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Numerical Representations And User Behaviour In Social Networking Sites: Towards A Multi-Theoretical Research Framework

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NUMERICAL REPRESENTATIONS AND USER BEHAVIOUR IN SOCIAL NETWORKING SITES: TOWARDS A MULTI-THEORETICAL RESEARCH FRAMEWORK

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Abstract

The new technological enhancements and the accessibility to varieties of online applications, enable users to collect personal data and perform self-evaluation through test, comparison and experimentation. The sparked interest in numbers and numbers as self-representative visualisations is prominent in social networking sites, which are the empirical setting for the present study. This paper sets out to establish a multi-theoretical framework which enables the investigation of emerging phenomena of the role of numbers in social networking sites. The proposed framework rests on three theoretical pillars: self-determination theory, heuristic decision making and behavioural economics. A discussion departs from these convictions to investigate user reactions and behaviour when faced with numerical representations in the SNS.

Keywords: User Behaviour, Social Networking Sites, Numerical Representations, Multi-Theoretical Framework, Quantified Self, Pointification

1 Introduction

The proliferation of information technologies, applications and services in everyday life has changed the way people access information from their environment. The present abundance of data related to almost every aspect of human behaviour creates new opportunities but at the same time poses challenges for individual's information processing such as coping with data overload (Bawden and Robinson, 2009). Much of this data is available in the form of numbers and collecting information through measurements is a common activity in the world. Companies measure sales, costs and profit, universities measure journal publications and students' enrolment versus dropout rates, physicians measure blood pressure on patients – yet this observation is not confined to organizations and professionals. Sports fans can now use devices to measure their pulse and varieties of physical progress when exercising, or gamers can inspect the value of their partners gaming experience. The numerical representations concern ourselves, other people, or activities and, as everyday life involves online activities in the virtual space, we are constantly subjected to various numerical representations.

The omnipresence of numerical data enables evaluation through test, comparison and experimentation and hence provides information on self-perception. The importance of addressing these needs in IS research is conveyed by Au et al. (2008), who argue that academics have been preoccupied with "how useful information systems are in meeting the end user's job performance-related needs, whereas the higher level of intrinsic needs have largely been ignored. Ironically, it is often the unawareness of these intrinsic needs, such as social and self-development needs, that has potentially caused user resistance in IS implementation" (p.46). The role of self-perception for the individual is emphasized by self-determination theory (SDT; Deci and Ryan, 2000). It suggests that people pro-actively aim at developing their individual potential in attempt to fulfil intrinsic personal needs for autonomy, relatedness and competence.

In our research, we focus on two notable examples of a prominent role of data in information systems: (1) the Quantified Self (QS) which is a full-fledged movement that promotes the idea of measuring yourself for self-knowledge, and (2) pointification, a process involving users collecting digital points through scoring systems which are inherent in social media due to gamification (Deterding et al., 2012; Robertson, 2012). We characterise the QS and the pointification process of offering numbers as a mirror of oneself which in turn motivate the user to engage in self-evaluation.

To theorise the role of numbers for self-perception we study the use of social networking sites (SNS). They target individual use and next to supporting digital social practices they are specifically designed to afford the definition and actualisation of a personal identity (Bouman et al., 2007). With the widespread adoption and increasing complexity of SNS, quantitative measures play an increasingly prominent role for the user experience. For example, explicit display of numbers represents new friendship requests, comments, likes and existing friends. When the user observes a number in the SNS, this number becomes a cue from the environment providing specific information to the user. In an information intense environment such as a SNS, we posit that a user may process and assess numbers through heuristics (Constantiou et al., 2012). Thus, we motivate a heuristic approach to investigate how users treat numbers in SNS to enrich their self-perception.

The interactions with numbers may influence the user's involvement and participation in the SNS. For example, pointification mechanisms are implemented by the SNS operators to increase user's participation. However, one might suspect that the repetitive exposure to these mechanisms may create automatic monitor behaviours or even motivate the user to actively engage in changing specific numbers which represent personal information or even manipulate them. The subjective interpretation of the numbers provided on SNS, implies a trade off between affective and rational reactions, which motivate the use of behavioural economics (Thaler and Shefrin 1981) to investigate the changes of user behaviour.

The ubiquity of (personal) numerical information and the likely implications for user behaviour is in stark contrast to a current paucity of academic research contributions on the implications of this design aspect for the users. Consequently, we develop a systematic IS research framework in which we conceptualise how the numbers in a SNS context, (1) motivate new ways of self-perception and self-assessment, (2) afford information processing, and (3) influence resulting behavioural outcomes. Thus, our research question is:

- *How* do numbers motivate users to behave and react in SNS?

The research question presents an opportunity to contribute to existing literature (Lin and Lu, 2011; Subrahmanyam et al, 2008; boyd and Ellison, 2007) on the motivation to participate in SNS by investigating the role of numerical representations. In particular, we contribute to IS research with developing an overarching framework which enables a better understanding of the motivation behind participating in SNS, by focusing on how users interpret information in the form of numerical representations and act accordingly. The framework provides a different perspective on users' motivation, as SNS present possibilities to quantify previously non-quantifiable aspects of users' life and as such, turn sentiment into metrics.

The rest of the paper is organized as follows. In the next section we introduce the QS and pointification process as two recent observable manifestations of our target phenomenon. We then derive and propose general theory domains of a research framework with the objective to guide future inquiries into different aspects of the role of numerical representations in information systems. We present the main elements of the multi-theoretical research framework. Subsequently, we motivate SNS as a relevant environment. We briefly discuss how the main elements of the framework can be used to explain user's reactions and behaviour in relation to the numerical representations in SNS. Finally, we conclude by describing future research directions.

2 Background: Self-knowledge through numbers

The ubiquity of numbers available through information technologies influences user's interactions with services and applications. There are two types of numbers that users may encounter in a SNS, namely those that they collect actively/knowingly and those that they are exposed to passively/unknowingly. The differences are, both literal and visual. QS involves *pulling* numbers from the users' personal databases while pointification emphasizes *pushing* numbers from the platforms database to the users. As a result, both require presence of the users, yet in QS the user is actively seeking numbers while in pointification numbers are presented to the user without user's intentional intervention (i.e., seeking for the numbers). From a user's perspective, pull and push may occur simultaneously as a platform may push numbers through a user interface at the same time that a user is self-determinedly pulling numbers from it. Accordingly, QS and pointification seem to complement each other. In the following section, we provide an overview of these phenomena to set the background for the subsequent theoretical conceptualisation.

2.1 Pull: The Quantified Self

The QS is an emerging phenomenon that has been dubbed as one of the leading trends of 2012. It involves "self-tracking" or "self-knowledge through numbers", namely tracking numerical personal data with the aim of using it for self-reflection, self-discovery, and self-improvement (Wolf 2010). In 2007, Gary Wolf and Kevin Kelly, editors at Wired magazine, spotted the increasing tendency for individuals to collect data, mirror themselves in it and strategize their lives accordingly, and started a forum to share practices. Since then QS has grown steadily across the globe and currently measures more than 14000 members in 78 cities in 29 countries and been showcased in popular media such as TEDx, The Economist, and TechCrunch (Quantified Self, 2012).

Anecdotal evidence suggests that QS members share "a belief that gathering and analysing data about their everyday activities can help them improve their lives—an approach known as "self-tracking",

"body hacking" or "self-quantifying" (Economist, 2012). In a New York Times article, Wolf (2010) conjures the notion of self-management when he speculates that the modern day manager has a fetish for numbers when attributing to himself and explains that practitioners, as well as people in general, are attracted to the power of numbers because it makes problems appear more rational and less emotion-laden. Wolf (2010) also argues that many users do self-tracking for unknown reasons and that numbers provide information about issues that they haven't thought of yet.

Academic research in QS is limited and often involves health and fitness, which is also the most common context in which QS members measure themselves. Self-reporting to track patient progress has been established as a valuable contribution to the patient's health outcome (Wicks, 2010; Wolbring and Leopatra, 2013). On the other hand, QS members collect data such as heart rate, pace, speed during running or cycling and subsequently pool them into digital visualisation tools such as Training Peaks and New Leaf. The examples showcase how an individual may collect and share information for personal benefit and how this new type of data can radically change the precision by which people are diagnosed and treated. According to Swan (2012, p.238) "the key reason individuals conducted some sort of QS project was to resolve or optimize a specific lifestyle issue". The terms such as optimization, resolve, and personal success allows speculation on whether individual users seek quantification of personal data to create personal optimisations.

We argue that the emerging phenomenon of QS and its attractiveness suggest an important and special role of quantitative data, as an influence on user behaviour. The users appear to experience novel motivations for utilising technology to evaluate everyday life. QS involves data collection on different levels and areas, but importantly, on the individual level. Instead, QS and its self-tracking members highlight the importance of data properties as well as the processes of how data is approached and handled in the present technological environment.

2.2 Push: Pointification

The omnipresence of numerical representations manifests in different types of online scoring systems (i.e. collection of points) enabling pointification. Examples include the average review scores found in user support such as the 'diggs' or +1s in social bookmarking services (e.g. digg.com). These scores can be interpreted as gamification principles applied by the platform providers.

Gamification is "the use of game design elements in non-game contexts" (Deterding et al. 2011, p.10). Gamification has been used to describe how game design elements have been applied to new settings, such as when designing social media platform and interactive interfaces with the intended belief that it will engage users (Deterding et al., 2011; Dominiguez et al., 2013). Game design elements often consist of functions that form a reward system where rewards may be points, badges, titles, levelling up and leader boards. In fact, the reward systems are generally tied to collecting points as a representation for progress within the platform, and these points may then in turn be translated into badges, titles, levelling up or a high position of a leader board. A traditional example of game design are loyalty programs, such as airline point collecting programs, which has been proven to have an impact on customer loyalty and thus customer behaviour (Pritchard et al., 1999). Academic research involving gamification, respectively pointification, has mainly revolved around human computer interaction, user experience design, educational purposes and marketing perspectives (Deterding et al., 2012; Domínguez et al., 2013; Lee and Hammer 2011).

Underlying the manifold manifestations, the main contributing factor of gamification is boiled down to points in a scoring system (Robertson, 2010; Markey et al, 2012; Parise and Crosina, 2012). In other words, gamification resembles a scoring system more than it is does an actual gaming activity. Scores are collected in points that can be mirrored in numbers of likes, comments, shares, messages, notifications, friends, and followers. Consequently, we adopted the term, "pointification" as a more suitable term to characterise the main underlying phenomenon. This term also emphasises the target relationship in this paper: how information processing and social actions in SNS may be motivated and influenced by numerical representations.

In summary, the presence of scoring systems that is pushing the users to translate numbers into points in a non-game context is a second useful domain for exploring how users are influenced by numerical representations. The departure point is that numerical data represent individual facts and drive change in user behaviour. We note that while the QS movement emphasises users that pro-actively pull data, pointification suggests the opposite, i.e. numerical data is pushed to the users by the platforms.

3 Towards a theoretical foundation

There are three levels on which the impact of numerical data on user behaviour is conceptualised and explained. First, the notion of self-perception relates to need fulfilment and can be investigated with SDT (Deci and Ryan, 2000) in order to conceptualize the motivation for users to engage in interpreting numbers. Second, users noticing and selecting numerical representations implies information processing techniques which are investigated by heuristic-based approach (Todd and Gigerenzer 2003) and third, the implications for user behaviour in SNS are explored by behavioural economics (Thaler and Shefrin 1981).

3.1 Self-determination theory

We posit self-perception as an important requirement for the user as it enables the individual to evaluate and track satisfaction from innate human needs on a conceptual level. Theoretical frameworks for categorising these needs have been proposed by Maslow who argued for a hierarchy of individual needs that reach from 'lower-level' needs like the need for safety to higher-level needs for belonginess, self-esteem and self-actualization (Maslow, 1943). Based on this seminal framework, Deci's and Ryan (2000) developed SDT, a macro theory of human motivation. SDT points to a simplified classification of three universal and innate psychological needs, relatedness, competence and autonomy (ibid). Needs, in this context, "specify the necessary conditions for psychological growth, integrity, and well-being" (p. 227). Relatedness is about being connected to others by caring or being cared for (ibid; Wang et al., 2008). Competence is the effectance-focused ability to produce valued outcomes and experience mastery which in turn implies the desire for information-based learning. Autonomy refers to a person's volition – the desire to self-organize experience and to engage in activities that are concordant with one's sense of the self (Deci and Ryan, 2000). These three characteristics are considered as vital to understand what and why certain goals are pursued by actors in a social context. There might be individual differences in need for competence, autonomy and relatedness so the focus lies not on what users final and absolute needs but rather the motivation that directs at achieving the three categories, i.e. needs fulfilment.

Deci and Ryan, however, argue that individuals are not simply passive and act only when they have to replenish perceived deficiencies of need fulfilment. Rather they argue that individuals proactively and self-determinedly engage in activities that interest them and develop or actualise their individual potential as long as they are "in a context that allows need satisfaction" (Deci and Ryan, 2000, p.230). This implies that naturally developed activities such as "curiosity-based exploration, openness to the sensory experiences of nature, and assimilation of values extant in one's social milieu" (ibid) will occur for positive resonance but not specifically because a need must be fulfilled (ibid). This correlation requires that activities have a back-channel which allows self-assessment as an option to evaluate need satisfaction.

Another support for the important role of effective self-perception can be found in Bandura's self-efficacy theory (Bandura, 1986). Closely related to satisfying needs of autonomy and competence, it proposes the concept of self-efficacy, defined as the perception of being in control based on judgments of how well one can execute courses of action informed by previous learning. Self-efficacy is influencing behavioural intention. Bandura's theory is consistent with needs theories but it more clearly exposes the notion of being in control as a desirable state, which again suggests the important role of effective self-perception and learning opportunities.

Lastly and interestingly, it should be noted that Deci and Ryan (2000) also argue that perceived deficiencies in needs fulfilment can also lead to higher levels of self-control (either defying or complying), which can intensify the requirement of cues to support self-perception.

In summary, SDT and the related self-efficacy theory set the background for a first important research domain: Empirical assessment of how numerical data, or their change between two observations, may be perceived as effective reflective cues, about personal development in terms of satisfying intrinsic higher-level needs, such as the need for relatedness, competence and autonomy.

3.2 Information processing: Use of heuristics when coping with numbers

Our main assumption is that humans are bounded rationally and have limited information processing abilities (Simon, 1955). The use of heuristics is a way of coping with the abundance of numerical representations available. The use of heuristics to simplify information processing has been investigated by many researchers in different contexts (e.g., Tversky and Kahneman 1974, Gilovich et al. 2002). Payne et al. (1993) underline the trade-off between cognitive effort and accuracy as a main determinant of the choice of heuristics or other methods of information processing in specific tasks.

Todd and Gigerenzer (2003) described four types of fast and frugal heuristic-based choices which are supported by a large number of empirical studies (e.g., Goldstein and Gigerenzer, 2002). First, the ignorance based choices rely on the lack of knowledge about the available options. This category is mainly represented by the 'recognition' heuristic, where it is recognition of one option and not another that leads to a choice (Goldstein and Gigerenzer, 2002). Second, the one-reason based choices include heuristics such as "take the best", "take the last", and "minimalist". The three heuristics are based on the proven value of a cue, the recent usefulness of a cue, and the choice of a random cue, respectively (Todd and Gigerenzer, 2003). Third, choice by elimination can take place when many options are available to categorise and evaluate. It is mainly manifested by the use of 'categorization by elimination' heuristic (Todd and Gigerenzer, 2003). Finally, satisficing involves use of the homonymous heuristic in sequential search mode, which stops when the "aspiration level" is met in relation to a specific cue or attribute of the option (Bazerman and Moore 2008).

These four categories of heuristics constitute an "*adaptive toolbox*" (Gigerenzer et al., 1999) of cognitive mechanisms that have been developed through learning and other evolution processes of the individual. The individual processing of numbers in the SNS may be based on fast and frugal heuristics. The adaptive nature of these heuristics accommodates the user experience with the SNS and enables distinctions between novice and experienced users. Finally, these heuristics provide a basic reference "toolbox" which supports identification of new heuristics from the adaptation in a specific context.

In summary, the fast and frugal heuristics set the background for a second important research domain: Empirical investigation of how attention towards numbers is manifested, the cognitive act of interpreting quantitative data in order to derive an evaluative self-perception.

3.3 User behaviour when interacting with numbers

User behaviour in the SNS may change when numbers relating to self-perception are noticed and processed. Insights from behavioural economics are introduced to enable understanding of these behavioural changes. Behavioural economics research combines theoretical concepts of economics and cognitive psychology to explain the individual's choice (Kahneman 2003). When choice is driven by hedonic motives, the emotions have a primary role in the decision making (Lichtenstein and Slovic 2006). For example, the user choice of monitoring how many likes a particular comment receives is motivated by the desire for instant gratification. However, this activity may also raise rational concerns for the consequences (Hoch and Loewenstein, 1991) the number of likes may have to the user's social sphere. Thaler and Shefrin (1981) proposed the use of a dual-self model in understanding the influence of emotions and rationality in the individual actions. They posit that the individual's

decision is influenced by two selves, a planner and a doer. The planner focuses on the long-term utility, and acts in a rational manner by considering the consequences of an action. The doer has a myopic, short-term view and acts in an impulsive way, influenced by emotions such as desire or the need for instant gratification. The individual's internal want/should conflict has been discussed for centuries (Milkman, Rogers, and Bazerman, 2008 provide an extensive literature review). We introduce the dual-self approach in order to investigate the different types of user's behaviours involving emotional incentives (want) and strategic concerns (should), such as interaction with numbers in the SNS. Depending on the motivation of the user behaviour, doer-self or planner-self driven, more or less subjective evaluations of numerical representations will be conducted leading to different actions.

In summary, the dual-self model sets the background for the third important research domain: Empirical investigation of how users' behaviours are influenced by the numerical representations of their actions in the SNS. Table 1 provides an overview of the different elements of our multi-theoretic research framework and explicates main theoretical relationships suggested in the literature.

Antecedents	Phenomenon	Consequences
Need fulfilment motivations	Information processing	User behaviour
• Numbers influence self-perception that in turn enables self-evaluation with regards to needs satisfaction. • Numbers allow for effective 'curiosity-based exploration' and 'sensory experiences' as inherently 'interesting' activities, which in connection with perceived need satisfaction yield intrinsic motivation. • Numbers support self-determined satisfaction of needs. • Numbers may effectively be used for learning which supports the self-efficacy belief of being in control.	• Numbers can be used as recognisable cues when the user lacks other information to use when making a decision. • Attention to a specific number may be guided by one prominent reason, motivating the user. • Numbers can be used as thresholds to eliminate options available to the user and reduce the cognitive burden when making a choice. • Numbers are judged as satisfactory when it reaches a subjective level set by user's aspirations.	• Numbers can trigger an emotion- laden, impulsive, short-term, sub-conscious behaviour. • Numbers can trigger a strategic, long-term, utility maximising, and consequences-based behaviour.

Table 1. Overview of the different elements of the multi-theoretical framework

In the next sections we discuss how our research framework can be used to study the role of numerical representations on user behaviour and reactions in SNS.

4 Numerical representations in social networking sites: User reflections and behaviours

SNS are the empirical context of the present study, investigating numerical representations and the influence on user behaviour. This domain is chosen because it has a well-established accessible scoring system in which it is possible to extract data for analysis and discussion. Further, Bouman et al. (2007) argue that social software is designed to allow users to mimic social practices and to build and develop their online identity (e.g., using the personal profile). This latter aspect is emphasizing the

notion of self-evaluation and self-determination. Studying the user of SNS hence addresses the objective of observing how numbers are useful to reflect about higher-level intrinsic needs.

Social media is understood as an umbrella term that encompasses SNS, such as Facebook, LinkedIn, MySpace and Google+. boyd and Ellison (2008) define the key elements of SNS as the presence of a personal profile, a selected friendship list and the ability to view and traverse others' friendship lists. Moreover, SNS can be distinguished in virtual communities, whose commitment to an online social space is found in users' emotional attachment to it (Bagozzi and Dholakia, 2002; Cheung and Lee, 2008). An important influence for continued SNS use is enjoyment (Lin and Lu 2011). Apart from emotional attachment and perceived enjoyment, social media and virtual communities, provide a forum for participation. The "joint and simultaneous creation of content by many end-users and are, in this sense, probably the most democratic manifestation of [user generated content]" (Kaplan and Haenlein, 2010, p.6), which proposes that social media provides a forum for public participation.

Numerical representations of the user have been already exploited by new business models. For example, Klout score has emerged as a demonstration of social media analytics and illustrates the score of individuals in an online social context. However, this study does not involve Klout score as it automatically generates and assigns a score to individual users by scraping SNS feeds. This study is not about automated assignments of scores. Instead, we investigate how numerical representations are presented in SNS and how they motivate users to behave and react rather than focusing on the aggregated representation of user influence formulated by an algorithm. In the following subsections we discuss how an SNS user may react to numbers and the possible subsequent behaviour.

4.1 User reactions to numerical representations in SNS

As a user scrolls through newsfeed in SNS, he automatically goes through a variety of posts that have been attributed likes, comments, or shares, which represent points, by other users. These SNS interactions, namely the number of likes, comments, or shares, are automatically noted and evaluated by the user because they offer signals about the content quality of a post (Donath, 2008; Hargittai, et al., 2010; Lankes 2008). Recent studies have also shown that youth is inclined to evaluate information online by trusting collective judgement rather than the credibility of a single author (Hargittai, et al., 2010). However, it is difficult to establish a uniform range of what signifies a high number for different users. Based on the empirical studies we observe that:

- *A high number of likes, comments, or shares, is treated as an indication of high quality content by an SNS user.*

The above user behaviour indicates ignorance-based choices. In other words, if many other users have liked a post, the aggregate number of likes is recognised as endorsements and an indication of high quality content. The recognition heuristic is used to describe reactions to the number of likes or comments, namely that the more likes or comments are posted on an update, the more likely it is that this update is worth consuming. The recognised cue is the number of other users, whose taste becomes the strongest signal of the content quality. An experienced user who spent extensive time on SNS observed a wide variety of posts and assessed a wide range of numbers of likes or comments as signals of content quality compare to a novice user, who is not exposed at the same range of numbers. Thus, a perceived high number of likes, or comments is subject to previous experiences.

A user pays attention to another user's posts which is perceived valuable. The attention and potential feedback in the form of likes, comments or +1s vary with respect to time, relationship and interests, and may be described as "social grooming" (Donath 2008). In the case of a reputable user, the repetitive reaction, or tailing of another user may create a bandwagon effect, to other users that may assume that the tailing user is also interesting and trustworthy. Based on the empirical studies we observe that:

- *High frequency of a user's reactions to another well-known user's activity is treated as an indication of positive reputation of the former user by other SNS users.*

This behaviour indicates a user's reaction to another unknown user through one-reason based choice and in particular triggered by the heuristic of "take the best". Accordingly, the user is making a choice based on a proven value of a cue, in this case the positive reputation of another user.

Collecting numerical data for personal use may be a highly selective process of choosing confirmatory data to the user's expectations. This information processing behaviour is empirically grounded by a number of studies in social psychology and coined as confirmatory bias (e.g., Bazerman and Moore 2008). As a result, the personal data collection may ignore essential pieces of information that might have led to different findings. Self-experimentation has been criticised on this particular point although its practitioner claims differently (Roberts 2010). Based on the empirical studies we observe that:

- *Numbers related to a user's behaviour in the SNS are treated subjectively to his convenience.*

A user perception of his success in the social sphere may be based on a selective choice of numerical representations made by the elimination-by-aspect heuristic, which implies high subjectivity.

The observations above describe some key aspects of users' information processing of the numbers that are flaunted and noticed in their SNS activity. These reactions influence how the psychological needs described in SDT are addressed. Relatedness is addressed in users' reactions to numbers (likes, comments, and shares) which indicate a connection between the other users and the content shared in a post. Likes, comments and shares are indicative of other users' care for or connection to the user who produced the content in the post. Competence is addressed when there is a high number or frequency of likes, comments and shares as these are the results of personally produced content and valued outcome. Autonomy is addressed by a user's appreciation of content's ownership in SNS, which enforces the sense of self regardless if the posts are based on selective success rates of posts.

4.2 Emerging behaviours from the user reactions to numerical representations in SNS

Numerical representation in SNS may be used as a tool of social validation (Jessen and Jørgensen, 2010) by quantifying a personal characteristic, a reaction, a feeling which due to their intangible nature could not be measured or assessed differently. In this respect, numerical representations in SNS may be seen as signals of a user's characteristics. Indeed, studies have shown that personality traits are associated with SNS use (e.g., Ross et al., 2009). Based on the empirical studies we observe that:

- *A SNS user treats numbers as means to understand personal characteristics, affective states and own reactions.*

Pointification mechanisms in SNS enable a user to get a numerical representation of other users' reactions to his affective state. The user enters personal information into system which offers a numerical representation and visualisation. In particular, a user may post a status update on an SNS, that describes his current mood and instantly receive feedback or alternatively positive cheers from other users. The feedback gained in the form of likes or comments provides a numerical representation in which the user may mirror himself in or validate his status. Thus, the pointification offers an opportunity to reflect on an affective state. In this case the user translates an intangible characteristic or affective state derived from the doer-self, through numbers, to a more tangible representation which can be assessed by the "planner-self".

SNS users may compulsively monitor the feedback provided by the other users, which can be described as addictive behaviour (Ehrenberg et al., 2008; Turel et al, 2011; Wilson et al., 2010). Turel et al (2011) explain that the relationship between addicted user and the respective technology is modified by the level of addiction and seen through misrepresented lens that enforce intrinsic and extrinsic needs through the system used. Thus, a technology addiction modifies the understanding of the system attributes (such as feedback in the form of likes, +1s, comments and shares received from

other users) and thrives on these for the purpose of intrinsic and extrinsic needs. Based on the empirical studies we observe that:

- *A SNS user may develop addictive behaviours that involve constant monitoring of number changes.*

SNS notifications in the user's communication channels become cues that correlate with SDT's needs for relatedness and competence. In essence, the feedback provided to the user by other users is represented by numbers and the user will strive for higher numbers, as higher numbers signal high content quality (Donath, 2008). Since numbers depend on the receivers' willingness to contribute, the user cannot predict the reactions of other users to a post. Thus, excessive monitoring may occur. This is automatic behaviour of the user, which occurs subconsciously, is led by the "doer-self", and may provide instant gratification. Moreover, user's behaviour is influenced by the provided feedback. The more the feedback, the higher likelihood that the user returns to the site in the future and posts additional or new content, perhaps in the pursuit of high numbers.

A user may employ strategies to "manipulate the impression they wish to give off" (Donath 2008, p. 241) like skewing numbers that represent certain activities in the SNS. Online credibility is increasingly situated in collective judgement (Hargittai, et al., 2010). For example, SNS (such as Instagram and YouTube) reward contribution which collected high numbers of likes by placing them on a leaderboard or trending newsflow. In order to be showcased, a user must have a certain amount of points (feedback in the form of likes, +1s, viewings etc). Besides, while on the trending page, the user is additionally exposed to new viewers which in turn may lead to additional points. In this context, a user may be tempted to inflate the numbers to arrive at a satisfactory leaderboard position. Based on the empirical studies we observe that:

- *A SNS user may actively engage in number manipulation in order to increase them*.

A user may ask for likes in return of likes, which is also related to social grooming (Donath 2008). The user may be led by the "planner-self" strategic reaction to the SNS pointification mechanisms, which are, for example, the number of views.

The observations above illustrate how numerical representations may influence user behaviour in SNS and how it is further motivated by SDT's needs fulfilment. Relatedness is visible in all the observations as the users pursue points that serves as connectivity points which indicate a certain level of caring. Nevertheless, the points delegated by the users or to the user may be a part of a strategic and reciprocal transaction, but the aggregated number may still send a signal of relatedness and opens up to a larger but more distant social network. Competence, where the user aspires for a personally produced and valued outcome, is visible throughout the categories as numbers serve as cues in an environment where content and subsequent feedback becomes self-evaluative. Self-evaluation of intangible thoughts, monitoring addiction and point manipulation all relate to competence as the user attempts to gain experience and mastery through a valued producing outcome. Finally, autonomy cuts across the observations as the users appreciate ownership of the content they have posted despite their need to act on feedback, monitoring or manipulation.

5 Conclusions and further research

This paper presented a multi-theoretical research framework developed to enable in-depth investigations of an emerging phenomenon in IS adoption and user behaviour research, namely the user's reactions and behaviour in SNS in the presence of an abundance of numerical representations which are able to fulfil specific user needs. We discuss the importance of numerical representations to the user ability to experiment and reflect on his behaviour by collecting feedback from others in SNS. We describe how the proposed framework can explain the user behaviour and reactions in the SNS. Future research should focus on refining and contextualising the proposed framework and test it through empirical studies. Both qualitative and quantitative techniques are warranted to shed light on

the multiplicity of user reactions and behaviours, motivated by numerical representations in the SNS. As soon as the framework has been tested in SNS, it would be relevant to expand the research into other areas of social media and organisational context that implement social media. Other possible areas of research is to investigate how numerical representations are understood and are motivated in a negative context, i.e. diffs, likes, votes, +1s that are attributed to negative sentiment or downward endorsement.

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