee, 2009).

Word-of-mouth (WOM) refers to a person's willingness to recommend a system to others. In the context of continued use intention (Bhattacharjee, 2001), it reflects the satisfaction of the user with the system in question, and his or her willingness to recommend the service to other people (Cheung & Thadani, 2012; Kim & Son, 2009; Srinivasan, Anderson, & Ponnnavolu, 2002).

As the instrumental purpose of the investigated technology is to promote continued exercise, it is also important to measure whether the continued use of the technology (Ajzen, 1991) does indeed co-exist with the intention to continue exercising. We expect to find that users who are more likely to continue the system use, will also be more likely to pursue the behaviour that is promoted by the system. Thus, the intentions to continue the behaviour are hypothesized to rise as a behavioural outcome.

Accordingly, we suggest the following hypotheses:

H5. Attitude positively influences intentions to continue using the system.

H6. Attitude positively influences intentions to recommend the system to others (i.e. WOM).

H7. Intentions to continue using the system positively influence intentions to continue exercising.

See Fig. 2 for the research model and hypotheses.

3. The empirical study

3.1. Data

The data was gathered via an online questionnaire from the users of a service called Fitocracy, an online service that gamifies exercise. The motivational design of the system consists mainly of affordances corresponding to achievement and competence as well as social influence and relatedness (see Zhang, 2008 on motivational affordances). More specifically, the service enables tracking of one's exercise. The user enters the exercise details into the

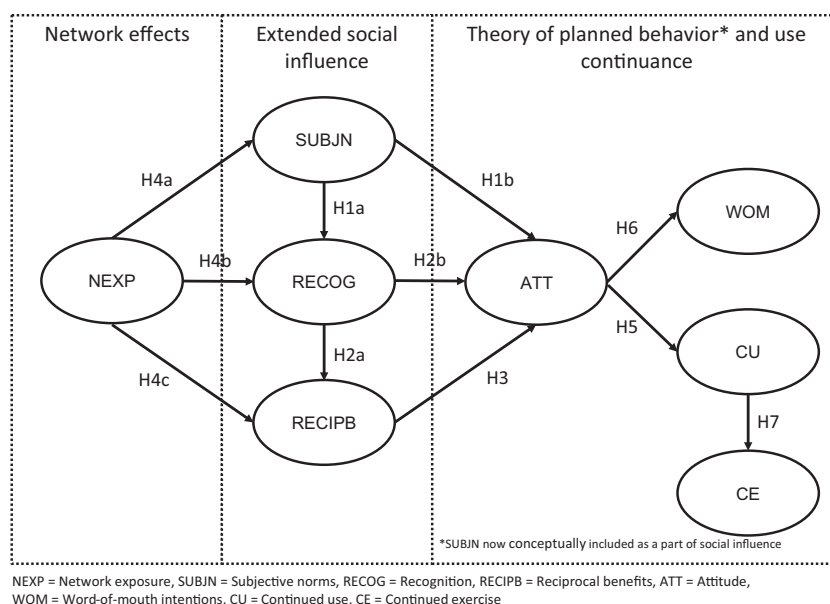


Fig. 2. Research model.

Table 3

Demographic information of the respondents: gender, age, time using the service and exercise information of the respondent data.

	Frequency	Percent		Frequency	Percent
<i>Gender</i>			<i>Length of experience</i>		
Female	102	51	Less than 1 month	24	12
Male	98	49	1–3 months	38	19
<i>Age</i>	<i>(mean = 29.5, median = 27.5)</i>		3–6 months	29	14.5
Less than 20	9	4.5	6–9 months	26	13
20–24	51	25.5	9–12 months	33	16.5
25–29	54	27	12–15 months	38	19
30–34	41	20.5	15–18 months	7	3.5
35–39	22	11	More than 18 months	5	2.5
40–44	16	8	<i>Exercise sessions per week</i>	<i>(mean = 5.3, median = 5.0)</i>	
45–49	3	1.5	1–4	83	41.5
50 or more	4	2	5–9	106	53.0
			10–14	6	3.0
			15 or more	5	2.5
			<i>Exercise hours per week</i>	<i>(mean = 7.2, median = 6.0)</i>	
			1–4	51	25.5
			5–9	99	49.5
			10–14	40	20.0
			15 or more	10	5.0

system as the service does not contain automatic tracking. Thus, the service relies on the self-reported data logged by the user. Furthermore, the service incorporates motivational design in the form of gamification. Based on the exercises logged by the user, the system enables the users to gain points, level-ups, and achievements (on badges, see [Hamari & Eranti, 2011](#)). For example, when a user logs an activity, the system calculates the point value that the user gains with the exercise. The point value is adjusted based on applicable details, such as amount, distance, time, intensity or weights, provided by the user. The user can also complete quests by performing and tracking an exercise corresponding to a given set of conditions, or challenge other users into duels. Moreover, other users can give feedback on achievements, level-ups and statuses by ‘liking’ or commenting the updates. The service holds similarities with social networking services in that it creates a venue for social activity such as group-forming and communication, incorporates profile-building, and the possibility of sharing content ([Baker & White, 2010](#); [Boyd & Ellison, 2007](#); [Ellison, Steinfield, & Lampe, 2007](#); [Lin & Lu, 2011](#); [Pfeil, Arjan, & Zaphiris, 2009](#)).

The survey was conducted by posting a description of the study and the survey link to the discussion forum and groups within the service. The questionnaire was therefore accessible only for users of the service. The survey was conducted at the end of 2012. At the time of the gathering of data, the service could be used with an iPhone application or via a Web browser. An Android application was released while the data gathering neared completion. The survey respondents were entered in a prize draw for one \$50 Amazon gift certificate.

Table 3 outlines the demographic details of the respondents. As can be seen from Table 3, the gender divide of the sample was fairly equal. The ages between 20 and 29 are more represented in the data than other age groups, however, the age distribution is wide with respondents in all the categories. The lengths of experience with the service reported by the respondents are distributed rather evenly. Table 3 also describes the details of amounts of exercise reported by the respondents. Furthermore, respondents were asked to report how they use the service: on a mobile device (mobile phone or tablet) and/or on a computer. Of the 200 respondents, 186 (93%) stated that they used the service on a computer. The options were not mutually exclusive, and the respondents could choose both mobile options and the computer option. In fact, of the 186 computer users, 101 (54%) reported also using the application on some type of a mobile device. Therefore, no effects of the devices used are examined.

3.2. Measurement

All variables included 4 items and were measured with 7-point Likert scales. All operationalizations of psychometric constructs were adapted from previously published sources. Table 4 reports the number of items in each construct as well as the sources from which each of the constructs was adapted. One item was omitted from the CE construct because the loading was rather low (0.589), although it was still higher than with any other construct. See Appendix A for the survey items, loadings and construct sources.

3.3. Validity and reliability

All of the model-testing was conducted via component-based PLS-SEM in SmartPLS 2.0 M3 ([Ringle, Wende, & Will, 2005](#)). Compared to co-variance-based structural equation methods (CB-SEM), the key advantage of the component-based PLS (PLS-SEM) estimation is that it is non-parametric, and therefore, makes no restrictive assumptions about the distributions of the data. Secondly, PLS-SEM is considered to be a more suitable method for prediction-oriented studies, while co-variance-based SEM is

Table 4
Measurement instruments.

Construct	Name	Included/ Total items	Adapted from
ATT	Attitude	4/4	Ajzen (1991)
CU	Continuance intentions for system use	4/4	Bhattacharjee (2001)
CE	Continuance intentions for exercise	3/4	Bhattacharjee (2001)
NEXP	Network exposure	4/4	Lin and Bhattacharjee (2008)
RECIPB	Reciprocal benefits	4/4	Hsu and Lin (2008) , Lin (2008)
RECOG	Recognition	4/4	Hernandez et al. (2011) , Hsu and Lin (2008) , Lin and Bhattacharjee (2010) , Lin (2008)
SUBJN	Subjective norms	4/4	Ajzen (1991) , Fishbein (1979) , Venkatesh et al. (2003)
WOM	Word-of-mouth intentions	4/4	Kim and Son (2009)

Table 5
Convergent and discriminant validity.

	AVE	CR	Alpha	ATT	CU	CE	NEXP	RECIPB	RECOG	SUBJN	WOM
ATT	0.795	0.939	0.914	0.892							
CU	0.734	0.917	0.880	0.657	0.857						
CE	0.654	0.847	0.719	0.462	0.664	0.809					
NEXP	0.855	0.959	0.944	0.372	0.228	0.268	0.925				
RECIPB	0.700	0.903	0.857	0.713	0.492	0.431	0.472	0.837			
RECOG	0.804	0.943	0.919	0.587	0.390	0.332	0.483	0.644	0.897		
SUBJN	0.735	0.917	0.879	0.666	0.494	0.442	0.408	0.582	0.461	0.857	
WOM	0.756	0.925	0.893	0.754	0.617	0.385	0.428	0.651	0.654	0.660	0.869

Square roots of AVEs are reported in bold in the diagonal.

better suited for testing which models best fit the data (Anderson & Gerbing, 1988; Chin, Marcolin, & Newsted, 2003).

Convergent validity (see Table 5) was assessed with three metrics: average variance extracted (AVE), composite reliability (CR), and Cronbach's alpha (Alpha). All of the convergent validity metrics were clearly greater than the thresholds cited in relevant literature (AVE should be greater than 0.5, CR greater than 0.7 (Fornell & Larcker, 1981), and Cronbach's alpha above 0.7 (Nunnally, 1978)). Only well-established measurement items were used (see Appendix A). Furthermore, there were no missing data; therefore, no imputation methods were used. We can, therefore, conclude that the convergent validity and reliability requirements are met.

Discriminant validity was assessed, firstly, through comparison of the square root of the AVE of each construct to all of the correlation between it and other constructs (see Fornell & 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; Jöreskog & Sörbom, 1996). Secondly, in accordance with the work of Pavlou, Liang, and Xue (2007), we determined that no inter-correlation between constructs was higher than 0.9. Thirdly, we assessed discriminant validity by confirming that every item had the highest loading with its corresponding construct (Appendix B). All three tests indicate that the discriminant validity and reliability are acceptable.

In addition, in order to reduce the likelihood of a common method bias, we randomized the order of the measurement items in the survey to limit the respondent's ability to detect patterns between the items (Cook, Campbell, & Day, 1979). The common method bias refers to a situation where there is "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Nevertheless, we tested whether common method bias existed in our data by "controlling for the effects of an unmeasured

latent methods factor" as proposed by Podsakoff et al. (2003) in the same manner as practically demonstrated in a PLS-SEM environment by Liang, Saraf, Hu, and Xue (2007). According to Williams, Edwards, and Vandenberg (2003), if the loadings of the "method factor" are statistically insignificant and/or considerably low in comparison to indicator loadings of the substantive factors, there is no evidence of the common method bias. In addition, the square of the loadings represents the percentage of the variance explained. As reported in Appendix C, we found a few significant loadings on the "method factor", however, they explain a negligibly small share of the variance (0.006 on average), whereas the indicators explain 0.762 variance on average in substantive factors. Therefore, we can be confident that common method bias is not likely to be an issue.

The sample size satisfies the guidelines stating that the PLS-SEM minimum sample size should be equal to the larger of the following: ten times the largest number of formative indicators used to measure one construct or ten times the largest number of structural paths directed at a particular latent construct in the structural model (Chin & Newsted, 1999; Hair, Ringle, & Sarstedt, 2011). Also, data should contain 150 observations for models with three or more indicators on constructs (Anderson & Gerbing, 1984).

3.4. Results

The research model (see Fig. 3) could account for 43.1% of the continued use intention as well as 56.8% of intention to recommend the service to other people. Furthermore, the model accounts for 44.1% of continued intention to exercise. The perceived social benefits accounted for 61.9% of the variance of attitudes toward the use of a gamified service. In addition, the model also accounted for 16.7% of the variance in social influence, 31.7% of recognition, and finally 44.9% of the variance of perceived reciprocal benefit. As can be seen in Fig. 3 all of the direct paths in the research model

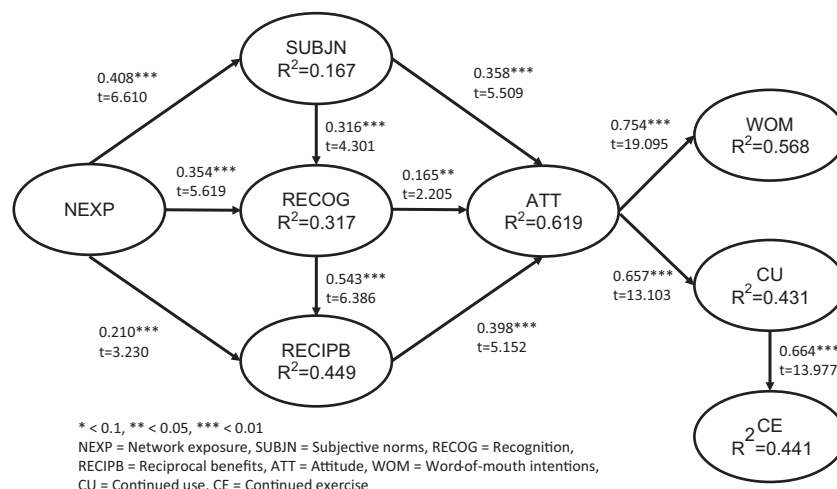


Fig. 3. Path model results.

Table 6

Total effects as mediated according to the path model.

	RECOG	RECIPB	ATT	WOM	CU	CE
NEXP	0.483*** (direct, SUBJN) ^a	0.472*** (direct, SUBJN, RECOG)	0.414*** (SUBJN, RECOG, RECIPB)	0.312*** (SUBJN, RECOG, RECIPB, ATT)	0.272*** (SUBJN, RECOG, RECIPB, ATT, CU)	0.181*** (SUBJN, RECOG, RECIPB, ATT, CU)
SUBJN		0.172*** (RECOG)	0.479*** (RECOG, RECIPB)	0.361*** (RECOG, RECIPB, ATT)	0.314*** (RECOG, RECIPB, ATT)	0.209*** (RECOG, RECIPB, ATT, CU)
RECOG			0.381*** (RECIPB)	0.287*** (RECIPB, ATT)	0.251*** (RECIPB, ATT)	0.166*** (RECIPB, ATT, CU)
RECIPB				0.300*** (ATT)	0.261*** (ATT)	0.174*** (ATT, CU)
ATT						0.436*** (CU)

Significance levels reported as * <0.1, ** <0.05, *** <0.01.

^a Listed in parentheses are the different paths through which the total effects is composed. Direct effects are reported in Fig. 3.**Table 7**

Confirmation of hypotheses.

H#	IV → DV	Hypothesis	Supported
H1a	SUBJN → RECOG	Subjective norms positively influence the impact of feedback from conforming to subjective norms	Yes
H1b	SUBJN → ATT	Subjective norms positively influence the attitude toward the technology	Yes
H2a	RECOG → RECIPB	Getting recognition positively influences the experience of reciprocal benefits within the system	Yes
H2b	RECOG → ATT	Recognition positively influences attitude toward the system	Yes
H3	RECIPB → ATT	Perceived reciprocal benefits positively influence the attitude toward the system	Yes
H4a	NEXP → SUBJN	Network exposure positively influences subjective norms	Yes
H4b	NEXP → RECOG	Network exposure positively influences perceived recognition	Yes
H4c	NEXP → RECIPB	Network exposure positively influences perceived reciprocal benefit	Yes
H4d	NEXP → ATT	The influence of network exposure on attitude is fully and positively mediated by the extended social influence	Yes
H4e	NEXP → RECOG, RECIPB	The influence of network exposure is partially and positively mediated within the causal chain of social factors	Yes
H5	ATT → CU	Attitude positively influences continued use intention	Yes
H6	ATT → CE	Attitude positively influences intentions to recommend the service (i.e., WOM)	Yes
H7	CU → CE	Intentions to continue using the system positively influence intentions to continue exercising	Yes

were positive and statistically significant. Therefore, the model supports the hypotheses H1a–H4c and H5–H7.

To further investigate the relationship of network effects and attitude (H4d), in addition to the direct effect, we modelled a mediated effect by the social factors in the model in accordance with our hypotheses. When modelling only a single direct effect between these variables and at the same time omitting the social factors, a significant positive association existed (.372***). However, when the social factors were added so that direct effect

and mediation were both modelled, the direct effect was now insignificant at a close to zero value (–.060). This suggests, that the effect between network exposure and attitude is fully mediated through the extended social influence. The resulting total effect between the variables was .414*** as mediated by the social factors, which is very close to the value of the uncontrolled direct effect. Furthermore, in addition to the direct effect between network exposure and both recognition and reciprocal benefits, we also modelled a mediation by the social factors (subjective norms mediating recognition; subjective norms and recognition mediating reciprocal benefits) in accordance with our hypotheses (H4e). While the direct effect from network exposure to both recognition and reciprocal benefits was significant (recognition = .354***, reciprocal benefits = .210***), the total effect mediated by the social factors showed an increase in the effects (recognition = .483***, reciprocal benefits = .472***). See Table 6 for the total effects. See Table 7 for summary of hypotheses.

In addition to the hypotheses presented in the research model, we controlled also for the effects of age, gender and length of experience with the service on all of the dependent variables. Only one of the tests provided statistically significant results: gender had a slight effect on continued intentions to exercise (R^2 of CE increased by 0.017), indicating that women reported somewhat higher intentions to continue with exercising in the future ($t = 2.470^{**}$).

Even though in the original TRA/TPB the subjective norm and attitude are both modelled as direct predictors for behavioural intentions, prior literature has considered that the modelled relationships of these variables may potentially vary based on the social influence processes (internalization, identification, or compliance (Kelman, 1958)) and consequently, for example, the voluntariness of use (Davis, Bagozzi, & Warshaw, 1989). People adopt the case service voluntarily and therefore we can expect that it is the individual's own attitudes that are likely to affect the decisions on use and therefore the subjective norms would be mediated through attitude rather than being a direct predictor. Indeed, in our data the relationship between subjective norms and continued use is mediated by attitude which is indicated by the following tests: (a) SUBJN → CU is positive and significant when the relationship ATT → CU is omitted, but (b) there is no significant direct association between SUBJN → CU when ATT → CU is modelled, (c) there is a positive and significant association between SUBJN → ATT and (d) the total effect indicated by the path model shows a significant total effect between SUBJN and CU in the mediation model (Fig. 3 and Table 6).

4. Discussion

In this study, we investigated the role of social influence in gamified exercise with the aim of examining how the social aspects affect use intentions of the technology, intentions to recommend it to others as well as the intentions to continue exercise, i.e. the behaviour that is being supported by the technology. Moreover, motivated by the fact that social influence as a process is clearly a manifold phenomenon in contexts such as gamification services, this study sought to expand measurements and conceptualizations of social influence.

4.1. Theoretical and practical implications

While in prior studies social influence in technology use has commonly been investigated by only measuring subjective norms with the theories of reasoned action and planned behaviour (Ajzen, 1991; Fishbein, 1979), in our research we theorized that merely measuring subjective norms does not take into account the feedback and benefits received through the social influence process which clearly seem to be important aspects in systems

such as gamification. Therefore, in this study, we sought to increase theoretical knowledge and contribute to the conceptualizations of the extended social influence, that is, the role of the network exposure on social influence, the role of social influence on IT use continuance, and further role in behaviour continuance. Guided by the theoretical developments in social psychology ([Cialdini & Goldstein, 2004](#); [Cialdini et al., 1992](#)), we theorized that social influence is not confined only to the perceptions of the individual about the beliefs of relevant others. Instead, it also includes the resultant positive recognition from signalling acceptance to those norms. We expanded theories of reasoned action and planned behaviour with recognition, i.e. the degree of positive feedback from conforming to subjective norms. Furthermore, we theorized that the reciprocal influence-compliance ([Cialdini & Goldstein, 2004](#)) with the community's norms can promote perceived benefits (the perceived increase in mutual benefits derived from the use). We hypothesized also that the size of the immediate community within the system would have a positive effect on all of the social aspects measured within the study.

Our empirical study does indeed support these theorizations and the hypotheses regarding them: according to the findings, the social factors consisting of subjective norms, perceived recognition, and perceived reciprocal benefit all had a positive relationship with use and exercise continuance as well as intention to recommend the technology to others as mediated by attitude. Furthermore, the continued use intentions were positively associated with the continued exercise intentions. Therefore, the findings of this study suggest that the social factors are an important antecedent for sustained behaviour and continued use intentions of motivational technologies. The findings of the study are in line with previous research on the importance of social aspects in gamification, and particularly gamification of exercise. For example, the findings of the studies by [Chen and Pu \(2014\)](#) and [Chen et al. \(2014\)](#) indicated that social features in gamification in general increased physical activity. Especially, when users cooperate together for exercise results they get the most positive effects. Similarly, in the study by [Allam et al. \(2015\)](#) gamification and social support features implemented into their intervention system increased physical activity of the users. However, the previous studies did not investigate the psychological aspects regarding the social aspects, but rather examined the relationships between the system elements and behaviour directly. In our study, we had an opposite approach as we particularly examined the process of social influence in the gamification of exercise but did not measure which particular elements affected social influence. Therefore, this study has attempted to fill this gap in the understanding of the social aspects in gamification. In synergy, the present study and the earlier studies begin to provide a more comprehensive view of the social influence from gamification elements to psychological aspects and onto behaviour. The results of the present study, in combination with the findings of [Chen and Pu \(2014\)](#), [Chen et al. \(2014\)](#) as well as [Allam et al. \(2015\)](#), suggest that the social support and benefits derived from the social interaction with the other users are important for continuing the behaviour supported by the system.

Furthermore, an important theoretical finding of this research was that the association between attitude and network effects is mediated through the extended social influence. Our empirical study supports the theorization that the social factors do indeed fully positively mediate the effect of network exposure on attitude. Moreover, another theoretical contribution pertains to the compounding nature of social factors and network effects. The larger the network, the larger the social influence becomes, the more recognition one receives and the more people benefit from the reciprocal social behaviour. Therefore, the results of the path model support the conclusion that the social factors positively and partially mediate network exposure on each other.

Moreover, interesting findings regarding the relationships of the factors within the extended social influence and the dependent variables were made in the study. Firstly, the direct effect of recognition on attitude was significant, but rather small, while the total effect (direct effect + effect mediated by reciprocal benefits) was considerably larger. This finding suggests that merely getting recognized does not necessarily translate into positive attitudes towards the service. However, when the user also perceives receiving reciprocal benefits from the service in addition to the recognition, it leads to further positive attitudes towards the service. Therefore, the nature of the interaction with the other users seems to be important instead of simply being acknowledged by the community. Secondly, in the data, subjective norms had a strong positive relationship with attitude, however, a portion of its influence was mediated by recognition and reciprocal benefits. This is an interesting finding as the common theories used to explain behavioural intentions, the TRA and TPB, consider both attitude and subjective norms as antecedents to behavioural intentions. However, as noted, in our research the relationship between subjective norms and behavioural intentions was not significant, while there was a significant, partially mediated, positive relationship between subjective norm and attitude (on the relationships of subjective norm, attitude and behavioural intention, see e.g. [Davis et al., 1989](#)).

In this study we investigated the phenomenon of social influence in the context of gamification. As the system studied here has been designed to have affordances that support social interaction ([Zhang, 2008](#)), it might be intuitive that factors pertaining to social influence play an important role. Nevertheless, more traditional information technologies can equally benefit from the use of similar design. The results of this research suggest that in order to support adoption and use of information technologies, the process of social influence could be harnessed in the design in several ways. Firstly, affording features that enable users/community to signal norms within the community in the system enables the diffusion of norms, and thus, enables creation and strengthening of the community. Secondly, providing features such as sharing functions and badges (see [Hamari, 2013](#); [Hamari & Eranti, 2011](#); [Zhang, 2008](#)) affords users to communicate or make visible their behaviour related to accepting the social influence. Thirdly, providing features such as “liking” and commenting enables users to give feedback on other users’ activities (and thus enables recognition and further support for emergence of relatedness related intrinsic motivations towards use of the system). Fourthly, the formation of such social communities in the information system context can support the continued social interaction and further use as well as the formation of reciprocal benefits through increased cooperation. Our data also show that the size of a person’s network in a community within a given system is an important predictor for other social benefits that can be derived from the use. Therefore, the integration of new users to the community seems to be crucial. Furthermore, efforts in the information system design towards connecting new and old users should prove to be highly beneficial. The diffusion of the community’s norms was especially pertinent in the context of this study (gamification), particularly since the system’s function was behaviour change. In similar systems, design aiming to progress the formation of a strong community and dissemination of the community’s norms should prove to be highly effective.

4.2. Future research directions

Future studies should seek to investigate the difference in effects of social influence depending on the system type, for example, depending on the degree of possible exposure to social interaction within the system. Although the type of motivational technologies investigated in this study seems to bring social influence to the forefront, the same phenomenon is also highly relevant,

for example, in the context of utilitarian information systems. For instance, in adoption of corporate systems, such as enterprise resource planning systems, it would be highly relevant to investigate how in the post-adoption phase the aspects of influence acceptance, recognition and benefits from reciprocity can influence satisfaction with the system, and further, attitude formation and intentions. Future work could also consider differences in the impact of social influence depending on the level of suggestibility/conformity of the users (see e.g. [Lascu & Zinkhan, 1999](#)).

In the motivational system/gamification contexts, further studies could also benefit from considering differences stemming from the users' orientation toward gameful interactions ([Hamari & Tuunanen, 2014](#); [Yee, 2006](#)). Moreover, as this study has explored the role of social influence in gamification and motivational systems, further studies could investigate hedonistic ([Hirschman & Holbrook, 1982](#); [van der Heijden, 2004](#); [Webster & Martocchio, 1992](#)) and utilitarian motivations (e.g., [Davis, 1989](#)) in such environments.

4.3. Limitations

As is commonplace with research conducted by online surveys, the data of this study is self-reported and the respondents are self-selected. Use of self-reported data may affect the results as the users responding are most presumably actively engaged with the service and eager to participate in activities related to it. Therefore, the results possibly represent perceptions and intentions of active users of the service and disregard less active and unengaged users. The perceptions of less active users could be addressed in future studies as well as reasons for not being or becoming involved in the service. Future research would also benefit from combining survey data with actual usage data as well as randomized experiments in order to diminish the effects of self-reported and selected data.

Furthermore, it is also commonplace with quantitative studies that the results are reductionist and geared towards generalizable

overall indications of the phenomenon. Therefore, the study does not investigate all possible ways of using the system nor all possible motivations behind using it. Therefore, it is expected and likely that the phenomenon can be more complex if we were to investigate the phenomenon on a more granular level by using e.g. qualitative methods. As with any system, ultimately it is up to the users how they eventually interact with a given system. Considering an exercise gamification system such as Fitocracy examined in this study, it is possible that some users may be motivated simply by the tracking features of the system and pay less attention to the gameful and social aspects. In contrast, some users may be motivated simply by the gamification and disregard the social features. Further studies could investigate how different user factors might moderate the effects between gamification element use and psychological aspects. The different ways in which individual respondents ultimately perceive and interact with the system is out of reach of this study due to the chosen method and approach.

Relatedly, in this study it was not directly measured how different gamification elements affect aspect of social influence and use but rather investigated the formation and process of social influence midst gamification service users. Further studies could be conducted where the linkages between service features and psychological responses were recorded.

Acknowledgements

The research has been partially supported by individual study grants for both authors from the Finnish Cultural Foundation as well as carried out as part of research projects (40134/13, 40111/14, 40107/14) funded by the Finnish Funding Agency for Innovation (TEKES). Both authors have contributed to this article equally.

Appendix A. Survey items, loadings, and construct sources

Construct name and source	Indicator	Survey item	Loading
<i>Attitude</i> Ajzen (1991)	ATT1	All things considered, I find using Fitocracy to be a wise thing to do	0.868
	ATT2	All things considered, I find using Fitocracy to be a good idea	0.914
	ATT3	All things considered, I find using Fitocracy to be a positive thing	0.898
	ATT4	All things considered, I find using Fitocracy to be favourable	0.885
<i>Continuance intentions for system use</i> Bhattacharjee (2001)	CU1	I predict that I will keep using Fitocracy in the future at least as much as I have used it lately	0.883
	CU2	I intend to use Fitocracy at least as often within the next three months as I have previously used	0.820
	CU3	I predict that I will use Fitocracy more frequently rather than less frequently	0.831
	CU4	It is likely that I will use Fitocracy more often rather than less often during the next couple months	0.891
<i>Continuance intentions for exercise</i> Bhattacharjee (2001)	CE1	I plan to increase the amount of exercise rather than to decrease it	0.900
	CE2	I predict that I will exercise more frequently within the next three months	0.880
	CE3	I think I will keep exercising in the near future at least as	0.615

(continued on next page)

Appendix A (continued)

Construct name and source	Indicator	Survey item	Loading
		much as I have during the last few months	
<i>Network exposure</i>			
Lin and Bhattacharjee (2008)	NEXP1	I have a lot of friends on Fitocracy who follow my activities	0.908
	NEXP2	Many people follow my activities on Fitocracy	0.941
	NEXP3	I follow many people on Fitocracy	0.915
	NEXP4	I have many friends in Fitocracy	0.935
<i>Reciprocal benefits</i>			
Hsu and Lin (2008), Lin (2008)	RECIPB1	I find that participating in the Fitocracy community can be mutually helpful	0.834
	RECIPB2	I find my participation in the Fitocracy community can be advantageous to me and other people	0.842
	RECIPB3	I think that participating in the Fitocracy community improves my motivation to exercise	0.811
	RECIPB4	The Fitocracy community encourages me to exercise	0.860
<i>Recognition</i>			
Hernandez et al. (2011), Hsu and Lin (2008), Lin (2008), Lin and Bhattacharjee (2010)	RECOG1	I feel good when my achievements in Fitocracy are noticed	0.882
	RECOG2	I like it when other Fitocracy users comment and like my exercise	0.900
	RECOG3	I like it when my Fitocracy peers notice my exercise reports	0.936
	RECOG4	It feels good to notice that other user has browsed my Fitocracy feed	0.868
<i>Subjective norms</i>			
Ajzen (1991), Fishbein (1979), Venkatesh, Morris, Davis, and Davis (2003)	SUBJN1	People who influence my attitudes would recommend Fitocracy	0.782
	SUBJN2	People who are important to me would think positively of me using Fitocracy	0.888
	SUBJN3	People who I appreciate would encourage me to use Fitocracy	0.895
	SUBJN4	My friends would think using Fitocracy is a good idea	0.861
<i>Word-of-mouth intentions</i>			
Kim and Son (2009)	WOM1	I would recommend Fitocracy to my friends	0.860
	WOM2	I will recommend Fitocracy to anyone who seeks my advice	0.907
	WOM3	I will refer my acquaintances to Fitocracy	0.825
	WOM4	I will say positive things about Fitocracy to other people	0.883

Appendix B. Cross-loadings

	ATT	CE	CU	NEXP	RECIPB	RECOG	SUBJN	WOM
ATT1	0.868	0.420	0.530	0.339	0.636	0.438	0.638	0.603
ATT2	0.914	0.444	0.641	0.330	0.636	0.478	0.585	0.651
ATT3	0.898	0.393	0.591	0.323	0.611	0.576	0.536	0.724
ATT4	0.885	0.392	0.577	0.336	0.659	0.592	0.617	0.704
CE1	0.419	0.900	0.601	0.199	0.331	0.299	0.414	0.343
CE2	0.398	0.880	0.547	0.204	0.366	0.226	0.421	0.304
CE3	0.289	0.615	0.451	0.261	0.358	0.284	0.211	0.285
CU1	0.580	0.668	0.883	0.213	0.449	0.332	0.536	0.552
CU2	0.568	0.483	0.820	0.194	0.428	0.387	0.318	0.517
CU3	0.557	0.432	0.831	0.230	0.409	0.373	0.361	0.590
CU4	0.550	0.660	0.891	0.152	0.403	0.262	0.454	0.471
NEXP1	0.317	0.254	0.198	0.908	0.387	0.373	0.380	0.371
NEXP2	0.285	0.187	0.153	0.941	0.353	0.413	0.317	0.343
NEXP3	0.399	0.264	0.242	0.915	0.532	0.550	0.392	0.457
NEXP4	0.354	0.277	0.234	0.935	0.441	0.419	0.410	0.390

Appendix B (continued)

	ATT	CE	CU	NEXP	RECIPB	RECOG	SUBJN	WOM
RECIPB1	0.521	0.310	0.385	0.384	0.834	0.526	0.494	0.582
RECIPB2	0.591	0.374	0.403	0.447	0.842	0.630	0.535	0.542
RECIPB3	0.660	0.412	0.417	0.330	0.811	0.435	0.471	0.512
RECIPB4	0.614	0.348	0.441	0.412	0.860	0.553	0.446	0.547
RECOG1	0.476	0.267	0.324	0.413	0.592	0.882	0.349	0.531
RECOG2	0.503	0.235	0.267	0.380	0.532	0.900	0.383	0.564
RECOG3	0.608	0.321	0.403	0.475	0.634	0.936	0.445	0.635
RECOG4	0.507	0.360	0.392	0.457	0.547	0.868	0.467	0.610
SUBJN1	0.520	0.321	0.372	0.352	0.447	0.302	0.782	0.496
SUBJN2	0.573	0.377	0.445	0.318	0.536	0.403	0.888	0.584
SUBJN3	0.593	0.408	0.447	0.374	0.506	0.424	0.895	0.576
SUBJN4	0.593	0.404	0.426	0.358	0.504	0.439	0.861	0.600
WOM1	0.665	0.291	0.487	0.355	0.528	0.486	0.562	0.860
WOM2	0.715	0.348	0.603	0.343	0.568	0.638	0.600	0.907
WOM3	0.540	0.312	0.459	0.431	0.531	0.508	0.547	0.825
WOM4	0.680	0.386	0.583	0.376	0.636	0.632	0.585	0.883

Bolded loadings represent the items belonging to the corresponding construct.

Appendix C. Common method bias test

	Method factor loading	<i>t</i> -value	Variance explained	Substantive factor loading	<i>t</i> -value	Variance explained
RECIPB1	−0.086	1.279	0.007	0.928***	16.453	0.861
RECIPB2	−0.089	1.024	0.008	0.883***	11.230	0.780
RECIPB3	0.058	0.796	0.003	0.792***	11.981	0.627
RECIPB4	0.115	1.453	0.013	0.745***	10.161	0.555
WOM1	0.095	1.233	0.009	0.805***	10.638	0.648
WOM2	−0.067	0.917	0.004	0.891***	14.436	0.794
WOM3	0.097	1.709	0.009	0.826***	16.672	0.682
WOM4	−0.137	1.903	0.019	0.965***	17.279	0.931
CE1	0.199**	2.436	0.040	0.467***	4.788	0.218
CE2	−0.074	1.506	0.005	0.939***	29.406	0.882
CE3	−0.057	1.372	0.003	0.942***	36.960	0.887
CU1	−0.112*	2.174	0.013	0.962***	29.108	0.925
CU2	0.090	1.417	0.008	0.807***	15.551	0.651
CU3	0.034	0.581	0.001	0.820***	14.526	0.672
CU4	−0.010	0.151	0.000	0.838***	15.532	0.702
ATT1	0.090	1.274	0.008	0.810***	11.375	0.656
ATT2	0.010	0.125	0.000	0.863***	11.433	0.745
ATT3	−0.060	1.233	0.004	0.964***	24.611	0.929
ATT4	−0.039	0.667	0.002	0.930***	17.409	0.865
RECOG1	−0.024	0.539	0.001	0.902***	21.243	0.814
RECOG2	0.071	1.584	0.005	0.814***	19.742	0.663
RECOG3	−0.100***	2.850	0.010	0.973***	32.956	0.947
RECOG4	0.050	1.429	0.003	0.899***	30.818	0.808
NEXP1	−0.086**	2.493	0.007	0.993***	68.324	0.986
NEXP2	0.013	0.408	0.000	0.929***	47.059	0.863
NEXP3	−0.028	0.843	0.001	0.930***	31.040	0.865
NEXP4	0.101**	2.588	0.010	0.851***	29.084	0.724
SUBJN1	−0.056	0.754	0.003	0.822***	13.457	0.676
SUBJN2	0.006	0.134	0.000	0.891***	22.538	0.794
SUBJN3	0.046	0.741	0.002	0.826***	12.592	0.682
SUBJN4	−0.001	0.028	0.000	0.890***	22.773	0.792
Average			0.006			0.762

References

- Ainslie, G. (1975). Specious reward: A behavioral theory of impulsiveness and impulse control. *Psychological Bulletin*, 82(4), 463–496.
- Ajzen, I. (1988). *Attitudes, personality, and behaviour*. Chicago, IL: Dorsey Press.
- Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Allam, A., Kostova, Z., Nakamoto, K., & Schulz, P. J. (2015). The effect of social support features and gamification on a web based intervention for rheumatoid arthritis patients: Randomized controlled trial. *Journal of Medical Internet Research*, 17(1), e14.
- Anderson, J. C., & Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika*, 49(2), 155–173.
- Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, 103(3), 411–423.
- Baker, R. K., & White, K. M. (2010). Predicting adolescents' use of social networking sites from an extended theory of planned behaviour perspective. *Computers in Human Behavior*, 26, 1591–1597.
- Bhattacharjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly*, 25(3), 351–370.
- Biddiss, E., & Irwin, J. (2010). Active video games to promote physical activity in children and youth: A systematic review. *Archives of Pediatrics and Adolescent Medicine*, 164(7), 664–672.
- Bista, S. K., Nepal, S., Paris, C., & Colineau, N. (2014). Gamification for online communities: A case study for delivering government services. *International Journal of Cooperative Information Systems*, 23(2).
- Bock, G.-W., Zmud, R. W., Kim, Y.-G., & Lee, J.-N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. *MIS Quarterly*, 29(1), 87–111.
- Bonde, M. T., Makransky, G., Wandall, J., Larsen, M. V., Morsing, M., Jarmer, H., et al. (2014). Improving biotech education through gamified laboratory simulations. *Nature Biotechnology*, 32(7), 694–697.
- Bonner, H. (1959). *Group dynamics: Principles and applications*. New York: Ronald Press.
- Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13, 210–230.
- Brauner, P., Calero Valdez, A., Schroeder, U., & Ziefle, M. (2013). Increase physical fitness and create health awareness through exergames and gamification: The role of individual factors, motivation and acceptance. In A. Holzinger, M. Ziefle, M. Hitz, & M. Debevc (Eds.), *Lecture notes in computer science* (Vol. 7946, pp. 349–362). Berlin, Heidelberg: Springer.
- Burger, J. M., Sanchez, J., Imber, J. E., & Grande, L. R. (2009). The norm of reciprocity as an internalized social norm: Returning favors even when no one finds out. *Social Influence*, 4(1), 11–17.
- Cafazzo, J. A., Casselman, M., Hamming, N., Katzman, D. K., & Palmert, M. R. (2012). Design of an mHealth app for the self-management of adolescent type 1 diabetes: A pilot study. *Journal of Medical Internet Research*, 14(3), e70.
- Carron, A. V., & Brawley, L. R. (2000). Cohesion: Conceptual and measurement issues. *Small Group Research*, 31(1), 89–106.
- Cechanowicz, J., Gutwin, C., Brownell, B., & Goodfellow, L. (2013). Effects of gamification on participation and data quality in a real-world market research domain. In *Proceedings of gamification '13*, Stratford, Ontario, Canada, October 2–4 (pp. 58–65).
- Celik, H. (2011). Influence of social norms, perceived playfulness and online shopping anxiety on customers' adoption of online retail shopping: An empirical study in the Turkish context. *International Journal of Retail & Distribution Management*, 39(6), 390–413.
- Chen, Y., & Pu, P. (2014). HealthyTogether: Exploring social incentives for mobile fitness applications. In *Proceedings of Chinese CHI '14*, Toronto, ON, Canada, April 26–27 (pp. 25–34).
- Chen, Y., Zhang, J., & Pu, P. (2014). Exploring social accountability in pervasive fitness apps. In *Proceeding of the UBICOMM2014*, Rome, Italy, August 24–28 (pp. 221–226).
- Cheung, C. M. K., Chiu, P.-Y., & Lee, M. K. O. (2011). Online social networks: Why do students use Facebook? *Computers in Human Behavior*, 27, 1337–1343.
- Cheung, C. M. K., & Lee, M. K. O. (2010). A theoretical model of intentional social action in online social networks. *Decision Support Systems*, 49(1), 24–30.
- Cheung, C. M. K., & Thadani, D. R. (2012). The impact of electronic word-of-mouth communication: A literature analysis and integrative model. *Decision Support Systems*, 54(1), 461–470.
- Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research*, 14(2), 189–217.
- Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295–336). London: Lawrence Erlbaum Associates.
- Chin, W. W., & Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. In R. H. Hoyle (Ed.), *Statistical strategies for small sample research* (pp. 307–342). Thousand Oaks, CA: Sage.
- Chiu, C.-M., Hsu, M.-H., & Wang, E. T. G. (2006). Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems*, 42(3), 1872–1888.
- Christy, K. R., & Fox, J. (2014). Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance. *Computers & Education*, 78, 66–77.
- Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology*, 55, 591–621.
- Cialdini, R. B., Green, B. L., & Rusch, A. J. (1992). When tactical pronouncements of change become real change: The case of reciprocal persuasion. *Journal of Personality and Social Psychology*, 63(1), 30–40.
- Cook, T. D., Campbell, D. T., & Day, A. (1979). *Quasi-experimentation: Design & analysis issues for field settings*. Boston: Houghton Mifflin.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35(8), 982–1003.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268.
- de-Marcos, L., Domínguez, A., Saenz-de-Navarrete, J., & Pagés, C. (2014). An empirical study comparing gamification and social networking on e-learning. *Computers & Education*, 75, 82–91.
- Denny, P. (2013). The effect of virtual achievements on student engagement. In *Proceedings of CHI 2013: Changing perspectives*, Paris, France, April 27–May 2, 2013 (pp. 763–772).
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining gamification. In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments*, Tampere, Finland, September 28–30 (pp. 9–15).
- Dholakia, U. M., Bagozzi, R. P., & Klein Pearo, L. (2004). A social influence model of consumer participation in network- and small-group-based virtual communities. *International Journal of Research in Marketing*, 21(3), 241–263.
- Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J.-I. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education*, 63, 380–392.
- Eickhoff, C., Harris, C. G., de Vries, A. P., & Srinivasan, P. (2012). Quality through flow and immersion: Gamifying crowdsourced relevance assessments. In *Proceedings of the 35th international ACM SIGIR conference on research and development in information retrieval*, Portland, Oregon, USA, August 12–16, 2012 (pp. 871–880).
- Elias, P., Rajan, N. O., McArthur, K., & Dacso, C. C. (2013). InSpire to promote lung assessment in youth: Evolving the self-management paradigms of young people with asthma. *Medicine*, 92(1), e1.
- Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook “friends”: Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication*, 12, 1143–1168.
- Farzan, R., & Brusilovsky, P. (2011). Encouraging user participation in a course recommender system: An impact on user behavior. *Computers in Human Behavior*, 27(1), 276–284.
- Farzan, R., DiMicco, J. M., Millen, D. R., Brownholtz, B., Geyer, W., & Dugan, C. (2008a). When the experiment is over: Deploying an incentive system to all the users. In *Symposium on persuasive technology*, Aberdeen, Scotland, April 2008.
- Farzan, R., DiMicco, J. M., Millen, D. R., Brownholtz, B., Geyer, W., & Dugan, C. (2008b). Results from deploying a participation incentive mechanism within the enterprise. In *Proceedings of the twenty-sixth annual SIGCHI conference on human factors in computing systems*, Florence, Italy, April 5–10, 2008 (pp. 563–572).
- Filsecker, M., & Hickey, D. T. (2014). A multilevel analysis of the effects of external rewards on elementary students' motivation, engagement and learning in an educational game. *Computers & Education*, 75, 136–148.
- Fishbein, M. (1979). A theory of reasoned action: Some applications and implications. *Nebraska Symposium on Motivation*, 27, 65–116.
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to the theory and research*. Reading, MA: Addison-Wesley.
- Fornell, C., & Larcker, D. (1981). Structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50.
- Gartner (2011). Gartner says by 2015, more than 50 percent of organizations that manage innovation processes will gamify those processes. <http://www.gartner.com/it/page.jsp?id=1629214> Accessed 25.11.14.
- Gartner (2012). Gartner says by 2014, 80 percent of current gamified applications will fail to meet business objectives primarily due to poor design. <http://www.gartner.com/newsroom/id/2251015> Accessed 25.11.14.
- Gouldner, A. W. (1960). The norm of reciprocity: A preliminary statement. *American Sociological Review*, 25(2), 161–178.
- Hair, J. F., Ringle, C. M., & Sarstedt, S. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, 19(2), 139–151.
- Hakulinen, L., Auvinen, T., & Korhonen, A. (2013). Empirical study on the effect of achievement badges in TRAKLA2 online learning environment. In *Proceedings of learning and teaching in computing and engineering (LaTiCE) conference*, Macau, March 21–24, 2013 (pp. 47–54).
- Hamari, J. (2013). Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. *Electronic Commerce Research and Applications*, 12(4), 236–245.
- Hamari, J. (2015). Do badges increase user activity? A field experiment on effects of gamification. *Computers in Human Behavior*.
- Hamari, J., & Eranti, V. (2011). Framework for designing and evaluating game achievements. In *Proceedings of the DiGRA 2011 conference: Think design play*, Hilversum, The Netherlands, September 14–17, 2011.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. In *Proceedings of the 47th*

- Hawaii international conference on system sciences, Hawaii, USA, January 6–9, 2014.
- Hamari, J., Huotari, K., & Tolvanen, J. (2015). Gamification and economics. In S. P. Walz & S. Deterding (Eds.), *The gameful world: Approaches, issues, applications*. Cambridge, MA: MIT Press.
- Hamari, J., & Koivisto, J. (2014). Measuring flow in gamification: Dispositional flow scale-2. *Computers in Human Behavior*, 40, 133–143.
- Hamari, J., & Koivisto, J. (2015). Why do people use gamification services. *International Journal of Information Management*.
- Hamari, J., & Tuunanen, J. (2014). Player types: A meta-synthesis. *Transactions of the Digital Games Research Association*, 1(2), 29–53.
- Hernandez, B., Montaner, T., Sese, F. J., & Urquiza, P. (2011). The role of social motivations in e-learning: How do they affect usage and success of ICT interactive tools? *Computers in Human Behavior*, 27, 2224–2232.
- Hirschman, E. C., & Holbrook, M. B. (1982). Hedonic consumption: Emerging concepts, methods and propositions. *Journal of Marketing*, 46, 92–101.
- Hogg, M. A. (1992). *The social psychology of group cohesiveness: From attraction to social identity*. New York: Harvester Wheatsheaf.
- Hsiao, C.-C., & Chiou, J.-S. (2012). The effect of social capital on community loyalty in a virtual community: Test of a tripartite-process model. *Decision Support Systems*, 54(1), 750–757.
- Hsieh, J. J. P.-A., Rai, A., & Keil, M. (2008). Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Quarterly*, 32(1), 97–126.
- Hsu, M.-H., & Chiu, C.-M. (2004). Internet self-efficacy and electronic service acceptance. *Decision Support Systems*, 38(3), 369–381.
- Hsu, C.-L., & Lin, J. C.-C. (2008). Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & Management*, 45, 65–74.
- Hsu, C.-L., & Lu, H.-P. (2004). Why do people play on-line games? An extended TAM with social influences and flow experience. *Information & Management*, 41(7), 853–868.
- IEEE (2014). *Everyone's a gamer – IEEE experts predict gaming will be integrated into more than 85 percent of daily tasks by 2020*. <http://www.ieee.org/about/news/2014/25_feb_2014.html> Accessed 06.06.14.
- Ipeirotis, P. G., & Gabrilovich, E. (2014). Quizz: Targeted crowdsourcing with a billion (potential) users. In *Proceedings of WWW '14, Seoul, Korea, April 7–11* (pp. 143–154).
- Jones, B. A., Madden, G. J., & Wengreen, H. J. (2014). The FIT game: Preliminary evaluation of a gamification approach to increasing fruit and vegetable consumption in school. *Preventive Medicine*. <http://dx.doi.org/10.1016/j.ypmed.2014.04.015>.
- Jöreskog, K. G., & Sörbom, D. (1996). LISREL 8 user's reference guide. *Scientific Software*.
- Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *The American Economic Review*, 75(3), 424–440.
- Kelman, H. C. (1958). Compliance, identification, and internalization: Three processes of attitude change. *Journal of Conflict Resolution*, 2, 51–60.
- Kim, S. S., & Son, J.-Y. (2009). Out of dedication or constraint? A dual model of post-adoption phenomena and its empirical test in the context of online services. *MIS Quarterly*, 33(1), 49–70.
- Koivisto, J., & Hamari, J. (2014). Demographic differences in perceived benefits from gamification. *Computers in Human Behavior*, 35, 179–188.
- Lascu, D., & Zinkhan, G. (1999). Consumer conformity: Review and applications for marketing theory and practice. *Journal of Marketing Theory and Practice*, 7(3), 1–12.
- Lee, J. J., Ceyhan, P., Jordan-Cooley, W., & Sung, W. (2013). GREENIFY: A real-world action game for climate change education. *Simulation & Gaming*, 44(2–3), 349–365.
- Lewis, W., Agarwal, R., & Sambamurthy, V. (2003). Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. *MIS Quarterly*, 27(4), 657–678.
- Li, Y.-M., Wu, C.-T., & Lai, C.-Y. (2013). A social recommender mechanism for e-commerce: Combining similarity, trust, and relationship. *Decision Support Systems*, 55(3), 740–752.
- Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *MIS Quarterly*, 31(1), 59–87.
- Lin, H.-F. (2008). Determinants of successful virtual communities: Contributions from system characteristics and social factors. *Information & Management*, 45, 522–527.
- Lin, C.-P., & Bhattacharjee, A. (2008). Elucidating individual intention to use interactive information technologies: The role of network externalities. *International Journal of Electronic Commerce*, 13(1), 85–108.
- Lin, C.-P., & Bhattacharjee, A. (2009). Understanding online social support and its antecedents: A socio-cognitive model. *The Social Science Journal*, 46(4), 724–737.
- Lin, C.-P., & Bhattacharjee, A. (2010). Extending technology usage models to interactive hedonic technologies: A theoretical model and empirical test. *Information Systems Journal*, 20(2), 163–181.
- Lin, K.-Y., & Lu, H.-P. (2011). Why people use social networking sites: An empirical study integrating network externalities and motivation theory. *Computers in Human Behavior*, 27, 1152–1161.
- Lindenberg, S. (2001). Intrinsic motivation in a new light. *Kyklos*, 54, 317–342.
- Lott, A. J., & Lott, B. E. (1965). Group cohesiveness as interpersonal attraction: A review of relationships with antecedent and consequent variables. *Psychological Bulletin*, 64(4), 259–309.
- Lounis, S., Pramatar, K., & Theotokis, A. (2014). Gamification is all about fun: The role of incentive type and community collaboration. In *Proceedings of ECIS 2014, Tel Aviv, Israel, June 9–11* (pp. 1–14).
- Mäntymäki, M., & Riemer, K. (2014). Digital natives in social virtual worlds: A multi-method study of gratifications and social influences in Habbo Hotel. *International Journal of Information Management*, 34(2), 210–220.
- McCauley, C. (1989). The nature of social influence in groupthink: Compliance and internalization. *Journal of Personality and Social Psychology*, 57(2), 250–260.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Pavlou, P. A., & Fygenson, M. (2006). Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior. *MIS Quarterly*, 30(1), 115–143.
- Pavlou, P. A., Liang, H. G., & Xue, Y. J. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. *MIS Quarterly*, 31(1), 105–136.
- Peil, U., Arjan, R., & Zaphiris, P. (2009). Age differences in online social networking: A study of user profiles and the social capital divide among teenagers and older users in MySpace. *Computers in Human Behavior*, 25, 643–654.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879–903.
- Preece, J. (2001). Sociability and usability in online communities: Determining and measuring success. *Behaviour & Information Technology*, 20(5), 347–356.
- Ringle, C. M., Wende, S., & Will, A. (2005). *SmartPLS 2.0 M3*. <<http://www.smartpls.de/>> Accessed 06.06.14.
- Riva, S., Camerini, A. L., Allam, A., & Schulz, P. J. (2014). Interactive sections of an internet-based intervention increase empowerment of chronic back pain patients: Randomized controlled trial. *Journal of Medical Internet Research*, 16(8).
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78.
- Shen, X.-L., Cheung, C. M. K., & Lee, M. K. O. (2013). Perceived critical mass and collective intention in social media-supported small group communication. *International Journal of Information Management*, 33(5), 707–715.
- Simões, I., Díaz Redondo, R., & Fernández Vilas, A. (2013). A social gamification framework for a K-6 learning platform. *Computers in Human Behavior*, 29(2), 345–353.
- Sledgianowski, D., & Kulviwat, S. (2009). Using social network sites: The effects of playfulness, critical mass and trust in a hedonic context. *The Journal of Computer Information Systems*, 49(4), 74–83.
- Srinivasan, S. S., Anderson, R., & Ponnnavolu, K. (2002). Customer loyalty in e-commerce: An exploration of its antecedents and consequences. *Journal of Retailing*, 78, 41–50.
- Stibe, A., Oinas-Kukkonen, H., & Lehto, T. (2013). Exploring social influence on customer engagement: A pilot study on the effects of social learning, social comparison, and normative influence. In *2013 46th Hawaii international conference on system sciences (HICSS)* (pp. 2735–2744).
- Terlutter, R., & Capella, M. L. (2013). The gamification of advertising: Analysis and research directions of in-game advertising, advergames, and advertising in social network games. *Journal of Advertising*, 42(2–3), 95–112.
- Thom, J., Millen, D., & DiMicco, J. (2012). Removing gamification from an enterprise SNS. In *Proceedings of the ACM 2012 conference on computer supported cooperative work, Seattle, Washington, USA, February 11–15, 2012* (pp. 1067–1070).
- Thorsteinsen, K., Vittersø, J., & Svendsen, G. B. (2014). Increasing physical activity efficiently: An experimental pilot study of a website and mobile phone intervention. *International Journal of Telemedicine and Applications*.
- Tolmie, P., Chamberlain, A., & Benford, S. (2014). Designing for reportability: Sustainable gamification, public engagement, and promoting environmental debate. *Personal and Ubiquitous Computing*, 18(7), 1763–1774.
- Tuckman, B. W. (1965). Developmental sequence in small groups. *Psychological Bulletin*, 63(6), 384–399.
- van der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly*, 28(4), 695–704.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46, 186–204.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.
- Watson, D., Mandryk, R. L., & Stanley, K. G. (2013). The design and evaluation of a classroom exergame. In *Proceedings of gamification '13, Stratford, ON, Canada, October 02–04* (pp. 34–41).
- Webster, J., & Martocchio, J. J. (1992). Microcomputer playfulness: Development of a measure with workplace implications. *MIS Quarterly*, 16(2), 201–226.
- Wellman, B., & Wortley, S. (1990). Different strokes from different folks: Community ties and social support. *American Journal of Sociology*, 96(3), 558–588.
- Williams, L., Edwards, J., & Vandenberg, R. (2003). Recent advances in causal modeling methods for organizational and management research. *Journal of Management*, 29(6), 903–936.
- Xiao, B., & Benbasat, I. (2007). E-commerce product recommendation agents: Use, characteristics, and impact. *MIS Quarterly*, 31(1), 137–209.
- Yee, N. (2006). Motivations of play in online games. *Journal of Cyberpsychology and Behavior*, 9, 772–775.
- Zhang, P. (2008). Motivational affordances: Reasons for ICT design and use. *Communications of the ACM*, 51(11), 145–147.
- Zhou, T. (2011). Understanding online community user participation: A social influence perspective. *Internet Research*, 21, 167–181.
- Zhou, L., Zhang, P., & Zimmermann, H. D. (2013). Social commerce research: An integrated view. *Electronic Commerce Research and Applications*, 12(2), 61–68.