This is the accepted manuscript of the article, which has been published in *International journal of information management*. 2019, 46, 151-162. https://doi.org/10.1016/j.ijinfomgt.2018.12.004

How motivational feedback increases user's benefits and continued use: A study on gamification, quantified-self and social networking

Lobna Hassan, Antonio Dias, Juho Hamari

Abstract

With the increasing provenance of hedonic and social information systems, systems are observed to employ other forms of feedback and design than purely informational in order to increase user engagement and motivation. Three principle classes of motivational design pursuing user engagement have become increasingly established; *gamification, quantified-self* and *social networkin*g. This study investigates how the perceived prominence of these three design classes in users' use of information system facilitate experiences of *affective, informational* and *social feedback* as well as *user's perceived benefits* from a system *and their continued use intentions*. We employ survey data (N=167) gathered from users of HeiaHeia; an exercise encouragement system that employs features belonging to the three design classes. The results indicate that gamification is positively associated with experiences of affective feedback, quantified-self with experiences of both affective and informational feedback and social networking with experiences of social feedback. Experiences of affective feedback are further strongly associated with user perceived benefits and continued use intentions, whereas experiences of informational feedback are only associated with continued use intentions. Experiences of social feedback had no significant

relationship with neither. The findings provide practical insights into how systems can be designed to facilitate different types of feedback that increases users' engagement, benefits and intentions to continue the use of a system.

Keywords: Gamification, social networking, quantified-self, feedback, continued use, hedonic design

1. Introduction

Since their inception, information systems have mostly been designed with instrumental ends in mind (Davis, 1989; Hirschheim and Klein, 2012; McLeod and Schell, 2008). In other words, information systems have thus far mainly attempted to make people more efficient through better provision of information and informational feedback. As technological developments took place, systems, services and their facilitating infrastructure became more varied. The focus of information systems departed from the mindset of efficiency and instrumentality towards facilitating human life in manifold ways such as through entertainment (e.g. games) and social connections (e.g. social networking applications) (Hamari 2015; Hassan, 2018; Oinas-Kukkonen, 2012). We have since observed an expansive understanding of user benefits and the feedback systems can provide their users to include not only informational benefit/feedback (e.g. performance reports) (Davis, Bogozzi, and Warshaw, 1989) but also affective benefit/feedback (e.g. entertainment, enjoyment) (van der Heijden, 2004) and social benefit/feedback (e.g. social interaction) (Boyd and Ellison, 2007) amongst others (Giboney, Briggs, and Nunamaker, 2017).

Today, it appears that the majority of contemporary systems and services attempt to facilitate user engagement, not only through providing users accurate information but additionally through providing them affective and social experiences to further support both the utility and the

self-purposefulness of system use (Fang, Zhao, Wen, and Wang, 20017; Giboney et al., 2017; Oinas-Kukkonen and Harjumaa, 2009; Zhang, 2008). However, even beyond both utility through efficiency and self-purposefulness through enjoyment, today's systems attempt to merge both notions and employ hedonic design to spur increased utility through increasing positive user motivation. Therefore, modern information systems can be increasingly considered "motivational information systems" (motivational ISs) (Hamari, 2015; Koivisto and Hamari, 2019). Whereas utilitarian information systems primarily aim at efficiency and productivity and whereas hedonic information systems (such as games) primarily aim to afford self-purposeful system use, motivational ISs aim to increase motivational affordance by implementing hedonic systems design, primarily aiming to increase productivity through increased motivation and engagement (Hamari 2015; Hamari et al. 2018; Koivisto & Hamari 2019).

For example, in the realm of exercise: motivational ISs such as exergames, motivate users towards exercising more through for example affective feedback, social connections, social comparison, next to traditional informational feedback and visual summaries of performance (Huang, Pham, Wong, Chiu, Yang, and Teng, 2018b; Nguyen, Huang, Wong, Yang, Huang, and Teng, 2018). Similar motivational systems have been introduced to for example: educational contexts (Coleman, 2018), and organizational contexts (Jung, Schneider, and Valacich, 2010).

At the helm of the motivational IS's development has notably been three popular conceptual and technological design classes (Hamari, Hassan, and Dias, 2018): 1) Gamification - drawing design from games with the aim of making activities, services and systems more intrinsically motivating and enjoyable by providing users affective feedback (Huotari and Hamari, 2017; Landers, Auer, Collmus, and Armstrong, 2018), 2) Quantified-self (QS) - benefiting from advances in big data and wearables, QS designs collect, store and visualize data related to users'

performance, attempting to provide users personal and precise informational feedback (Lupton, 2016; Nafus and Sherman, 2014) and 3) Social networking - drawing from the designs of social networking services and social computing to attempt to invoke socio-psychological responses, such as a sense of community through social feedback (Boyd and Ellison, 2007; Chen, Lu, Chau, Gupta, 2014). As discussed, these design developments are prominently observed in consumer applications and systems in various areas such as in exercise (Fitocracy, Myfitnesspal), education (Codecademy, Khan Academy) and Habits formation (Habitica, Superbetter). The popularity of the three classes of design is also observed in how established system packages have come to employ gamification and social features as seen in many ERP implementations (e.g., Alcivar and Abad, 2016; Herzig et al., 2012).

Despite the growing prominence of gamification, quantified-self and social designs both in academia and industry, we lack a concrete and comparative understanding of how these designs provide the informational, affective and social feedback that they are assumed to provide to engage and benefit users. The veins of literature on the respective three design classes and the feedback they could be providing remain, for the most part, separate and distinct as each design practices are separately investigated by respective veins of literature. While features from the three design classes may be simultaneously present in a motivational IS, the features are likely to overshadow one another, and users are likely to view features differently, being more attuned to the features that they find prominent. There is, hence, a need to determine what feedback do users experience from the features they attune to the most and if the feedback users experience from these designs does lead to perceived benefits from, or intentions to continue the use of a system or a service that employs these designs. It is hence pertinent theoretical, as well as a practical, questions to ask:

1) How does the prominence of gamification, quantified-self and social networking features in users' use of a system affect experiences of affective, social and informational feedback?
2) How does experiences of affective, social and informational feedback affect the perceived beneficial-ness of the system use and their continued use intentions?

Investigating these questions assists 1) designers in designing motivational systems and services that employ features and provide feedback that best resonates with users, and 2) individuals and organizational managers in selecting technologies that provide individuals and organizations benefits and that are used more longitudinally, which could help in attaining more returns from IS investments. To answer the outlined research questions, we utilized data from a survey (N=167) of users of HeiaHeia; an exercise encouragement system which employs features belonging to the three design classes: gamification, quantified-self and social networking allowing for the simultaneously study of the feedback these designs provide.

2. Background

2.1 Feedback and Motivational information system design

The, affective and social responses and performance information people attain in response to their behavior are what is commonly referred to as feedback (Carver and Scheier, 1990; Hattie and Timperley, 2007; op den Akker, Jones, and Hermens, 2014). One of the main purpose of feedback is to help individuals reduce the discrepancies between intended and actual behavior (Hattie and Timperley, 2007; Shute, 2008). Hence, it can guide an individual's attention towards their intended performance (Fishbach and Finkelstein, 2011; Kluger and DeNisi, 1996). Feedback can thus be used as a tool of motivation and behavioral change and has been a topic of interest in motivational research (e.g., Custers and Aarts, 2005; Kluger and DeNisi, 1996;, 1998; Zhang, 2008)).

As a motivational tool, feedback has a high, positive bearing on levels of motivation when provided in the right form (Positive or negative, personal or in group, etc.) and at the right time (Fishbach and Finkelstein, 2011; Hattie and Timperley, 2007). There is hence a high need for systems that provide the appropriate feedback to users to help users perceive benefits from the systems (Davis et al., 1989; Fang et al., 20017; op den Akker et al., 2014). One design pattern to ensure that all users of a system perceive benefits from a system is to integrate many features in a system as possible, enriching the choices available to users so that they are more likely to find features that they appreciate. It is indeed important to provide users with a variety of choices, however, this strategy of providing as many design features and consequently forms of feedback as possible creates an overwhelming information overload and a confusing environment for many users (Willemsen, Graus, and Knijnenburg, 2016) that they may not continue their use of the system altogether.

The division of feedback into affective, social and informational is established in the psychology and computer science literature (Bandura, Hamilton, and Bower., 1988; Giboney et al., 2017; Zhang, 2008). Nonetheless, there also are other theories and ways to categorize feedback into for example normative, formative, corrective, positive or negative as theorized on by researchers such as Bandura et al. (1988); Chesire and Antin (2008); Kluger and DeNisi (1996); Shute (2008), Since it is argued that designers of motivational system and service should significantly attend to the informational, affective and social needs of users (Fang et al., 20017; Osatuyi and Qin, 2018; Zhang, 2008) and provide feedback that resonates with the preferences of the targeted users rather than an endless array of features and feedback, it is important to identify which motivational designs provide which types of feedback and to then facilitate a user-design-feedback fit (Hamari et al., 2018; op den Akker et al., 2014; Willemsen et al., 2016). We hence

limit the scope of this study to an investigation of affective, social and informational feedback and prominent motivational design classes.

2.1.1. Affective feedback and gamification design

Humans tend to employ affect as regulatory information to understand and respond to life (Butler and Winne, 1995; Clore and Huntsinger, 2007; Fishbach and Finkelstein, 2011). Individuals are often observed to consciously or unconsciously consider how they feel about something, and then use their affective response as a guide for how to behave (Clore and Huntsinger, 2007). Affective feedback is the positive or negative emotional responses individuals experience from an intrinsic or extrinsic stimulus, based on which they evaluate, maintain or change their behavior (Butler and Winne, 1995; Custers and Aarts, 2005).

When an activity is followed by a positive (negative) affective feedback, the activity as well as the motivation for it are positively (negatively) influenced even without a logical explanations for the affective feedback, making affective feedback a powerful motivational tool (Fishbach and Finkelstein, 2011). It is further argued that the affect individuals experience could have a quicker and a more powerful influence on them than information would (Clore and Huntsinger, 2007). For example; individuals in experiments developed favorable attitudes towards and engaged more with an activity simply because it was paired with a positive affective stimulus (Custers and Aarts, 2005; Fishbach and Finkelstein, 2011). Hence, affective feedback, when of the appropriate type and at the appropriate time, is helpful in engaging and motivating individuals and should hence be facilitated by systems and services that intend to stimulate motivation and engagement (Hamari and Koivisto, 2015a; Osatuyi and Qin, 2018; Zhang, 2008).

One of the motivational design classes that capitalize the most on utilizing affect to induce motivation, is gamification (Huotari and Hamari, 2017; Landers et al., 2018; Rigby, 2015). While

playing games, individuals experience a variety of affects such as; happiness, frustration, disappointment, or enjoyment (McGonigal, 2011). Although variant, these experiences are perceived as holistically motivational within the appropriate context (Hamari & Keronen, 2017; Hassan, 2018; Morschheuser, Maedche, and Walter, 2017b; Morschheuser, Riar, Hamari, and Maedche, 2017c) Gamification takes inspiration from game design and refers to designing systems, activities and services in manners through which they induce motivating and engaging affective experiences similar to those induced by games (Deterding, Dixon, Khaled, and Nacke, 2011; Huotari and Hamari, 2017; Liu, Li, and Santhanam, 2013).

Empirical research indicates that users of gamified and game-based systems experience various affective states from the use of these applications such as flow (Hamari and Koivisto, 2014; Huang et al., 2018b), enjoyment (van der Heijden, 2004), and happiness (Nguyen et al., 2018). Nonetheless, users who use game-based applications also experience social feedback (Hamari and Koivisto, 2015a; Morschheuser 2017b, 2017c), and access informational feedback on their performance (Christy and Fox, 2014; Coleman, 2018; Herzig et al., 2012), although, arguably, the designs of these applications often do not intentionally attempt to provide social and informational feedback. It is hence important to determine which types of feedback do users who perceive gamification as important experience from gamification. Since gamification borrows it's design practices from games and individuals who appreciate and view games as important tend to perceive affective feedback and experiences from them (Hamari and Keronen, 2017; McGonigal, 2011), perceptions of gamification prominence similarly can indicate that it's users increasingly perceive affective feedback from it. Therefore, we hypothesize the following:

H1*: Perceived prominence of gamification design in a user's use of a motivational information system positively associated with experiences of affective feedback.*

2.1.2 Social feedback and social networking design

Social feedback is understood as information that provides a social evaluation of behavior, which is usually solicited from the social circle surrounding the individuals such as friends, families, colleagues, neighbors or partners (Fishbach and Finkelstein, 2011). Individuals in many situations rely on social feedback in order to determine whether to remain engaged with a behavior, or to abandon it (Bandura, 1991; Hamari and Koivisto, 2015a; Teng, 2017a) and to evaluate their progress and behavior (Butler and Winne, 1995; Fishbach and Finkelstein, 2011). Furthermore, some individuals have a psychological makeup that orients them towards higher appreciation and valuation of social cues (such as communicated through social norms or likes on social media) (Bandura, 1991; Venkatesh and Davis, 2000).

Since humans by nature have a need for socialization and interaction (Ryan and Deci, 2000), many of the technological developments that mankind has witnessed since the early ages were to increase connectivity and improve communications amongst people and along generations (Boyd and Ellison, 2007; McLeod and Schell, 2008; Pan, Lu, Wang, and Chau, 2017). We have thus witnessed inventions of communication techniques starting from writings and drawings on stonewalls, to the currently more technologically complex and socially vibrant "writing on walls" facilitated by the social networking application: Facebook.

Social networking applications incorporate features to create profiles and avatars that allow users to connect with friends and like-minded individuals, and to share information and provide each other with social feedback (Boyd and Ellison, 2007; 2015b; Kukkonen et al., 2010) Such social feedback often occurs through social comparison, praise, or criticism (Cheung, Chiu, and Lee, 2011; Hamari and Koivisto, 2015a; Tandoc, Ferrucci, and Duffy, 2015; Venkatesh and Davis, 2000). Individuals are usually exposed to and expectant of social feedback in many aspects of their

lives. Merely seeing how friends live as communicated through what they share online, could encourage individuals towards higher commitment to some goals or encourage them to tune their behavior to that of their social group (Dwivedi, Kapoor, and Chen, 2015; Shiau, Dwivedi, and Lai, 2018). It hence appears that social feedback has an impact on motivation for various reasons, making social design a motivational tool often employed by motivational ISs (op den Akker et al., 2014; Osatuyi and Qin, 2018; Zhang, 2008).

While social features facilitate social feedback, they also facilitate affective experiences such as of relatedness, and recognition (Hamari and Koivisto, 2015a; Huang, Cheng, Huang, and Teng, 2018a; Teng, 2017a). They similarly provide performance information (Butler and Winne, 1995; Fishbach and Finkelstein, 2011). While the feedback social designs provide users can often be considered positive, it often can induce negative experience such as of failure, envy or disappointment (Krasnova, Widjaja, Buxmann, Wenninger, and Benbasat, 2015; Krasnova, Wenninger, Widjaja, and Buxmann, 2013; Pan et al., 2017); experiences that can be demotivational. It is hence important to determine which types of feedback do users who perceive social design as prominent experience from social design and whether that feedback is positive or negative. As the main purpose of social design is to facilitate social connection and communication (Boyd and Ellison, 2007; Kapoor, Tamilmani, Rana, Patil, Dwivedi, and Nerur, 2018). Therefore, we hypothesize the following;

H2: *Perceived prominence of social networking design in a user's use of a motivational information system is positively associated with experiences of social feedback.*

2.1.3. Informational feedback and Quantified-self (QS) design

One of the long-established ways through which individuals evaluate their behavior is by seeking informational feedback from their environment (Hamari and Koivisto, 2015b; Kluger and DeNisi,

1996; 1998; op den Akker et al., 2014). Informational feedback refers to the objective information one receives pertaining to a specific matter (Butler and Winne, 1995; Hattie and Timperley, 2007), such as exam results, health reports, or performance measures (Fishbach and Finkelstein, 2011). In daily life, many individuals may go as far as to discount the importance of affect in influencing their behavior relative to objective information. Others may devalue social feedback if they don't experience a sense of relatedness to those who provide it to them. It appears that informational feedback is regarded with high importance by most individuals as meta-analysis of studies conducted on feedback show that informational feedback potentially has a stronger effect on behavior than other forms of feedback (Hattie and Timperley, 2007).

Informational feedback can be obtained through various techniques. Individuals often can attain informational feedback through self-tracking. Self- tracking, refer to the practices of tracking one's own activities and behavior for the purposes of increasing awareness of them and their possible consequences (Burke, Wang, and Sevick, 2011; Peterson, Middleton, Nackers, Medina, Milsom, and Perri, 2014; Rapp and Cena, 2014). Humans have almost always been undertaking self-tracking activities, however, with the advent of sensors, wearables, Internet of Things and data analytics, self-tracking became more accessible and cheaper than before, giving rise to the Quantified-Self (QS) movement (op den Akker et al., 2014; Swan, 2009).

QS is an observed social and design trend towards the tracking of several aspects of interest to individuals (e.g., weight, sleep, work productivity) so that these aspects can be optimized and the quality of life of the self-trackers improved (Lupton, 2016; Mehta, 2011; Swan, 2013). Self-tracking has been extensively researched since the 70s (Choe, Lee, Lee, Pratt, and Kientz, 2014) as a means of informational feedback but the QS movement - that argues for the increased use of self-tracking as means of self-regulation - has popularized self-tracking in the recent years (Mehta,

2011). The two terms; quantified-self and self-tracking, have now come to often be used interchangeably (Lupton, 2016) Thus far, QS has popularized self-tracking most prominently in the contexts of health management and exercise motivation, where performance monitoring and self-regulation are often of high importance (Choe et al., 2014; Nafus and Sherman, 2014; Swan, 2009).

QS applications employ features such as logs, geo-maps, statistical summaries, and visualization to facilitate self-tracking and motivate individuals towards the attainment of desirable goals (Hamari et al., 2018; Lupton, 2016; Swan, 2009, 2013). These features by definition provide information to users. Hence, it is very likely that the users who possibly perceive QS design features prominent, mainly experience informational feedback. Therefore, we hypothesize the following:

H3: *Perceived prominence of quantified-self design in a user's use of a motivational information system is positively associated with experiences of informational feedback.*

2.2. Feedback and user perceived benefits from the use of a motivational information system

Psychology research in general and the self-determination theory in specific, distinguish between intrinsic and extrinsic motivation (Deci and Ryan, 2002). Intrinsic motivation is often understood as autotelicy; undertaking an activity for the sake of the satisfaction derived from the activity itself, while extrinsic motivation is often understood as engagement in an activity for extraneous reasons to the activity such as consequent rewards or to avoid punishment (Ryan and Deci, 2000).

In the information systems field, the *affective feedback* users experience such as experiences of enjoyment or flow, has been linked to beneficial, intrinsically motivated behavior (Fang et al., 20017; Huang et al., 2018b; Teng, 2017b; van der Heijden, 2004). Such affective

experiences often influence user engagement with the activity that the motivational system is being used for (e.g., exercise), leading to benefits such as improvements in the quality of the activity being performed through the system or an increase in its frequency (Clore and Huntsinger, 2007; Hamari, 2015; Oinas-Kukkonen, 2012; Osatuyi and Qin, 2018). We thus hypothesize the following;

H4*: Experience of affective feedback is positively associated with perceived benefits from the use of a motivational information system.*

Similar connections with perceived benefits from the use of a motivational system have been observed with regards to *social feedback* (Hamari and Koivisto, 2015a; Morschheuser et al., 2017b; 2017c; Smock, Ellison, Lampe, and Wohn, 2011; Tandoc et al., 2015). Reviews of research on the use of social media also indicates that social feedback can often lead to positive benefits such as assistance in informed decision making and in feeling connected with others (Kapoor et al., 2018; Shiau et al., 2018), suggesting that it is of high benefit to individuals. Therefore, we hypothesize the following;

H5: *Experience of social feedback is positively associated with perceived benefits from the use of a motivational information system.*

In terms of *informational feedback*; Individuals are increasingly attempting to overcome the bounded rationality of personal decision-making through informational feedback and measurements (Mehta, 2011). Frequent and comprehensive self-monitoring as a source of informational feedback has been associated with better behavioral outcomes, and decisions (Kluger and DeNisi, 1996; Peterson et al., 2014), thus increasing possible perceived benefits from a system or service as has always been evident for a long time by the stream of research on systems'

perceived usefulness with regards to utilitarian systems (Daviss et al., 1989; Hsu et al., 2008; Venkatesh and Bala, 2008; Venkatesh et al., 2000). Therefore, we hypothesize the following;

H6: *Experience of informational feedback is positively associated with perceived benefits from the use of a motivational information system.*

2.3. Feedback and continued use of a motivational information system

Accumulation of literature related to the adoption of information systems points towards a contemporary increase in the research and use of hedonic information systems that primarily aim to evoke *affective feedback* in terms of experiences of enjoyment (Gerow, Ayyagari,Thatcher, and Roth, 2013 Hassan, Morschheuser, Alexan, and Hamari, 2018; Morschheuser, Hassan, Werder, and Hamari, 2018; Koivisto and Hamari, 2019; Morschheuser, Hamari, Koivisto, and Maedche, 2017a). As has prominently and repeatedly been shown in this body of literature affective gratification are primary contributors to continued use (e.g., Davis, 1989; Koivisto and Hamari, 2019; Smock et al., 2011; Ruggiero, 2000; van der Heijden, 2004). Therefore, we hypothesize the following:

H7*: Experience of affective feedback is positively associated with continued use intentions of a motivational information system.*

Social feedback in terms of social influences and the stimulation of psychological innate needs for relatedness, recognition, and reciprocal benefits, in and of themselves lead individuals to adopt new technologies across cultures (Dwivedi, Shareef, Simintiras, Lal, and Weerakkody, 2016) and continue the use of already adopted systems (Kamboj, Sarmah, Gupta, and Dwivedi, 2018; Teng, 2017a). While a few studies on social influences on social communities have suggested that social influences have a limited effect on post adoption behavior on these platforms (Shiau et al., 2018; Yang et al., 2017), studies on social influences in the contexts of motivational

ISs have consistently indicated a positive connection between social influences/feedback and intentions to continue the use of adopted systems (Hamari and Koivisto, 2015a; Huang et al., 2018a; Osatuyi and Qin, 2018). Therefore, we hypothesize the following;

H8: *Experience of social feedback is positively associated with continued use intentions of a motivational information system.*

Finally, *informational feedback* is usually perceived to be of high value that individuals use and continue to use media and systems to pursue it (Hattie and Timperley, 2007; Lupton, 2016; Swan, 2013, 2009). Systems have been essentially designed to provide informational benefits and it has long been established that the acceptance of systems relies on their perceived utilitarian usefulness (Davis, 1989). Such connections between the utilitarian value of systems and their adoption and possible continued use have been established even on a cross-cultural level (Dwivedi et al., 2016). Therefore, we hypothesize the following;

H9: *Experience of informational feedback is positively associated with continued use intentions of a motivational information system.*

2.4. Research model

While we - in the previous section - only hypothesized a direct relationship between the perceived prominence of a class of motivational design and the experience of one type of feedback based on the available literature, we investigated if users could experience more than one type of feedback from all the investigated class of motivational designs that they perceive as prominent. This was to ensure the identification of all possible relationships. Furthermore, we hypothesized as discussed in the previous section that experiences of the different types of feedback may impact perceived benefits from the use of a motivational IS and intentions to continue the use of a motivation IS. The investigated model is presented in Figure 1.

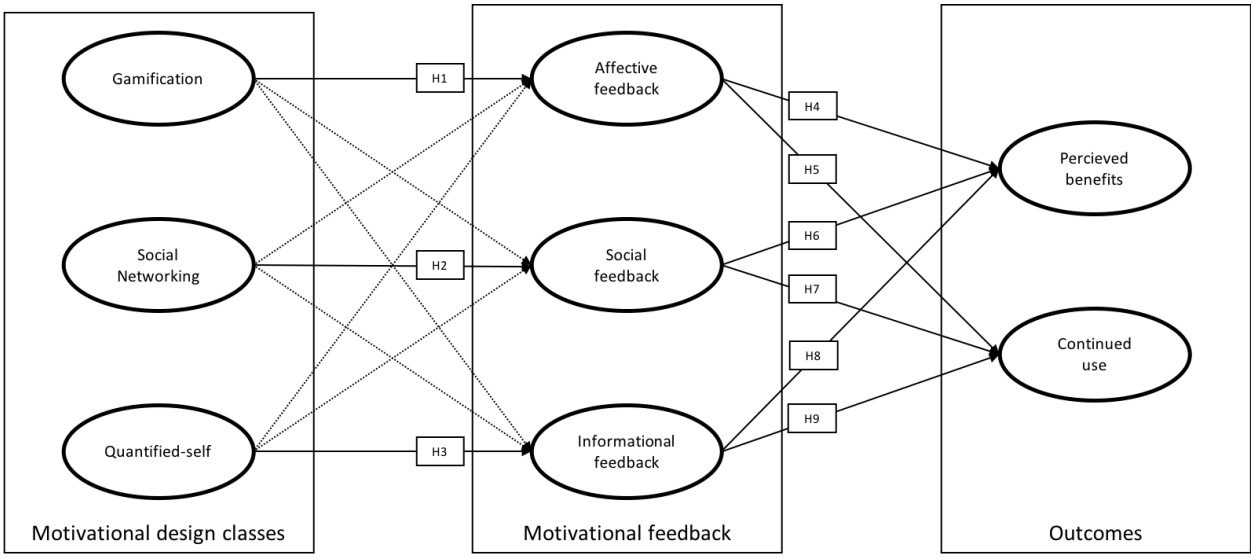

Figure 1: Research model

3. Empirical study

3.1. Participants

Data (N=167) was gathered via an online survey of users of HeiaHeia: an exercise tracking system that incorporates features of gamification, QS and social networking. Gamification features included a leaderboard of the sports a user played the most, medals earned, and levels reached. Social networking features included cheering, commenting, viewing of friends' activity logs on a timeline and a list of the friends a user interacts the most with. Quantified-self features included advanced tracking features that track for example calories burned, and heartrate, a feature to mark an exercise day as sick and a feature to add notes as a comment on one's performance during a day. Figure 2 presents screenshots of the system, showcasing some of its key features.

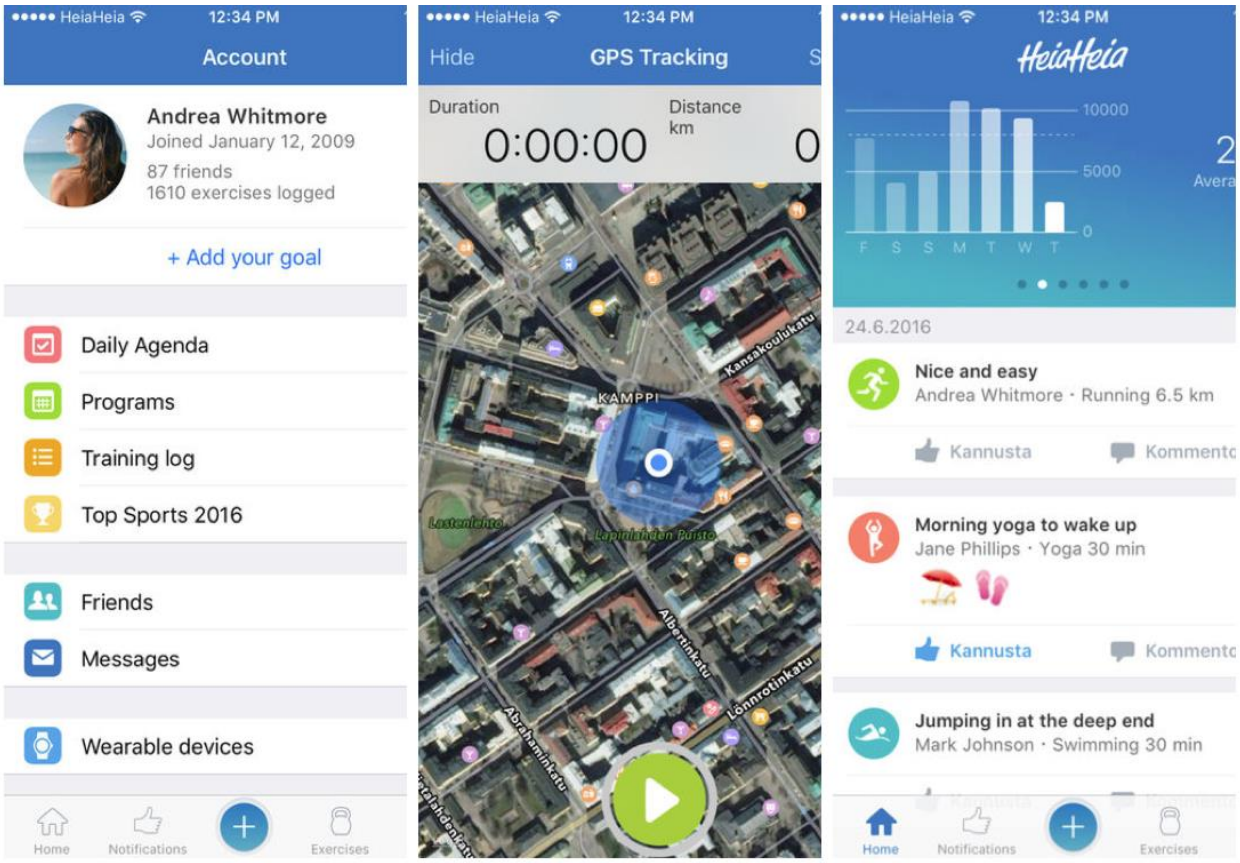

Figure 2: Screenshots of the examines exercise tracking system

As the system in question combines the three classes of motivational design and has been available for use since 2010, it provided an established platform for the simultaneous investigation of the three design classes understudy. Table 1 provides a summary of the demographics of the study participants. Worthy of a highlighting from Table 1 is that the majority of the participants are tenured users of HeiaHeia and visit it frequently on a weekly basis, indicating their familiarity with the system and its features.

Table 1: demographics of study respondents

		Frequency	Percent			Frequency	Percent
Age	Under 20	3	1.8	Weekly visits to the service	More than once a day	10	6
	20-29	34	20.4		Daily	46	27.5
	30-39	53	31.7		Several times	87	52.1

	40-49	47	28.1		1 or 2 times	20	12
	50-59	22	13.2		Rarely	4	2.4
	60 or older	8	4.8		More than once a day	6	3.6
Gender	Male	46	27.5		Daily	29	17.4
	Female	121	72.5	Weekly Exercise	Several times	122	73.1
Tenure	< 1 year	34	20.4		1 or 2 times	10	6
	1-2 years	28	16.8		Rarely	0	-
	2+ years	105	62.9				

3.2. Materials and measurements

This research investigates the perceived prominence of gamification, QS and social networking features to uncover how these perceptions connect to experiences of feedback, and how feedback in turn connects to continued use intentions and perceived benefits. The perceived prominence of these design classes is investigated as it reflects what users value the most. Such perceptions may not have been reflected by server logs as, for example: users may value earning medals, however they may not click on the list of medals they have earned every day. The features users perceive as prominent, influence what feedback they may be experiencing.

Surveys are employed in measuring perceptions, use intentions, beliefs and similar latent variables as they allow researchers to grasp the respondent's view of reality and such latent variables might not be reflected through other methods (Barker and Pistrang, 2012; Fransella, 1981; Nunnally, 1978; Pinsonneault and Kraemer, 1993). The survey administered in this study employed 7-point likert scale items surveying users as to their perception of gamification, QS and social networking designs as well as the affective, social and informational feedback that they possibly are experiencing, as well as the benefits they perceive from the use of the system in question; and their intentions to continue their use of it. The survey was distributed as an in-service

pop-up, visible only to registered users who, organically, have thus far been free to use the outlined features of the system as they pleased. Medals however are automatically awarded to users upon their attainment of significant milestones defined by the system designers. Table 2 provides the measurement items employed and their loadings and sources.

Table 2: Measurement items of the questionnaire

Construct	Survey Item	Loading	References
Affective feedback	Consider the following statements about your use of HeiaHeia:		
	It feels very satisfying to see my exercise progress in HeiaHeia	0.805	Adapted from Lin, Gregor, and Ewing (2008)
	Browsing my exercise reports in HeiaHeia is fun	0.831	
	It feels good to review my training logs and stats in HeiaHeia	0.860	
	It's very enjoyable to see my exercise history in HeiaHeia	0.906	
Social feedback	Consider the following statements about your use of HeiaHeia :		
	I like it when other HeiaHeia users comment and like my exercise	0.929	Adapted from Hamari and Koivisto, (2015a), Hernandez, Montaner, Sese, and Urquizo, (2011), Hsu and Lin, (2008), Lin, (2008), and Lin and Bhattacherjee, (2001)
	I feel good when my achievements in HeiaHeia are noticed	0.816	
	I like it when my HeiaHeia peers notice my exercise reports	0.926	
	I often pay attention to exercise that my friends or others log in HeiaHeia	0.835	
Informational feedback	Consider the following statements about your use of HeiaHeia :		
	The information from HeiaHeia has helped me better understand the way I exercise	0.761	Adapted from Hsu and Lu, (2007)
	The information I receive from HeiaHeia is useful for me	0.798	
	The information from HeiaHeia has helped me with decisions regarding my exercise goals	0.719	
	The statistics of my exercise that HeiaHeia provides is useful to me	0.827	
Perceived benefits	Please indicate how much do you agree with the following statements:		
	I exercise more now than before I started using HeiaHeia	0.877	Developed by the authors based on possible context specific benefits that could be associated with the system in question
	The quality of my exercise is better now, after I started using HeiaHeia	0.837	
	I am in better shape now than before I started using HeiaHeia	0.829	
	I enjoy exercise more now than I did before joining HeiaHeia	0.852	
	(Not taking into account any outstanding temporary illnesses) I feel healthier now than I did before joining HeiaHeia	0.801	

Continued Use	Consider the following statements regarding your exercise:		
	In the coming months I plan to use HeiaHeia more than I currently do	0.505	Adapted from Bhattacherjee, (2001) and Hamari and Koivisto, (2015a)
	It is likely that I will use HeiaHeia more often rather than less often during the next couple months.	0.772	
	I intend to use HeiaHeia at least as often within the next three months as I have previously used.	0.755	
	I predict that I will keep using HeiaHeia in the future at least as much as I have used it lately.	0.842	
Gamification features	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Your top sports list	0.784	
	Medals	0.889	
	The levels (bronze, silver, etc.)	0.779	
Social Networking features	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Thumbs up and cheering features	0.894	
	Comments on exercises	0.814	
	Your friends logs	0.903	
	The ”Top friends” feature	0.778	
'Quantified-self features	On a scale of 1 (not at all) to 7 (extremely), how important are the following features to you?		
	Advanced features (calories, heart rate)	0.644	
	The ”Sick days” feature	0.701	
	The notes in exercise logs	0.871	

3.3. Validity and reliability

The number of participants in this study exceeds the criteria for minimum PLS-SEM sample size from several angles. The sample size is more than ten folds the maximum number of paths to any construct in the inner PLS path model (Anderson and Gerbing, 1988; Chin, 1998). Secondly, the sample has more than at least 5 participants for each construct in the model (Bentler and Chou, 1987) which is often considered a strict criteria. The independent variables were tested for multicollinearity. No multicollinearity between the variables existed.

The model-testing was conducted via the component-based (PLS-SEM) in SmartPLS. We chose component-based (PLS-SEM) instead of co-variance-based SEM as PLS-SEM does not operate under restrictive assumptions on data distributions since it is non-parametric (Ringle,

Wende, and Will, 2005). Furthermore, as our study is geared towards prediction of user behavior and experiences, PLS-SEM was a selected as it is the better fit for predictive studies, on the other hand, co-variance-based SEM is considered best for estimating model fits (Anderson and Gerbing, 1988; Chin, Marcolin, and Newsted, 2003).

Table 3 presents three measures for evaluating convergent validity: average variance extracted (AVE), composite reliability (CR), and Cronbach's alpha (Alpha). All of the convergent validity metrics were greater than the thresholds cited in relevant literature (AVE > 0.5, CR > 0.7 (Fornell and Larcker, 1981). There was no missing data and no imputation methods were used. We can therefore conclude that the convergent requirements of validity and reliability for the model were met.

Table 3 additionally allows the assessments of discriminant validity through 1) ensuring that the square root of the AVE of one construct is larger than any of the reported correlations between the construct in question and the rest of the constructs in the model (Chin, 1998; Fornell and Larcker, 1981). Secondly, in accordance with Pavlou, Liang, and Xue (2007), we observed that no inter-correlation between the constructs was higher than 0.9. Thirdly, measurement items had the highest loading only with their corresponding construct. All the tests indicated that the discriminant validity was acceptable.

Table 3: Convergent and discriminant validity

	AVE	**CR**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 Gamification	0.670	0.859	0.819							
2 Social Networking	0.721	0.911	0.395	0.849						
3 Quantified Self	0.551	0.782	0.459	0.412	0.742					
4 Informational F	0.725	0.913	0.432	0.266	0.502	0.852				
5 Social F	0.771	0.931	0.295	0.836	0.393	0.320	0.878			
6Affective F	0.655	0.851	0.290	0.203	0.489	0.612	0.314	0.809		
7 Benefits	0.704	0.923	0.201	0.170	0.193	0.345	0.127	0.273	0.839	
8 Continued use	0.585	0.847	0.164	0.118	0.282	0.261	0.083	0.265	0.271	0.765

4. Results

The investigated perceived prominence of the three classes of motivational design: gamification, quantified-self and social networking) accounted for 24.5% of the variance in the experiences of informational feedback, 70.6% of the variance in the experiences of social feedback and 30.4% of the variance in the experiences of affective feedback. Perceptions of experiencing affective, social and informational feedbacks account for 12.5% of the variance in the perceived benefits from the use of the motivational IS and 8.8% of the variance in the continued use intentions of the motivational IS.

The obtained significant results in Figure 3 show support for the hypothesized relationships between the perceived prominence of the motivational features and the types of feedback they were hypothesized to afford: H1: gamification -> affective feedback, H2: social networking -> social feedback and H3: quantified-self -> informational feedback. The results also reveal unexpected relationships such as the negative association between gamification -> social feedback and quantified-self -> affective feedback. The data failed to support H6, H7, and H8. The complete results of the model testing are in Table 4.

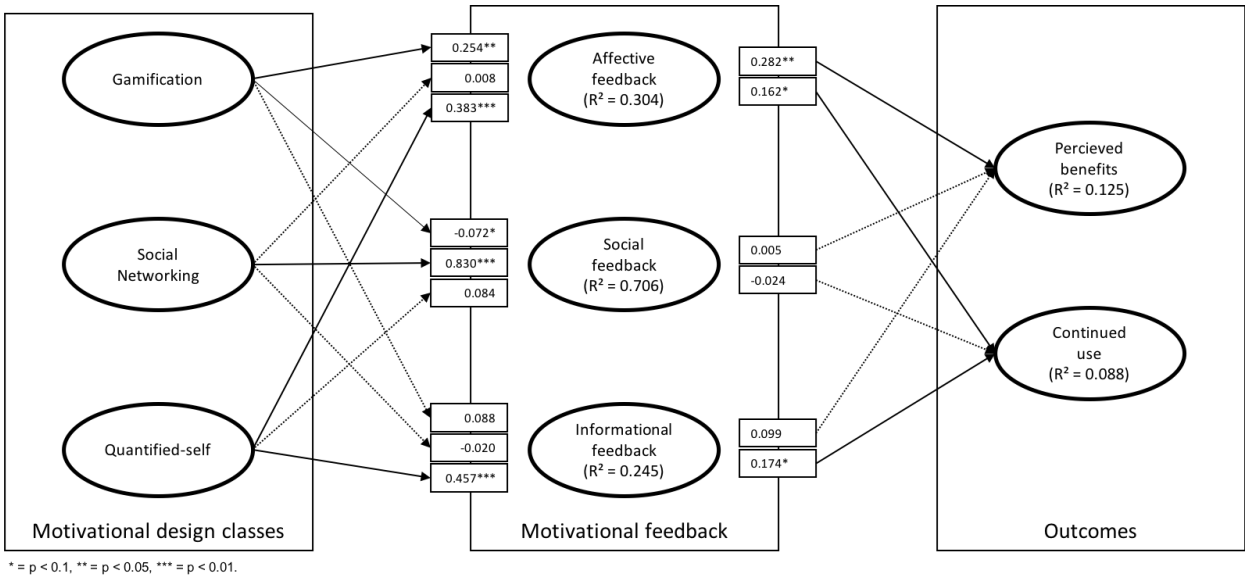

Figure 3: Significant results of the Investigated model

Table 4: Full results

	β	p	CI95 LOW	CI 95 HI
Affective feedback (R2 = 0.304)				
H1: Gamification design	**0.254****	**0.029**	**0.026**	**0.470**
Social networking design	0.008	0.924	-0.145	0.169
Quantified-self design	**0.383*****	**0.000**	**0.172**	**0.585**
Social feedback (R2 = 0.706)				
Gamification design	**-0.072***	**0.097**	**-0.151**	**0.018**
H2: Social networking design	**0.830*****	**0.000**	**0.740**	**0.911**
Quantified-self design	0.084	0.207	-0.040	0.218
Informational feedback (R2 = 0.245)				
Gamification design	0.088	0.386	-0.117	0.282
Social networking design	-0.020	0.822	-0.196	0.153
H3: Quantified-self design	**0.457*****	**0.000**	**0.286**	**0.639**
Perceived benefits (R2 = 0.125)				
H4: Affective feedback	**0.282****	**0.015**	**0.065**	**0.517**
H5: Social feedback	0.005	0.949	-0.168	0.166
H6: Informational feedback	0.099	0.336	-0.102	0.304

Continued use intentions (R2 = 0.088)				
H7: Affective feedback	**0.162***	**0.091**	**-0.010**	**0.368**
H8: Social feedback	-0.024	0.779	-0.189	0.138
H9: Informational feedback	**0.174***	**0.095**	**-0.033**	**0.382**
Bolded hypotheses are supported by our results at the following significance levels: * = p < 0.1, ** = p < 0.05, *** = p < 0.01. β = standard regression coefficients, CI = Confidence interval				

5. Discussion

The results obtained by this study indicate that the 1) experience of affective feedback is facilitated by the perceived prominence of gamification and quantified-self designs and is positively associated with intentions to continue the use of a motivational IS and is solely and positively associated with perceived benefits from the use of a motivational IS, 2) experience of social feedback is facilitated by the perceived prominence of social networking designs, negatively associated with the perceived prominence of gamification and did not translate into perceived benefits from the use of a motivational IS or intentions to continue its use, and 3) experience of informational feedback is solely facilitated by the perceived prominence of quantified-self features and positively associated with intentions to continue the use of a motivational system. The implications of these results are discussed in this section.

5.1. Affective feedback

Games are believed to be an exceptionally effective media in satisfying intrinsic needs (Granic, Lobel, and Engels, 2014; Malone, 1981; Ryan, Rigby, and Przybylski, 2006). This notion is the foundational premise behind the increased movement to gamify systems, activities and organizations (Huotari & Hamari, 2017; Hamari, Koivisto, and Sarsa, 2014; Hassan, 2018; Huotari

and Hamari, 2017; Rigby, 2015). It is hence unsurprising to observe a positive connection between it's prominence and experiences of affective feedback as hypothesized (H1).

Surprisingly, the prominence of quantified-self design was positively associated with experiencing both affective and informational feedback. This finding could be attributed to that information (as provided by QS designs) not only facilitates informational feedback but additionally and simultaneously affective feedback (Bandura, 1991; Tosi, Locke, and Latham, 1991). For example, whenever individuals are presented with information such as medical results or school reports, they are not only cognitively informed but they additionally and involuntarily experience an affective response (e.g., happiness, sadness) along with the information. The two feedback types hardly exist in seperation of one another (e.g., Huang et al., 2018b; Nguyen et al., 2018). It is further argued that individuals experience affective feedback simultaneously with most kinds of feedback they experience (Fishbach and Finkelstein, 2011) and not just affective feedback. Affect is entwined in all our activities and perceptions of life and it is hence conceivable that the same mechanics that make users experience informational feedback, also provides them affective experiences.

Affording affective feedback is important as our results indicate that experiencing it has a positive association with benefits perceived from the use of a motivational IS (H4) and with the intentions to continue the use of a motivational IS (H5). In fact, out of all measured feedback, the experience of affective feedback is solely associated with benefits perceived from the use of a motivational IS. This stands in contrast to a large stream of information systems research most prominently led by the research stream around the Technology Acceptance Model (TAM) (Davis et al., 1989) that mainly defined usefulness of an information systems in terms of the utilitarian, non-affective benefit it provides individuals. Later versions of TAM e.g. TAM 2 recognized the

importance of certain socio-psychological variables (Venkatesh and Davis, 2000), personal differences, and affect such as enjoyment, gamefulness and trust in perceiving benefits from the use of a system (Venkatesh and Bala, 2008).

5.2. Social feedback

The perceived prominence of social features, as their name would suggest, facilitates experiences of social feedback (H2). Unexpectedly, the perceived prominence of gamification had a negative, albeit small un-hypothesized relationship with experiencing social feedback. Gamification research seems to also indicate that social motivation is often facilitated by gamification mechanics through the social experiences of for example competition or cooperation between users (Chen et al., 2014; Morschheuser et al., 2017a; 2017b). The observed negative association from our data could be due to the competitive gamification design of the system on which this study was based. While competition certainly can engage and facilitate the emergence of social interaction (op den Akker et al., 2014), it may engender negative interactions amongst users (Krasnova et al., 2015, 2013; Tandoc et al., 2015). Watching others overachieve in a competition while one is struggling might engender negative experiences of one's own performance. On the other hand, overachieving and winning a competition could direct negative social behavior towards the achieving individual such as those of envy, bullying, and increased competitiveness. It is argued that these negative interactions are hardly avoidable in any competitive context (Bandura, 1991; Hutter, Füller, Hautz, Bilgram, and Matzler, 2015). Cooperative gamification designs might on the other hand engender positive social interaction between users (McGonigal, 2011; Morschheuser et al., 2017b, 2017c) and users may come to experience more positive social feedback through them.

Overall, experiences of social feedback in our study appear to have no influence on the benefits perceived from the use of a motivation IS or the intentions to continue the use of the

system in question, in line with some of the closely related research on social connections and prolonged use of systems that has not been able to identify such connections (Dwivedi et al., 2016; Peng, Sun, and Guo, 2018; Shiau et al., 2018; Yang et al., 2017). On the other hand, research work has been able to identify connection between social feedback and intentions to continue the use of systems (Kamboj, Sarmah, Gupta, and Dwivedi, 2018; Teng, 2017a) and benefits percieved from the use of systems (Hamari and Koivisto, 2015a; Morschheuser et al., 2017b; 2017c; Smock, Ellison, Lampe, and Wohn, 2011; Tandoc et al., 2015). It hence appears that perhaps further research is needed to discern nuanced variables that influence possible outcomes from experiences of social feedback. Such variables may include the size and structure of the social communities to which individual belong on motivational systems (Shiau, Dwivedi, and Yang, 2017) or individual variances in privacy awareness and sharing behavior online (Hamari et al., 2018; Munson and Consolvo, 2012; Swan, 2009).

5.3. Informational feedback

The perceived prominence of quantified-self features was positively associated with experiences of informational feedback as hypothesized (H3). QS features by definition intend to provide informational feedback on one's activity that can be employed in self-evaluation and determination of future behavior (Munson and Consolvo, 2012; Swan, 2009). While experiences of informational feedback were positively associated with intentions to continue the use of a motivational IS (H9), it had no associations with benefits perceived from the use of the motivational IS. This later finding is especially interesting as it is held in general consensus that informational feedback is instrumental and of benefit to individuals (Davis, 1989; Hirschheim and Klein, 2012; McLeod and Schell, 2008).

The use of QS features requires mental and physical investments. Often, the informational feedback provided through QS is hard to interpret and is fragmented (Burke et al., 2011; Munson and Consolvo, 2012). It could be that the informational feedback provided by QS is of little help if not accompanied with interpretations or contextualization that help individuals realize benefit from it. For example; handing a student a test grade without directing them as to what it means, would be of little benefit to the student. Hence, users may have failed to draw benefits from the informational feedback provided through the QS features, although they intend to continue collecting it maybe in hopes that on the long run they could make better use of it or merely to justify the investments already made to use the motivational IS.

5.4. Contributions to theory

As described in recent work on gamification (e.g. Hamari, 2015; Hassan, 2018; Koivisto & Hamari, 2019), the increased pervasive introduction of gamification, QS and social networking designs to systems that have an ultimate utilitarian goal may indicate a shift in the perceptions of how efficiency and productivity may be improved. Classically, adoption of information systems has been regarded to stem from more traditional usefulness, efficiency and ease of use. However, many of the novel interface technologies actually complicate the interface with more features which would - from the perspective of the classical view - make the systems less efficient. This emphasizes the need for revisiting the theory on technology acceptance and adoption in order to possibly augment it and introduce new, and more user-centered variables that might be influencing systems adoption and continued use. Especially, the complex interplay between utility and hedonism would call for more research. Evidently, there is a growing stream of research in the IS sphere that is recognizing this importance and perhaps the indirect utilitarian value of the autotelicity of system use. This research interest has perhaps influenced and is being influenced

by the growing research on hedonic designs in general (Fang et al., 20017; Hamari et al., 2018; van der Heijden, 2004; Osatuyi and Qin, 2018; Zhang, 2008) and gamification in specific (Hamari and Koivisto, 2015b; Koivisto and Hamari, 2019; Morschheuser et al., 2018).

Extending emotional attachment theory to technology is one such emerging research stream on technology acceptance. Emotional attachment represents a state of high loyalty to a product, service or a system (Japutra, Ekinci, and Simkin, 2014; Thorsteinsson, and Page 2014). Marketing theory and research indicate that it occurs as a result of affective and social experiences from the interaction with a product or a service (Grisaffe and Nguyen, 2011) and that such experiences are seen as user/consumer benefits from the use of a product or a service and are benefits of high importance to designers of products and services as well as consumers since such benefits can bring prolonged use of products and services and hence increased financial returns (Japutra et al., 2014). This notion of the utilitarian value of affective and social experiences to consumers is being introduced to the Technology Acceptance Model and related theory (Read, Robertson and McQuiken 2011; Teo, 2016) so as to investigate prolonged system use and user loyalty. While we did not investigate emotional attachments, our results indicate that gamification design appears able to induce affective and social experiences which in turn influence the continued use of systems. It appears that our results may hint at that gamification is a design practice with the potential to induce positive emotional attachments and it is of value to investigate whether such extension of the technology acceptance theory to include investigations of emotional attachments are valid within the information systems use context.

Habituation theory also seems to provide increased grounds for understanding technology acceptance and the results of our study. Originating in psychology research, Kluger and DeNisi (1996) put forward the idea of habituation in conjunction with the feedback intervention theory:

individuals over time grow accustomed to the activities they are performing and/or the information they are receiving, that they might stop perceiving value from them although they could be of benefit to individuals. It is interesting to observe that the participants of this study, being mostly tenured users of the investigated system, perceived benefits from affective feedback and not from informational feedback that is arguably of a higher utilitarian value. While the technology acceptance theory focuses on utilitarian value of systems (Davis, 1989; Davis et al., 1989) and even recently on some of the hedonic values of systems (Venkatesh and Bala, 2008; Venkatesh and Davis, 2000), it is interesting to investigate if/when the habituation effect takes place with regards to systems and when the novelty effect (e.g., Patwardhan and Balasubramanian et al., 2013) wears off and if habituation has a stronger impact on the continued use of some technologies or designs more than others. The extension of such psychology theory to the information systems field can help in understanding how to vary design so as to minimize or counter the effects of habituation.

5.5. Contributions to practice

Out of the investigated feedback types, experiences of affective feedback have been solely connected to perceptions of benefits from the use of a motivational IS. This suggests that if a system is to appear of benefit to users, then it is recommended that it facilitates experiences of affective feedback. That can possibly be done through the mechanics of gamification and quantified-self as our results indicate that these designs afford experiences of affective feedback.

On the other hand, if the objective is to prolong the use of a system, then affording experiences of affective and/or informational feedback would be of value as they appear to be associated with intentions to continue the use of a system as our results and the literature suggest (Fang et al., 20017; Osatuyi and Qin, 2018). It is, furthermore likely that experiences of affective

feedback might lead users to develop affective attachments with the system, which could encourage users to withstand possible systems failures or degradation in service quality that may occasionally occur for various reasons (Japutra et al., 2014). We hence encourage managers and designers of systems to recognize the importance of affective feedback in prolonging the use of systems and to consider adding features to their systems that facilitate experiences of affective feedback.

If a system is to be introduced to a large, heterogeneous market or to an organization of heterogeneous demographics, and possibly features and feedback preferences, then it might be beneficial for the system in question to afford different types of feedback (Fang et al., 20017), possibly through a limited, mindful combination of especially gamification, and QS designs. This facilitates that the system in question would provide different types of feedback that users prefer differently, increasing the likelihood that they would all perceive benefits from the use of the system and prolong their use of it, reaping designers and organizations increased benefits and financial gains.

However, limiting system features to the preferences of the target user base of a system to avoid overwhelming them with features is important and manageable if the motivational IS is to be introduced to a small organization or a consumer market with relatively homogeneous individuals. Since gamification and QS facilitate both affective and informational feedback, their introduction to systems may be of value to facilitate both perceiving benefits from the use of an information system as well as its prolonged use simultaneously through a small set of features. QS features would specially be of value as they afford both affective and informational feedback. We thus encourage managers and system designers to consider adding a set of gamification and QS

features to their systems, but not too many of them, so as to provide users with perceived benefits from the systems without overwhelming them with a plethora of features.

While the lack of relationships between experiences of social feedback and perceived benefit from the use of a motivational IS or its prolonged use could hint at that social features - as the main source of social feedback - are of little motivational benefit, having social features as part of a motivational IS is nonetheless of no apparent harm except that it might overwhelm users if the system in question already employs a plethora of features. Nonetheless, it is likely that some individuals might find social features prominent and of value as the research indicates (Araújo and Pestana, 2017; Hamari et al., 2018; Pan et al., 2017). Future research is highly encouraged to investigate social feedback and its possible motivational outcomes. Managers are recommended to mindfully consider the introduction or utilization of these features in organizational systems.

6. Conclusion

This paper investigated the three main design classes of motivational information systems, namely: gamification, quantified-self and social networking features and their effects on user experience. As our results indicate, users of these design classes experience a combination of different feedback types ranging between affective, social and informational feedback. Out of these feedback types facilitated by motivational systems design classes, it appears that affective feedback, often facilitated by gamification and quantified-self design, is associated with both benefits perceived from the use of a system in questions and intentions to continue its use. Informational feedback facilitated by quantified-self features is associated with intentions to continue the use of a system in question. Social feedback however, as facilitated by social features, appears to have no association with perceived benefits or intentions to continue the use of a system.

6.1 Limitations & future research directions

As is usual with many types of survey based studies (Barker and Pistrang, 2012; Fransella, 1981; Nunnally, 1978), the data of this study is self-reported and the respondents, self-selected. The results present the perceptions and intentions of only the active users of a system. Additionally, there are possible risks in respondents misinterpreting questions or in the reported perceptions not exactly reflecting actual behavior. While surveys may not reflect actual behavior, they offer a different vantage point onto what individuals hold of value which is not always reflected by their actual behavior (Pinsonneault and Kraemer, 1993). Future studies are encouraged to employ different methods such as experiments and behavioral data analysis, so as to expand our understanding of the variables investigated by this study.

This research measured the perceived prominence/importance of the features of gamification, quantified-self and social networking rather than the frequency of use of these features. While frequency of use may be an indicator of behavior, the interaction frequency can vary clearly within a category of features by system design, whereas overall prominence can be assumed to be a significantly more stable measurement as it reflects what features users intentionally seek. Some users may, for example, perceive earning medals important, however they may not click on the list of medals they earned to check them out every day and hence use frequency does not reflect user perception of the features. Future studies are encouraged to augment our findings with an investigation of use frequency.

There are various theories and ways to categorize feedback as both technological or psychological phenomena. Future studies can delve deeper and wider into differing perspectives of feedback, for example, by studying normative, formative, corrective, positive or negative feedback as theorized on by e.g. (andura et al., (1988); Chesire and Antin, (2008); Kluger and

DeNisi, (1996), providing more perspective to understanding motivational feedback and classes of motivational systems design.

Future research is encouraged to isolate specific motivational design features of gamification, quantified-self and social networking and examine the feedback and user benefits they afford. The role of mediating variables such as self-efficacy and goal commitment amongst others is worthy of investigation so as to determine how they influence experiences of motivational ISs and the continued use and benefits received from them. Use contexts often influence the types of feedback users experience and their appreciation of it in specific contexts but not others (Chesire and Antin, 2008). Hence, perceptions of benefits and prolonged use of motivational ISs may be influenced by the context of their utilization, Future research is encouraged to investigate different use contexts of motivational ISs and their influence on feedback experiences, continued use intentions and perceived benefits.

References

Alcivar, I., & Abad, A. G. (2016). Design and evaluation of a gamified system for ERP training. *Computers in Human Behavior*, 58, 109–118.

Anderson, J. C., & Gerbing, D. W. (1988). Structural Equation Modeling in Practices: A review and recommended two-step approach. *Psycholgy Bulletin*, 103, 411.

Araújo, J., & Pestana, G. (2017). A framework for social well-being and skills management at the workplace. *International Journal of Information Management*, 37(6), 718-725.

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly*, 25(3), 351–370.

Bandura, A. (1991). Social Cognitive Theory of Self-Regulation. *Organizational behavior and human decision processes*, 50, 248–287.

Bandura, A., Hamilton, V., & Bower, G. H. (1988). Self-regulation of motivation and action through goal systems, in: *Cognitive perspectives on emotion and motivation*, (pp. 37-61). Springer, Dordrecht.

Barker, C., & Pistrang, N. (2012). Research Methods in Clinical Psychology: An introduction for Students and Practitioners. John Wiley & Sons.

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, 16(1), 78–117.

Boyd, D., & Ellison, N. (2007). Social network sites:definition, history, and scholarship. *Journal of Computer-mediated Communications*, 13(1), 210–30.

Burke, L. E., Wang, J., & Sevick, M. A. (2011). Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Associatio*, 111(1), 92–102.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of educational research*, 65(3), 245-281.

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psycholgical Review*, 97(1), 19–35.

Chen, A., Lu, Y., Chau, P. Y., & Gupta, S. (2014). Classifying, measuring, and predicting users' overall active behavior on social networking sites. *Journal of Management Information Systems*, 31(3), 213–253.

Chesire, C., & Antin, J. (2008). The social psychological effects of feedback on the production of Internet information pools. *Journal of Computer-mediated Communications*, 13(3), 705–727.

Cheung, C. M., Chiu, P. Y., & Lee, M. K. (2011). Online social networks: Why do students use facebook? *Computers in Human Behavior*, 27(4), 1337–1343.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. M*odern methods for business research*, 295(2), 295-336.

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.

Choe, E. K., Lee, N. B., Lee, B., Pratt, W., & Kientz, J. A. (2014). Understanding quantified-selfers' practices in collecting and exploring personal data. *Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems - CHI '14*, (pp. 1143–1152). ACM

Christy, K. R., & Fox, J. (2014). Computers & Education Leaderboards in a virtual classroom: A

test of stereotype threat and social comparison explanations for women 's math performance. *Computers & Education*, 78, 66–77.

Clore, G. L., & Huntsinger, J. R. (2007). How emotions inform judgment and regulate thought. *Trends in Cognitive Sciences*, 11(9), 393–399.

Coleman, J. D. (2018). Engaging undergraduate students in a co-curricular digital badging platform. *Education and Information Technologies*, 23(1), 211-224.

Custers, R., & Aarts, H. (2005). Positive affect as implicit motivator: On the nonconscious operation of behavioral goals. *Journal of personality and social psychology*, 89(2), 129–142.

Davis, F. D. (1989). 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. Sciences*, 35(8), 982–1003.

Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining gamification. *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11*. Tampere, Finland. (pp. 9-15). ACM.

Dwivedi, Y. K., Kapoor, K. K., & Chen, H. (2015). Social Media Marketing and Advertising. The *Marketing Review*, 15(3), 289-309

Dwivedi, Y. K,, Shareef, M. A., Simintiras, A. C., Lal, B., & Weerakkody, V. (2016). A generalised adoption model for services: A cross-country comparison of mobile health (m-health). *Government Information Quarterly*, 33(1), 174-187.

Fang, J., Zhao, Z., Wen, C., & Wang, R. (2017). Design and performance attributes driving mobile travel application engagement. *International Journal of Information Management*, 37(4), 269-283.

Fishbach, A., & Finkelstein, S. R. (2011). How Feedback Influences Persistence, Disengagement, and Change in Goal Pursuit. *Goal-directed Behavior*, 203–230.

Fornell, C., & Larcker, D. F. (1981). Structural Equation Models with Unobservable Variables

and Measurement Error: Algebra and Statistics. *Journal of Marketing Research*, 18(3), 382.

Fransella, F. (Ed.). (1981). Personality: theory, measurement and research (Vol. 719). Routledge Kegan & Paul.

Gerow, J. E., Ayyagari, R., Thatcher, J. B., & Roth, P. L. (2013). Can we have fun @ work? The role of intrinsic motivation for utilitarian systems. *European Journal of Information Systems*, 22(3), 360–380.

Giboney, J. S., Briggs, R. O., & Nunamaker Jr, J. F. (2017). Special Issue: Creating Social Value with Information. *Journal of Management Information Systems*, 34(4), 935–938.

Granic, I., Lobel, A., & Engels, R. C. (2014). The benefits of playing video games. *American Psychologist*, 69(1), 66–78. Gugerell,

Grisaffe, D. B., & Nguyen, H. P. (2011). Antecedents of emotional attachment to brands. *Journal of Business Research*, *64*(10), 1052-1059.

Hamari, J. (2017). Do badges increase user activity? A field experiment on the effects of gamification. *Computers in human behavior*, 71, 469–478.

Hamari, J. (2015). Gamification, Motivations & Effects. Aalto University.

Hamari, J., Hassan, L., & Dias, A. (2018). Gamification, quantified-self or social networking? Matching users' goals with motivational technology. *User Modeling and User-adapted Interaction*, 28(1), 35-74.

Hamari, J., & Keronen, L. (2017). Why do people play games? A meta-analysis. *International Journal of Information Management*, 37(3), 125-141.

Hamari, J., & Koivisto, J. (2015a). "Working out for likes": An empirical study on social influence in exercise gamification. *Computers in Human Behavior*, 50, 333–347.

Hamari, J., & Koivisto, J. (2015b). Why do people use gamification services? *International Journal of Information Management*, 35(4), 419-431.

Hamari, J., & Koivisto, J. (2014). Measuring flow in gamification: Dispositional Flow Scale-2 *Computers in Human Behavior*, 40, 133–143.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work?--a literature review of empirical studies on gamification. *Proceedings of the 47th Hawaii International Conference on System Sciences*. Hawaii, USA. (pp. 3025–3034). IEEE.

Hassan, L. (2018). Means to Gameful Ends: How Should Gamification be Designed?. *Doctoral thesis*. Hanken School of Economics, Finland.

Hassan, L., Morschheuser, B., Alexan, N., & Hamari, J. (2018). First-hand experience of why gamification projects fail and what to do about it. *Proceedings of the 2nd International GamiFIN Conference (GamiFIN2018),* (pp. 141-150). Pori, Finland,

Hattie, J. T., & Timperley, H. (2007). The power of feedback. *Review of educational research*, 77(1), 81-112.

Herzig, P., Strahringer, S., & Ameling, M. (2012). Gamification of ERP systems - Exploring gamification effects on user acceptance constructs. *Multikonferenz Wirtschaftsinformatik 2012 - Tagungsband Der MKWI 2012. Braunschweig: GITO*, pp. 793–804.

Hirschheim, R., & Klein, H. K. (2012). A glorious and Not-So-Short history of the information systems field. *Journal of the Association for Information Systems*, 13(4), 188.

Hsu, C. L., & Lu, H. P. (2007). Consumer behavior in online game communities: A motivational factor perspective. *Computers in Human Behavior*, 23(3), 1642-1659.

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(1), 65–74.

Huang, H. C., Cheng, T. C. E., Huang, W. F., & Teng, C. I. (2018a). Impact of online gamers' personality traits on interdependence, network convergence, and continuance intention: Perspective of social exchange theory. *International Journal of Information Management*, 38(1), 232-242.

Huang, H. C., Pham, T. T. L., Wong, M. K., Chiu, H. Y., Yang, Y. H., & Teng, C. I. (2018b). How to create flow experience in exergames? Perspective of flow theory. *Telematics & Informatics*, *35*(5), 1288-1296.

Huotari, K., & Hamari, J. (2017). A definition for gamification: anchoring gamification in the service marketing literature. *Electronic Markets*, 27(1), 21–31.

Hutter, K., Füller, J., Hautz, J., Bilgram, V., & Matzler, K. (2015). Machiavellianism or Morality: Which Behavior Pays Off In Online Innovation Contests?. *Journal of management information systems*, 32(3), 197-228.

Hernandez, B., Montaner, T., Sese, F. J., & Urquizu, 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(6), 2224–2232.

Japutra, A., Ekinci, Y., & Simkin, L. (2014). Exploring brand attachment, its determinants and

outcomes. *Journal of strategic Marketing*, *22*(7), 616-630.

Jung, J. H., Schneider, C., & Valacich, J. (2010). Enhancing the motivational affordance of information systems: The effects of real-time performance feedback and goal setting in group collaboration environments. *Management science*, 56(4), 724-742.

Kamboj, S., Sarmah, B., Gupta, S., & Dwivedi, Y. K. (2018). Examining branding co-creation in brand communities on social media: Applying paradigm of Stimulus-Organism-Response. *International Journal of Information Management*, 39, 169–185.

Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in Social Media Research: Past, Present and Future. *Information Systems Frontiers.* 20(3), 531–558.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological bulletin*, 119(2), 254.

Kluger, A. N., & DeNisi, A. (1998). Feedback interventions: Toward the understanding of a double-edged sword. *Current directions in psychological science*, 7(3), 67-72.

Koivisto, J., Hamari, J. (2019). The Rise of Motivational Information Systems: A Review of Gamification Research. *International Journal of Information Management*.

Krasnova, H., Wenninger, H., Widjaja, T., & Buxmann, P. (2013). Envy on Facebook: A Hidden Threat to Users' Life Satisfaction?. *Proceedings of the 11th International Wirtschaftsinformatik*. (pp. 1–16).

Krasnova, H., Widjaja, T., Buxmann, P., Wenninger, H., & Benbasat, I. (2015). Why Following Friends Can Hurt You: An Networking Sites among College-Age Users College-Age Users. *Information. Systems Research*, 26(3), 585–605.

Landers, R. N., Auer, E. M., Collmus, A. B., & Armstrong, M. B. (2018). Gamification Science, Its History and Future: Definitions and a Research Agenda. *Simulation & Gaming*, *49*(3), 315–337.

Lin, H. F. (2008). Determinants of successful virtual communities: Contributions from system characteristics and social factors. *Information & Management*, 45(8), 522–527.

Lin, A., Gregor, S., & Ewing, M. (2008). Developing a scale to measure the enjoyment of web experiences. *Journal of Interactive Marketing*, 22(4), 40-57.

Lin, C. P., & Bhattacherjee, A. (2010). Extending technology usage models to interactive

hedonic technologies: A theoretical model and empirical test. *Information Systems Journal*, 20(2), 163–181.

Liu, D., Li, X., & Santhanam, R. (2013). Digital Games and Beyond: What Happens When Players Compete?. *MIS Quarterly*, 37(1), 111–124.

Lupton, D. (2016). The Quantified Self: A Sociology of Self-Tracking. Polity Press, Cambridge.

Malone, T. W. (1981). Toward a Theory of Intrinsically Instruction Motivating. *Cognitive Science*, *5*(4), 333–369. http://doi.org/10.1207/s15516709cog0504_2

McGonigal, J. (2011). Reality is Broken: Why Games Make Us Better and How They Can Change the World, New York. Penguin.

McLeod, R., & Schell, G. P. (2008). Management information system. Pearson Education India.

Mehta, R. (2011). The Self-Quantification movement–implications for healthcare professionals. *SelfCare*, 2(3), 87-92.

Morschheuser, B., Hamari, J., Koivisto, J., & Maedche, A. (2017a). Gamified crowdsourcing: Conceptualization, literature review, and future agenda. *International Journal of Human-Computer Studies*, 106, 26–43.

Morschheuser, B., Maedche, A., & Walter, D. (2017b). Designing Cooperative Gamification: Conceptualization and Prototypical Implementation. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing - CSCW '17*. (pp. 2410–2421). ACM.

Morschheuser, B., Riar, M., Hamari, J., & Maedche, A. (2017c). How games induce cooperation? A study on the relationship between game features and we-intentions in an augmented reality game. *Computers in Human Behavior*, 77, 169–183.

Morschheuser, B., Hassan, L., Werder, K., & Hamari, J. (2018). How to design gamification? A method for engineering gamified software. *Information and Software Technology*, 95, 219–237.

Munson, S., & Consolvo, S. (2012). Exploring Goal-setting, Rewards, Self-monitoring, and Sharing to Motivate Physical Activity. *Proceedings of the 6th International Conference on Pervasive Computing Technologies for Healthcare.* (pp. 25–32). IEEE

Nafus, D., & Sherman, J. (2014). This one does not go up to 11: The quantified self movement as an alternative big data practice. *International Journal of Communication*, 8 (11), 1784–1794.

Nunnally, J. (1978). Psychometric methods. McGraw-Hill, New York.

Nguyen, H. V., Huang, H. C., Wong, M. K., Yang, Y. H., Huang, T. L., & Teng, C. I. (2018). Moderator roles of optimism and weight control on the impact of playing exergames on happiness: The perspective of social cognitive theory using a randomized controlled trial. *Games for Health Journal*, *7*(4), 246-252.

Oinas-Kukkonen, H. (2012). A foundation for the study of behavior change support systems. *Personal and ubiquitous computing*, 17(6), 1223-1235.

Oinas-Kukkonen, H., & Harjumaa, M. (2018). Persuasive systems design: key issues, process model and system features. In *Routledge Handbook of Policy Design.* (pp. 105-123). Routledge.

Osatuyi, B., & Qin, H. (2018). How vital is the role of affect on post-adoption behaviors? An examination of social commerce users. *International Journal of Information Management*, 40, 175-185.

op den Akker, H., Jones, V. M., & Hermens, H. J. (2014). Tailoring real-time physical activity coaching systems: a literature survey and model. *User-modeling & user-adapted Interaction*, 24(5), 351–392.

Pan, Z., Lu, Y., Wang, B., & Chau, P. Y. K. (2017). Who Do You Think You Are? Common and Differential Effects of Social Self-Identity on Social Media Usage. *Journal of Management Information Systems*, 34(1), 71–101.

Patwardhan, H., & Balasubramanian, S. K. (2013). Reflections on emotional attachment to brands: Brand romance and brand love. *Journal of Customer Behaviour*, *12*(1).

Pavlou, P. A., Liang, H., & Xue, Y. (2007). Understanding and mitigating uncertainty in online exchange relationships: A principal-agent perspective. *MIS quarterly*, 31(1), 105-136.

Peng, Z., Sun, Y., & Guo, X. (2018). Antecedents of employees' extended use of enterprise systems: An integrative view of person, environment, and technology. *International Journal of Information Management*, 39, 104-120.

Peterson, N. D., Middleton, K. R., Nackers, L. M., Medina, K. E., Milsom, V. A., & Perri, M. G, (2014). Dietary self-monitoring and long-term success with weight management. *Obesity*, 22(9), 1962–1967.

Pinsonneault, A., & Kraemer, K. L. (1993). Survey Research Methodology in Management Information Systems: An Assessment. *Journal of Management Information Systems*, 10(2),

75–105.

Rapp, A., & Cena, F. (2014). Self-monitoring and technology: challenges and open issues in personal informatics. *Proceedings of the International Conference on Universal Access in Human-Computer Interaction.* (pp. 613-622). Springer, Cham.

Read, W., Robertson, N., & McQuilken, L. (2011). A novel romance: the technology acceptance model with emotional attachment. *Australasian Marketing Journal (AMJ)*, *19*(4), 223-229.

Rigby, C. S. (2015). Gamification and Motivation 4, in: Walz, S. P., Deterding, S. (Eds.), The Gameful World: Approaches, Issues, Applications. Cambridge, MA, USA. (pp. 113-138). MIT Press.

Ringle, C., Wende, S., & Will, A. (2005). Smart-PLS Version 2.0 M3. University of Hamburg.

Ruggiero, T. E. (2000). Uses and gratifications theory in the 21st century. *Mass Communication & Society*, 3(1), 3e37.

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.Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and emotion*, *30*(4), 344-360.

Shiau, W. L., Dwivedi, Y. K., & Yang, H. S. (2017). Co-citation and cluster analyses of extant literature on social networks. International Journal of Information Management, 37(5), 390–399.

Shiau, W. L, Dwivedi, Y. K., & Lai, H. H (2018). Examining the core knowledge on Facebook. *International Journal of Information Management*, 43, 52-63

Shute, V. J. (2008). Focus on formative feedback. *Review of educational research*, 78(1), 153-189.

Smock, A. D., Ellison, N. B., Lampe, C., & Wohn, D. Y. (2011). Facebook as a toolkit: A uses and gratification approach to unbundling feature use. *Computers in Human Behavior*, 27(6), 2322–2329.

Swan, M. (2013). The Quantified Self: Fundamental Disruption in Big Data Science and Biological Discovery. *Big Data*, 1(2), 85–92.

Swan, M. (2009). Emerging Patient-Driven Health Care Models : An Examination of Health Social Networks, Consumer Personalized Medicine and Quantified Self-Tracking.

International journal of environmental research and public health, 6(2), 492-525.

Tandoc, E. C., Ferrucci, P., & Duffy, M. (2015). Facebook use, envy, and depression among college students: Is facebooking depressing?. *Computers in Human Behavior*, 43, 139–146.

Teng, C. I. (2017a). Impact of avatar identification on online gamer loyalty: Perspectives of social identity and social capital theories. *International Journal of Information Management*, *37*(6), 601-610.

Teng, C. I. (2017b). Strengthening loyalty of online gamers: Goal gradient perspective. *International Journal of Electronic Commerce*, *21*(1), 128-147.

Teo, T. (2016). Modelling Facebook usage among university students in Thailand: the role of emotional attachment in an extended technology acceptance model. *Interactive Learning Environments*, *24*(4), 745-757.

Thorsteinsson, G., & Page, T. (2014). User attachment to smartphones and design guidelines. *International Journal of Mobile Learning and Organisation*, 8 (3), pp. 201 - 215.

Tosi, H. L., Locke, E. A., & Latham, G. P. (1991). A Theory of Goal Setting and Task Performance. *The Academy of Management Review*. Prentice-Hall.

van der Heijden. (2004). User Acceptance of Hedonic Information Systems. *MISQuarterly*, 28(4), 695.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204.

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision sciences*, 39(2), 273–315.

Willemsen, M. C., Graus, M. P., & Knijnenburg, B. P. (2016). Understanding the role of latent feature diversification on choice difficulty and satisfaction. *User Modeling and User-Adapted Interaction*, 26(4), 347–389.

Yang, Y., Asaad, Y., & Dwivedi, Y. K. (2017). Examining the Impact of Gamification on Intention of Engagement and Brand Attitude in the Marketing Context. *Computers in Human Behavior*, 73(August), 459-469.

Zhang, P. (2008). Technical opinion: Motivational affordances: reasons for ICT design and use. *Communications of the ACM*, 51(11), 145–147.