Incremental Persuasion through Microblogging: A Survey of Twitter Users in Latvia

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ABSTRACT
Emerging socio-technical environments facilitate the advancement of existing social activities and creation of innovative forms of online social influence. Social networks and microblogging services are few of the most frequently used forms of online interaction. These channels provide means for intensive communication embodying persuasion in one way or the other. This paper presents features of Twitter to uncover inbuilt persuasion patterns that influence users' behaviors and attitudes. An online survey of Twitter users in Latvia was carried out receiving 403 valid responses for quantitative data analysis. Recent frameworks for designing persuasive systems and measuring the success of Behavior Change Support Systems (BCSSs) were applied in the evaluation process. The main findings from this study relate to incremental behavior and attitude change among Twitter users. Other results magnify the understanding of social influence patterns amongst Twitter users. These findings could be used for further research focused on the persuasive potential of Twitter.

Categories and Subject Descriptors
H.1.2 [**Information Systems**]: User/Machine Systems – *human factors, software psychology.* H.3.4 [**Information Systems**]: Systems and Software – *information networks.* J.4 [**Computer Application**]: Social and Behavioral Sciences – *sociology.*

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Twitter, social influence, behavioral patterns, incremental, attitude change, persuasive systems design, microblogging

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1. INTRODUCTION
Novel information and communication technologies continuously affect many aspects of modern life. Global use of the Internet has created a substantial shift in communication both at local and international stages. More than a decade ago, the definition of "timeless time" emerged [1], a phenomenon created by hypertext and other new multimedia features, such as hyperlinks, message permutations, and image manipulations, which ended what was historically perceived as the natural sequence and time ordering of events. These communication forms altered the way people, organizations, and the rest of the world was experienced. Messages of all kinds become enclosed in the medium because it became so comprehensive, diversified, malleable, that it absorbed the entire of human experience i.e. past, present, and future in the same multimedia text.

Digitalization has enabled new forms for social activities in the virtual world. Interpersonal and mass communication is widely and actively used through social networks, blogs, e-mails, text messages, online games, and other means of social interaction, all of which are referred as social web. Previous research emphasized the significance of social networks, their structure and development [2], as well as their impact on individuals and organizations [3]. In addition, social networks have become a rapidly growing research area for computer science and information systems (ISs) scholars [4]. Academics and industry experts have acknowledged social networks as a key element of the next-generation web [5]. Some practitioners claim that no matter what type of web site or service is being developed, social interaction among the users will be critical to the site or service's success [6].

Interest in microblogging, posting reflections on personal blogs, particularly by using instant messaging or mobile phones, has gained momentum recently. Twitter (twitter.com) is an online service that combines social networking and microblogging, thereby creating a universal environment for active users of digital communication channels. At the same time, there are people who do not see any value in using Twitter and consider it time-consuming, while others think it is quite addictive. Varying types of user groups inhabit Twitter. There is a certain group of Twitter users that refer to this service as a website about nothing while on the other hand, Twitter transmits dozens of messages per day from socially hyperactive users who need instant connectivity and cannot seem to stop themselves from posting [7].

Twitter use has changed and still affects users and their behaviors and attitudes. Important characteristics to understand are the principles and features underlying Twitter, which facilitate the aforementioned changes. A key element in behavior and attitude change is persuasion, which is also described as a *social influence* mechanism [8] or a form of interaction that aims at changing the way people think or behave. Hereof, the research question for this study was posed as follows:

> *RQ: What kinds of inherent persuasion patterns exist in Twitter that can change users' behaviors and/or attitudes?*

In order to answer this research question, a quantitative online survey was designed and carried out in Latvia between July 19 and July 28, 2010. In all, 403 valid responses were statistically analyzed. Recent frameworks for designing persuasive systems, *Behavior Change Support Systems (BCSSs)* [9], and measuring the success of persuasive technology applications were applied during the evaluation.

The paper is structured as follows: Section 2 presents related research, Section 3 explains main concepts of recent frameworks for designing persuasive systems and BCSSs, Section 4 describes the research setting and survey elements, Section 5 outlines the statistical data analysis and results, Section 6 opens up discussion, and Section 7 draws conclusions based on the earlier sections.

2. RELATED RESEARCH

Digital environments such as social web, mobile platforms, and other technological innovations, have rapidly expanded over last decades. The emergence of the socio-technical systems has created opportunities for scholars from various disciplines to perform advanced research in their fields. Further, software developers and the general audience should be aware of various approaches how people might be, are being, and will be influenced through information technology designs [9].

The related research discusses three main dimensions relevant to this paper: persuasion, online social networks, and Twitter as a microblogging service. *Persuasion* refers to an active attempt to influence peoples' actions or beliefs with an apparent appeal to reason or emotion [10], or communication intended to influence choice [11]. Since beliefs are the ultimate determinants of behavior, to influence an intention or the corresponding behavior, it is essential to change the underlying beliefs. Persuasion has been shown to be one of the most important strategies for influencing beliefs and behaviors [12].

The beginning of studies related to online social networks was determined by the emergence of computing networks and development of online interconnectivity. When a computer network connects people or organizations, it is a social network [13]. Further studies have described the evolution of online social networks with more detailed characterization of their structures and, consequently, a simple network growth model that also captures these aspects of the component structure [2]. Following that model, users of online social networks can be characterized as either passive members, "inviters" who encourage offline friends and acquaintances to come online, or "linkers" who fully participate in the social evolution of the network. Furthermore, several studies related to persuasion in online social networks have been conducted. As a result, a new phenomenon of mass interpersonal persuasion has been introduced that describes the options for individuals to change attitudes and behaviors on a mass scale [14]. Next, patterns of persuasion in online social networks have been defined, suggesting that persuasion happens in predictable ways [15]. One of the recent developments is to study persuasion patterns in ISs underlying the social web, such as Facebook, but a relatively minor effort has yet to be directed towards investigating the persuasiveness of ISs designed for microblogging, such as Twitter.

Twitter as a web-based service was launched on July 15, 2006, and since then the number of users and posts has grown rapidly. At the same time, practitioners and scholars started to produce research-based scientific papers aimed at discussing Twitter, its use, to define its impact on people, organizations, and societies. Soon after Twitter emerged, researchers tackled the core question i.e. why people "tweet" to obtain deeper understanding of the microblogging phenomenon. They found that Twitter users' intentions comprised of regular chatting, conversing, sharing information, and reporting news [16]. Another study identified distinct classes of Twitter users, such as broadcasters, acquaintances, miscreants, or evangelists, and their corresponding behaviors [17].

Investigating Twitter, researchers found that the linked structures of social networks do not reveal actual interactions among people. Studying social interactions within Twitter revealed that the driver of usage is a sparse and hidden network of connections underlying the declared set of friends and followers [18]. The first quantitative study on the entire Twitter sphere and information diffusion on it studied the topological characteristics of Twitter and its power as a new medium of information sharing, which marked a deviation from known characteristics of human social networks [19]. However, efforts to investigate Twitter were mainly aimed at studying the components of the Twitter service rather than exploring its persuasiveness and inherent social influence patterns.

3. PERSUASIVE SYSTEMS DESIGN

Scholars and practitioners see online social networks as a representation of social interactions that can be used to study the propagation of ideas, social bond dynamics, behavior, and attitude change, among others. Studies related to attitudes and behaviors of users have a fairly long history in ISs research [9]. The theories for understanding attitudes and behaviors related to ISs and their use are taken from various areas, such as social psychology [20], cognitive psychology [21, 22], and related theories, such as the focus theory of normative conduct [23], and others.

A key element in behavior and attitude change is persuasion. Research on persuasive technology has been introduced relatively recently [24], focusing on how interactive technologies may be used to create, maintain, or change human thought and behavior. This combines well-established research methods and traditions from epistemology, rhetoric, social psychology, communication, and information science with contemporary technologies. Persuasive systems may be defined as computerized software or ISs designed to reinforce, change, or shape attitudes, or behaviors, or both without using coercion or deception [25].

Elaborate conceptual and design frameworks for ISs have been suggested recently, such as the *Persuasive Systems Design (PSD) model* [26] and a BCSS [9]. To carry out research on BCSSs, a five-step process model has been suggested: select the theoretical basis for research, analyze the intent through what is known as the O/C Design Matrix (Outcome/Change Design Matrix), analyze the BCSS through the PSD model, measure the behavior change, and explain the change with theories, the O/C Design Matrix, and

the PSD model [27]. The PSD model is designed as a meta-level model to be used with fitting theories. The PSD model has been applied in several studies to evaluate the persuasiveness of computerized ISs in different areas, for example, in the health domain to evaluate weight loss and maintenance web sites [28], and in software development to evaluate software design specifications for a mobile Internet device [29].

The PSD model defines seven postulates that need to be addressed when designing and evaluating persuasive systems [26]: information technology is never neutral, people like their views about the world to be organized and consistent, direct and indirect routes are key persuasion strategies, persuasion is often incremental, persuasion through persuasive systems should always be open, persuasive systems should aim at unobtrusiveness, and persuasive systems should aim at being useful and easy to use.

Furthermore, the PSD model suggests four categories of persuasive features: primary task support, computer-human dialogue support, system credibility support, and social influence support. The social influence category, which is the most appropriate for studying social web services, such as Twitter, includes persuasive features such as social learning, social comparison, normative influence, social facilitation, cooperation, competition, and recognition [26].

In this research, the abovementioned frameworks were applied for the evaluation of findings from quantitative data analysis to explore aspects of social influence and patterns of behavioral and attitudinal changes among Twitter users.

4. RESEARCH SETTING

Microblog is a relatively new phenomenon that provides additional communication opportunities for people to share information that they most likely would not distribute otherwise through existing channels, such as e-mail, phone, etc. Channels of this type handle intensive communications that embody persuasion in a one-way or the other. Previous research within this discourse focuses mostly on studying either different components of the social web [e.g., 2, 30] or persuasion in online social networks [e.g., 14, 31], leaving microblogging aside. Although a few studies have examined persuasion through microblogging, for example, to motivate teenagers to exercise [32], this area of research focus has, in general, been studied very little. Therefore, this research investigated persuasion through microblogging, particularly with Twitter.

Twitter is a microblogging service where users send tweets from a variety of devices to a network of followers. Unlike most online social networks, the relationship of "following" and "being followed by" in Twitter requires no reciprocation. The users following one are called *followers*, but those who are followed are called *followees*. *Tweets* are text-based posts of up to 140 characters. Each user has a Twitter page where all his or her updates are aggregated into a single list, but they can also be delivered directly to followers via instant messaging, short message service, really simple syndication, e-mail, or other social networking services. The *retweet* option in Twitter means forwarding of any received tweet to one's followers; thus, this mechanism empowers users to spread information of their choice beyond the reach of the original tweet's followers.

Launched in the summer of 2006, Twitter rapidly attracted users, reaching 190 million users globally (wikipedia.org) within four years. In August 2010, more than 30 000 people were identified as Twitter users in Latvia (soon.lv). Twitter lacks definite means for defining the affiliation of a Twitter user; consequently, the number of Twitter users in Latvia was acquired by considering two main criteria: Latvian as the language of communication and the location provided in Twitter profiles. The number of users may be even larger due to filtering off of Russian-speakers who type their posts in Russian and spend online time in social networks established in Russia.

The online survey of Twitter users in Latvia was carried out between July 19 and July 28, 2010. The survey was published online through pandaform.com, an online database designed to manage various forms and collect data, and received 411 responses, out of which 403 were valid for further analysis. The number of respondents who answered 37 survey questions was generated out of seven tweets from the survey authors and 37 retweets from other Twitter users and a technology blogger article about the survey.

The survey questions were designed to determine the role of Twitter in the virtual space, to understand the habits, thoughts, behaviors and attitudes of Twitter users, to uncover hidden communication networks, groups of interests, the drives for using Twitter, and to get demographic data about Twitter users. Findings of previous research reveal that a link between any two people in social networks does not necessarily imply an interaction between the two [18]. Most of the links declared within Twitter are meaningless from an interaction point of view. Thus, there is the need to find the hidden social influence patterns, the essential ones that matter when targeting to persuade people.

Some of the questions were constructed to reveal potential persuasion patterns within Twitter, as follows:

- How long have you been using Twitter?
- How often do you tweet?
- Do there exist some communication and/or behavioral rules on Twitter, which are created by its users that need to be considered?
- Do you consider yourself in Twitter a reader, retweeter, responder, or content generator?
- Do you think that Twitter is a powerful tool to call for action outside the virtual world?
- What is the level of credibility on Twitter?

5. DATA ANALYSIS AND RESULTS

The survey generated 403 valid responses that represented a wide sample of population in terms of gender, age, education, and the period of use, as presented in Table 1. The percentage distribution between men and women is very similar: 48.1% (n=194) of respondents are male, and 51.9% (n=209) are female. The largest group of respondents (37.5%, n=151) is between 20 and 24 years of age, followed by the group of respondents between 25 and 29 years of age (25.1%, n=101). These groups form the majority of respondents (63.6%, n=252), representing the most active group of Twitter users in Latvia. In addition, 44.4% (n=179) of the respondents had a bachelor's degree, but 65.7% (n=265) of the respondents have higher education. Respondents are almost equally distributed regarding length of Twitter use: 49.9% (n=201) of respondents have used Twitter less than a year, and 50.1% (n=202) of respondents have used Twitter more than a

year. The length of Twitter use for the largest group of respondents (42.2%, n=170) is between 1 and 2 years, and the second largest group (34.5%, n=139) with experience in using Twitter is between 6 months and 1 year.

Table 1. Profile of the respondents

The total number of respondents: N=403			
Measure	Items	Frequency	Percentage
Gender	Male	194	48.1
	Female	209	51.9
Age	Less than 20 years	59	14.6
	20-24 years	151	37.5
	25-29 years	101	25.1
	30 years or more	92	22.8
Education	Studies in school	35	8.7
	Secondary school	103	25.6
	Bachelor's	179	44.4
	Master's	83	20.6
	Doctorate	3	0.7
The length of Twitter use	Less than 6 months	62	15.4
	6 months to 1 year	139	34.5
	1 to 2 years	170	42.2
	2 years or more	32	7.9

The aim of the research is to analyze and evaluate the survey data looking for evidence of Twitter users' behavior changes by applying frameworks of evaluating persuasive systems [26, 27] and measuring the success of BCSSs [9] described in section 3. Behavior change may occur when one is being persuaded. Therefore, the intention is to look for inherent persuasion patterns in Twitter that persuade people to change their behavior, attitude, or both. Because behavior change takes time, the focus of the data analysis is to study relationships between the length of use of Twitter and responses to other survey questions. The survey results sufficiently cover all categories of users by their length of use of Twitter. See Table 1.

5.1 Followees and Followers

The results of the initial analysis validated existence of a relationship between Twitter users' period of use and their behavior change in several questions. The participants were asked about the number of people they followed and how many followers they had. The collected numbers were grouped according to the four types of users by their length of use. Table 2 shows the average number for each group that was calculated. The survey results show that the average number of followees and followers columns grows over time, but only their proportions change. The average number of followees (n=78) is larger than the number of followers (n=53) for less experienced users (less than 6 months). Slightly more experienced users (6 months to 1 year) on average have almost equal number of followees (n=155) and followers (n=160). The most experienced Twitter users (2 years or more) have half as many followees (n=296) as followers (n=590). *The average number of a user's followees and followers increases over time incrementally.*

Table 2. The relationship between the length of use and the average number of followees and followers

The length of use of Twitter	The average number of:	
	Followees	Followers
Less than 6 months	78	53
6 months to 1 year	155	160
1 to 2 years	212	295
2 years or more	296	590

Additional sophisticated data analysis was carried out with the SPSS software, which is one of the most widely used computer programs for statistical analysis in social sciences. Descriptive statistics were used, especially cross-tabulation, which is very popular in research related to surveys and represent the process of creating a contingency table from the multivariate frequency distribution of statistical variables.

5.2 Frequency of Tweeting

As one of the aspects that might contribute to behavior change while using Twitter is the frequency of posting tweets, it was studied with the following question, which starts with "You tweet…" and using a five-point scale, with the options "Do not tweet," "Once in several months," "Sometimes during the month," "Several times per week" and "Every day." Only 4.0% (n=16) of the responses were in the first two categories; therefore, the first three categories were combined under "Sometimes during the month and less." Consequently, the distribution of responses is located in cross-tabulation, where four rows represent the length of use starting with less experienced people and three columns representing their responses about the intensity of their tweeting starting with less intensive tweeters. The Pearson chi-square test was then used to assess the dependence of the column and row variables. The null hypothesis states there is no dependence between the length of use and the intensity of tweeting. According to cross-tabulation followed by a Pearson chi-square test, quite expectedly, there is a dependence showing that *the amount of tweeting increases over time* ($\chi 2(6)=18.059$, $p=0.006$).

This provides support for the presumption that experienced users tweet more than new users and this behavior develops incrementally. Especially, the growth in the percentage of respondents tweeting every day from each category of users by their length of use of Twitter: 27.4% (n=17) of new users (less than 6 months), 36.0% (n=50) of users using Twitter for more than 6 months and less than 1 year, 50.6% (n=86) of users with between 1 and 2 years of Twitter experience, and 59.4% (n=19) of the most experienced users (2 years or more) tweet every day. This example obviously shows the incremental nature of this process. It might seem obvious that the longer one has used Twitter the more often he or she tweets, but on the other hand, users may not increase their frequency of tweeting if Twitter was not constructed to be useful and easy to use. This reflects the main idea of the seventh postulate behind persuasive systems [26].

5.3 Content Generation

The results of the statistical analysis provide support for the existence of significant relationships between the duration of Twitter use and the behavior and/or attitude change of Twitter users in several questions. Content generation and management is one of the most interesting, because it may uncover how it changes the attitudes and behaviors of Twitter users while their experience of using Twitter is extended over a longer period. Respondents in relation to content generation and management were studied with the question that starts, "As a Twitter user, do you consider yourself a…" and using a four-point scale, with the options "Reader," "Retweeter" (reader, who also retweets), "Responder" (retweeter, who also replies and comments), and "Creator" (responder, who also generates new content). See Table 3 for cross-tabulation of the associated data.

Table 3. The relationship between the length of use and content generation in Twitter

How long have you been using Twitter?	As a Twitter user, you consider yourself a:			
	Reader	Retweeter	Responder	Creator
Less than 6 months	16.1% (n=10)	21.0% (n=13)	43.5% (n=27)	19.4% (n=12)
6 months to 1 year	8.6% (n=12)	14.4% (n=20)	43.2% (n=60)	33.8% (n=47)
1 to 2 years	4.1% (n=7)	9.4% (n=16)	47.6% (n=81)	38.8% (n=66)
2 years or more	6.3% (n=2)	9.4% (n=3)	21.9% (n=7)	62.5% (n=20)

As previously, the Pearson chi-square test was used to assess the dependence of the column and row variables. According to the cross-tabulation followed by a Pearson chi-square test, there is a dependence showing very clearly that *experienced users generate more content than new users* ($\chi2(9)=29.789$, $p=0.000$). Especially remarkable is the growth in the percentage of creators from each category of users by their length of use of Twitter. There are only 19.4% (n=12) creators among new users (less than 6 months), 33.8% (n=47) creators within users using Twitter more than 6 months and less than 1 year, 38.8% (n=66) creators of users with between 1 and 2 years of Twitter experience, and reaching 62.5% (n=20) creators among the most experienced users (2 years or more). To conclude, the results provide support for the assumption that the longer one uses Twitter, the more one's behavior regarding content generation changes. Persuaded incrementally, Twitter users become more responsive and more ready to generate new content.

Supplementary analysis was conducted to recognize the role of retweeters. Their character includes the activity of retweeting, which differentiates them from the passive group of users who only read. At the same time, retweeting does not generate any new content as well. The same content is just spread to a larger audience. In the first round, the relationship between readers and all other groups (retweeters, responders, creators) was investigated. According to cross-tabulation followed by a Pearson chi-square test, there is a relationship between readers and all other groups ($\chi2(3)=9.541$, $p=0.023$). In the second round, the relationship between the united group of readers and retweeters together and the united group of responders and creators together was studied. According to cross-tabulation followed by a Pearson chi-square test, there is a relationship between the group of readers and retweeters and the group of responders and creators ($\chi2(3)=16.497$, $p=0.001$). The p-value in the second round of analysis was noticeably smaller than in the first round. Thus, support is provided for the assumption that *retweeters are much closer in their use behavior to readers than to responders or creators*. Even though that retweet, as a mechanism, requires an action from the user, this activity may not contribute enough to content generation to be considered significant. The other assumption supported was that responders and creators might have similar characters. The only difference between creators and responders most likely is in creating new content instead of commenting and complementing the content received.

5.4 Credibility on Twitter

The credibility of web services is becoming an increasingly important area to understand [33]. Moreover, the credibility level of information in Twitter and overall trust in this service are essential for persuasion. The PSD model describes design principles for system credibility support, stating that the more credible systems are, the more persuasive they may become [26]. In this survey, the credibility was studied with the question, "In your opinion, what is the level of credibility on Twitter?" and using a five-point scale, with the options "No credibility," "Low," "Medium," "Medium high," and "High." Only 4.0% (n=16) of the responses were in the first two categories; therefore, the first two categories were combined under "Low." See Table 4.

Table 4. The relationship between the length of use and credibility on Twitter

How long have you been using Twitter?	In your opinion, what is the level of credibility on Twitter?			
	Low	Medium	Medium high	High
Less than 6 months	4.8% (n=3)	35.5% (n=22)	45.2% (n=28)	14.5% (n=9)
6 months to 1 year	3.6% (n=5)	41.0% (n=57)	43.2% (n=60)	12.2% (n=17)
1 to 2 years	1.8% (n=3)	30.0% (n=51)	50.6% (n=86)	17.6% (n=30)
2 years or more	15.6% (n=5)	25.0% (n=8)	53.1% (n=17)	6.3% (n=2)

The results from Pearson chi-square test uncover that *the longer one has used Twitter the higher the user's trust* ($\chi2(9)=21.130$, $p=0.012$). This provides support for the assumption that experienced users trust Twitter more than new users; thus, credibility is built incrementally. However, in future studies more attention should be paid to experienced users, such as those with at least 2 years' experience in this study, and also perhaps to even more experienced users as time goes on. The current data indicates a decrease in trust from 15.6% (n=15) who answered

"Low" to 6.3% (n=2) who answered "High." This deviation from overall tendency might be because of the comparably small total number of respondents in this group (2 years or more), which is 7.9% (n=32) out of all respondents (N=403), but at the same time this low proportion does not affect the overall dependency that was uncovered.

5.5 "Unwritten" Behavioral Rules

Another aspect of Twitter is simplicity in its structure compared to conventional online social networks, such as Facebook. The latter has a well-defined structure of elements that can be used and organized, and a set of rules that works throughout the service. In contrast, Twitter embodies a comparably small number of different options to be performed through the service. Therefore, it is interesting to investigate the following question: "Do there exist some communication and/or behavioral rules on Twitter, which are created by its users that need to be considered?" A three-point scale was used for answers: "No," "Hard to say," and "Yes." See Table 5 for cross-tabulation of the data.

Table 5. The relationship between the length of use and belief that there are "unwritten" communication and/or behavioral rules on Twitter

How long have you been using Twitter?	Do there exist some communication and/or behavioral rules on Twitter, which are created by its users that need to be considered?		
	No	Hard to say	Yes
Less than 6 months	16.1% (n=10)	64.5% (n=40)	19.4% (n=12)
6 months to 1 year	21.6% (n=30)	50.4% (n=70)	28.1% (n=39)
1 to 2 years	12.4% (n=21)	48.2% (n=82)	39.4% (n=67)
2 years or more	9.4% (n=3)	37.5% (n=12)	53.1% (n=17)

In this case, the Pearson chi-square test results reveal that *users learn over time "unwritten" communication and/or behavioral rules on Twitter* ($\chi 2(6)=19.064$, $p=0.004$). The tendency can be noted even by observing the growth in the percentage of "Yes" responses from each category of users by their length of use: only 19.4% (n=12) of new users (less than 6 months), 28.1% (n=39) of users with experience of more than 6 months and less than 1 year, 39.4% (n=67) of users with between 1 and 2 years of Twitter experience, and 53.1% (n=17) of the most experienced users (2 years or more).

These results provide support for the assumption that experienced users are more aware of the existence of communication and/or behavioral rules on Twitter, which are created by the users and need to be considered in such type of interaction. Most likely this starts with recognizing the rules, complying them with beliefs, changing one's behavior by following the rules, and finally appreciating them. A more detailed investigation of these persuasion patterns is a subject to further studies.

5.6 Call for Action Outside the Virtual World

The borderlines between virtual and real worlds are continuously converging, thus marking an important area for research. To investigate this interplay, the following question was asked: "Do you think Twitter is a powerful tool to call for action outside the virtual world?" A three-point scale was used for answers: "No," "Hard to say," and "Yes." See Table 6 for data cross-tabulation.

Table 6. The relationship between the length of use and the responses about the power of Twitter to call for action outside the virtual world

How long have you been using Twitter?	Do you think Twitter is a powerful tool to call for action outside the virtual world?		
	No	Hard to say	Yes
Less than 6 months	9.7% (n=6)	25.8% (n=16)	64.5% (n=40)
6 months to 1 year	8.6% (n=12)	19.4% (n=27)	71.9% (n=100)
1 to 2 years	3.5% (n=6)	11.2% (n=19)	83.5% (n=145)
2 years or more	15.6% (n=5)	9.4% (n=3)	75.0% (n=24)

From analysis of this question, the Pearson chi-square test results reveal that *Twitter is also powerful tool to call for action offline, i.e., outside the virtual world, and that experienced users are more ready to take action based on their communication via Twitter* ($\chi 2(6)=18.551$, $p=0.005$). This provides support for the assumption that experienced users are more responsive to taking actions in the real world after a call received on Twitter. The analysis seems to demonstrate that this change in attitude and behavior of Twitter users happens incrementally over time depending on the length of use. Twitter also provides a convenient mechanism for spreading the calls to action via retweeting.

6. DISCUSSION

The results from statistical analysis provide support that the behavior and attitude changes of Twitter users occur incrementally. The initial data analysis highlighted patterns of behavior change depending on how long Twitter was used, such as an increase in the average number of one's followees and followers, and the intensity of tweeting. Later, sophisticated data analysis revealed advanced patterns of behavior and attitude changes among Twitter users. To summarize key findings, the following general patterns can be observed from the survey responses: the longer Twitter is used, the more its users become content generators, the more they trust information on Twitter, the more they recognize "unwritten" communication and/or behavioral rules, and the more they consider Twitter a powerful tool to call for action outside the virtual world.

Theories from social and cognitive psychology may partially explain and support the findings of this study. For example, one reason Twitter users over time become more active content generators may be supported by the human capability for vicarious learning [34]. This implies that individuals learn not

only from their own experience but also by observing the behaviors of others. In this case, less experienced Twitter users may observe others posting tweets and learn from that. The corresponding design principle or persuasive software feature in this case is social learning [26] that belongs to the social influence category of the PSD model.

At the same time, social facilitation [26], another persuasive software feature from the same social influence category, may play a significant role in changing users' behavior toward more active content generation, because social facilitation examines behavior when it occurs in the presence of other people also engaged in the same activity [35]. The very same principle may well provide also support for the increased frequency of tweeting that was found to be more inherent for users with a longer experience in Twitter.

The finding about changes of more experienced users' attitudes toward increasing recognition of the existence of "unwritten" communication and/or behavior rules on Twitter might be supported by human capability for self-regulation [36]. This implies that people observe their own behavior, compare it with standards or norms, and then punish or reward themselves depending on the performance. Furthermore, in the focus theory of normative conduct [23], it has been emphasized that social norms play significant role in determination of human behavior. In this study, the results demonstrate that more experienced users have greater awareness of the norms that should be followed on Twitter. For such situation, the PSD model proposes a relevant design principle, namely, normative influence [26]. Previous research suggests that normative influence has a significant effect on people's attitudes [8]. Accordingly, this persuasive software feature may also underpin other altitudinal changes discovered with this survey, i.e., more experienced Twitter users have higher trust in information on Twitter and they consider Twitter a powerful tool to call for action outside the virtual world.

The remaining findings about increasing number of followees and followers for users with longer experience in Twitter at first may seem to be very obvious, but on the other hand this pattern may be a consequence of several social influence features inherent to Twitter service. Two counters representing a quantity of followees and followers for each user are displayed at their account. This provides opportunity for Twitter users to observe these counters, to compare them with counters of others, to seek for norms in such way, and to compete with others by boosting these counters. The aforementioned are reflections of four social influence features from the PSD model: social learning, social comparison, normative influence, and competition [26], accordingly. Earlier research on competition has distinguished it as one of influential intrinsic motivators that has persuasive powers to change people's behaviors and attitudes [37].

7. CONCLUSIONS

The main results from this study relate to incremental behavior changes among Twitter users. Findings revealed interrelationships among seven responses, thus providing support for the hypothesis that users are persuaded to change their behavior or attitude while using Twitter. The in-depth analysis of data unfolded six patterns of behavioral and attitudinal changes that occur in Twitter over time. These findings deliver the main idea of the fourth postulate of the PSD framework, which states that persuasion is often incremental. It implies that a persuasive system should enable making incremental steps toward the target behavior, and Twitter seems to follow this model in the areas covered in this survey.

Further, all of the main findings seem to demonstrate a presence of one or more social influence aspects in Twitter. Besides social learning that is enabled by the overall design of Twitter service, two findings on behavioral change have indicated a potential presence of social facilitation, then three findings on attitudinal change have indicated a potential presence of normative influence, and then the remaining finding have shown additional potential to comprise social comparison and competition aspects. It is important to investigate how social influence features form and alter user behaviors, because it helps advancing the design of future ISs.

The generalizability of the results is limited because the data was gathered in one country with a comparatively small population and a certain culture. Consequently, further research should examine the revealed persuasion patterns in other countries with different cultural settings or the study can be repeated after some time to test the reliability of current findings.

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