

Exploring Social Influence and Incremental Online Persuasion on Twitter: A Longitudinal Study

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Abstract. This paper outlines the second phase of an ongoing longitudinal research initiative aimed at exploring and describing why people use Twitter the way they do and what factors change their behaviors and attitudes over time. In a repeated online survey, 501 valid responses were collected from Twitter users. A comparative analysis of findings from both surveys verified persistent online persuasion patterns influencing both user behavior related to content generation and tweeting frequency, as well as user attitudes about Twitter being an influential tool to use in calling for action outside the virtual world. A comprehensive analysis of responses from 49 individuals who had participated in both surveys revealed underlying factors that had prompted changes in what they thought about Twitter, as well as their use behaviors. Further findings emphasized the role of social influence design principles and their capacity to explain changes that Twitter users had experienced over the period of two years.

Keywords. Twitter, online persuasion, social influence, design principles, user behavior, incremental, longitudinal.

1 Introduction

Online social networks increasingly change the ways in which people communicate, collaborate, consume, and create [2]. They transform the ways organizations manage their relationships with markets and societies, creating new possibilities and challenges for various aspects of business operations from traditional marketing and electronic commerce to more sophisticated participatory design and co-creation with customers. Such transformations increase the necessity for organizations to embrace new ways of maintaining customer relationships and monitoring their behaviors.

Research on social networks has been a rapidly growing area for many years. However, recently, it has experienced significant acceleration [2]. Studies have been carried out in various contexts, including business [27], health [29], education [17], disasters [7], and even revolutions [22]. Among other social networks, Twitter has demonstrated its relevance within an organizational context [14] because it enables the development of virtual customer environments, in which online interest groups can form around particular brands [10], thus facilitating the co-design of products.

Several studies have addressed the adoption [5] and continued usage [8] of Web 2.0, including Twitter. However a large part of existing research is focused on statistical descriptions of Twitter itself [4]. In addition to Twitter, studies that are simply based on extensive analyses of available log data [1], such as the content of tweets and other parameters, further attempt to explain the behaviors and attitudes of Twitter users are needed. According to Aral et al. [2], further research based on the recurrent metering of the attitudes and behaviors of Twitter users is necessary in order to study their dynamics and design social media strategies, especially those focusing on the individual level [2].

Therefore, this study outlines the second phase of an ongoing longitudinal research initiative aimed at exploring, understanding, and explaining why people use Twitter the way they do and what factors change their behaviors and attitudes over time. The motivation behind this phase was to discover the underlying factors and persuasive design principles that influence what people think about Twitter and their use behaviors. Ultimately, the aim was to uncover how social interactions on Twitter can influence peoples' behaviors and attitudes outside the virtual world. The research questions for this study were posed as follows:

RQ1: What types of persistent online persuasion patterns exist on Twitter that can change the behaviors and attitudes of users over time?

RQ2: What factors affect these changes and how they are interlinked on an individual level?

2 Background

Earlier research highlighted Twitter's ability to disseminate news and other information regarding both online trends and real-world events quickly and broadly [24]. Such online networking capabilities often facilitate the fast circulation of last-minute information, thus attracting considerable commercial and consumer interest. Thus, Twitter can be seen as an interesting channel via which companies can develop brands and improve their customer service [4]. The existing body of knowledge about Twitter contains various types of studies. A large part of it is based on descriptive and statistical research about this social network, such as the identification of different user types [18], social networks on Twitter [16], "retweeting" behaviors as conversational practice [6], and collaboration via Twitter [15]. Recent studies have been based on a partial least squares path modeling approach, which was intended to examine Twitter use [23] and use continuance [4] behaviors.

Social patterns observed on Twitter differ from known behaviors on other social networks [19]. This includes an asynchronous type of relationship between Twitter users, which permits them to select whom to follow without any obligation to be followed in return. This principle has liberated Twitter use behavior, thus making it less predictable than other social networks with synchronous types of relationships at the core of systems design. The major social interaction on Twitter is reading through an instantly updated feed of tweets, a chronologically ordered list of all messages openly posted by the users one is following. On the one hand, this seemingly light functionality may have simplified the user experience on this social network. On the other hand,

this may hinder the recognition of the actual behavioral patterns of Twitter users. Thus, studies are required to uncover all potentially hidden consequences of human behavior and social influence, e.g., the interest groups formed.

A myriad of studies related to online social networking have been conducted previously, but only very recently has an organizing framework for social media research been reported [2]. The underlying intention was to help scholars frame their research initiatives in a systematic way. The framework proposed a conceptualization of the social media landscape as an intersection of four types of activities that users or producers can undertake and three levels of analysis at which these activities can be investigated. According to the research questions stated earlier, the most relevant activity from the proposed framework was “design and features,” which is aimed at describing how consumers and organizations use or design specific social media features. On the level of “users and society,” this activity is focused on studying user interactions with specific features and the user behaviors affected by their design, while on the level of “platforms and intermediaries,” it concentrates on how these features can be designed to influence user behavior.

The functionality, design, and dynamic social processes govern how social networks affect the behaviors and attitudes of their users. For instance, organizations can create word-of-mouth peer influence and social contagion by designing features around their products [3]. Firms can also manage the strength of network effects by adjusting features embedded in software, together with appropriate network seeding [11]. Finally, users’ statuses, similarities, and desire to differentiate affect their content generation behavior [31].

3 Research Methodology

This study has a longitudinal character. The initial online survey of Twitter users was carried out in June of 2010 [26]. Two years later, for the purposes of the second phase of this ongoing longitudinal research initiative, the survey instrument was improved, and another survey was conducted in July of 2012. A link to the online survey was promoted via Twitter. Respondents who had reported their usernames in the first survey were invited to participate in the second with specially designed tweets containing their usernames. In the second round, 501 valid responses were collected. Based on the identical Twitter usernames, 49 respondents were identified to be the same in both surveys. The repeated survey mainly contained the same questions about the habits, thoughts, behaviors, and attitudes of Twitter users, but in the second round, specific questions aimed at measuring users’ attitudes toward the presence of social influence factors on Twitter were included. Particular questions were constructed to reveal persuasion patterns on Twitter, e.g., How long have you been using Twitter? How often do you tweet? What do you consider yourself on 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? Do some user-created communication and behavioral rules exist on Twitter? What is the level of credibility on Twitter?

The newly incorporated statements were designed to capture users' attitudes about social influence design principles [25] on Twitter. E.g., Twitter allows me to compare my behavior with other users (social comparison). There are norms on Twitter that should be followed by me (normative influence). I can discern other active users while using Twitter (social facilitation). I can cooperate with other users on Twitter (cooperation). I can compete with other users on Twitter (competition). Twitter users receive public recognition for their merits (recognition).

The sample from the second survey was very similar to the sample from the original survey in terms of gender, age, and education. The length of use naturally differed because two more years that has passed between both surveys. More descriptive statistics about the new sample are provided in Table 1, which also contains descriptive statistics for 49 repeated respondents.

Table 1. Descriptive statistics for the new sample of 501 total and 49 repeated respondents

		New sample		Repeated	
		N=501	%	N=49	%
Gender	Male	237	47.3	17	34.7
	Female	264	52.7	32	65.3
Age	Less than 20 years	68	13.6	5	10.2
	20 to 24 years	195	38.9	15	30.6
	25 to 29 years	112	22.4	14	28.6
	30 to 34 years	60	12.0	7	14.3
	35 to 39 years	33	6.6	4	8.2
	40 years or more	33	6.6	4	8.2
Education	Studies in school	49	9.8	4	8.2
	Secondary school	158	31.5	14	28.6
	Bachelor	198	39.5	22	44.9
	Master	95	19.0	9	18.4
	Doctoral	1	0.2	-	-
The length of Twitter use	Less than 6 month	23	4.6	-	-
	6 months to 1 year	50	10.0	-	-
	1 to 2 years	148	29.5	5	10.2
	2 to 3 years	187	37.3	23	46.9
	More than 3 years	93	18.6	21	42.9

4 Incremental Online Persuasion

The findings from the initial survey in 2010 revealed several incremental online persuasion patterns that influenced the behaviors and attitudes of Twitter users over time [26]. Before comparing the results from both surveys, the same analysis methods were applied to the dataset of the 501 newly gathered respondents. As previously, the data analysis was carried out with SPSS software, which is widely used for statistical analysis in the social sciences. Descriptive statistics were used, especially cross-tabulation,

which is the process of creating a contingency table from the multivariate frequency distribution of statistical variables. The results of the statistical data analysis provided support for the existence of significant relationships between the duration of Twitter use and behavior or attitude changes in Twitter users for several questions.

4.1 Content Generation on Twitter

The question about content generation behavior remained exactly the same as in the original survey [26], i.e., “As a Twitter user, do you consider yourself a...,” and the responses was measured using a four-point ordinal scale with the following response options: “Reader,” “Retweeter” (reader who also retweets), “Responder” (retweeter who also replies and comments), and “Generator” (responder who also generates new content). The Pearson chi-square test was used to assess the dependence of the column and row variables (Table 2).

Table 2. The relationship between length of use and content generation on Twitter

How long have you been using Twitter?	As a Twitter user, you consider yourself a:			
	Reader	Retweeter	Responder	Generator
Less than 6 month	17.4% (n=4)	39.1% (n=9)	30.4% (n=7)	13.0% (n=3)
6 months to 1 year	6.0% (n=3)	38.0% (n=19)	42.0% (n=21)	14.0% (n=7)
1 to 2 years	9.5% (n=14)	24.3% (n=36)	44.6% (n=66)	21.6% (n=32)
2 to 3 years	5.9% (n=11)	19.8% (n=37)	44.4% (n=83)	29.9% (n=56)
More than 3 years	3.2% (n=3)	14.0% (n=13)	40.9% (n=38)	41.9% (n=39)

According to the cross-tabulation, followed by a Pearson chi-square test, there was a dependent relationship showing very clearly that experienced users generate more content than new users ($\chi^2(12) = 34.569$, $p = .001$). Especially remarkable was the growth in the percentage of generators from each category of users according to their length of Twitter use. There were only 13.0% generators among new users (less than 6 months), 14.0% generators among slightly more experienced Twitter users (more than 6 months and less than 1 year), 21.6% generators among even more experienced users (between 1 and 2 years), 29.9% generators among users with Twitter experience between 2 and 3 years, and 41.9% generators among the most experienced group of Twitter users (3 years or more). To conclude, this finding provides additional support for a previously tested 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.

4.2 Frequency of Tweeting

Also, the question about the frequency of tweeting behavior remained exactly the same as in the original survey [26], i.e., “You tweet:,” but the responses were measured using a six-point ordinal scale (instead of the original five-point ordinal scale) with the following response options: “Do not tweet,” “Once in several months,”

“Sometimes during a month,” “Several times a week,” “Every day,” and “Several times a day.” The first five response options remained exactly the same as in the original survey. Only the sixth response option was added to the measurement scale for this question. Because only 5.2% of the responses were in the first two categories, the first three categories were combined under the name of “Sometimes during the month and less.” The Pearson chi-square test was used to assess the dependence between variables (Table 3). According to the cross-tabulation followed by a Pearson chi-square test, there was a dependent relationship emphasizing that the amount of tweeting has increased over time ($\chi^2(12) = 27.177, p = .007$).

Table 3. The relationship between length of use and frequency of tweeting

How long have you been using Twitter?	You tweet:			
	Sometimes a month or less	Several times a week	Every day	Several times a day
Less than 6 months	21.7% (n=5)	52.2% (n=12)	17.4% (n=4)	8.7% (n=2)
6 months to 1 year	34.0% (n=17)	38.0% (n=19)	16.0% (n=8)	12.0% (n=6)
1 to 2 years	20.3% (n=30)	44.6% (n=66)	18.9% (n=28)	16.2% (n=24)
2 to 3 years	16.6% (n=31)	32.1% (n=60)	23.0% (n=43)	28.3% (n=53)
More than 3 years	11.8% (n=11)	36.6% (n=34)	22.6% (n=21)	29.0% (n=27)

This provides support for the presumption that experienced users tweet more than new users and that this behavior develops incrementally. Especially significant growth was seen in the percentage of respondents tweeting several times a day from each category of users according to their length of Twitter use: 8.7% of new users (less than 6 months), 12.0% of users using Twitter for more than 6 months and less than 1 year, 16.2% of users with Twitter experience between 1 and 2 years, 28.3% of users with Twitter experience between 2 and 3 years, and 29.0% of the most experienced users (3 years or more) tweeted several times a day. Similarly to the finding from the initial survey [26], this result obviously contributed to the persistent incremental nature of this behavior.

4.3 Call for Action Outside the Virtual World

The borderlines between the virtual and real worlds are continuously converging. To investigate this interplay, exactly the same question was asked in the second survey as in the first [26]: “Do you think Twitter is a powerful tool to call for action outside the virtual world?” However, in the second survey, a seven-point scale was used for measuring the responses: “Strongly disagree,” “Disagree,” “Somewhat disagree,” “Undecided,” “Somewhat agree,” “Agree,” and “Strongly agree.” In order to exclude cells with expected counts less than the required minimum for the Pearson chi-square test, the first three responses were combined under “Disagree,” and last two responses were combined under “Agree” (Table 4). The Pearson chi-square test results reveal that Twitter has been perceived by respondents as an influential tool to call for action offline, i.e., outside of the virtual world, and that experienced users were more ready

to take action based on their communication via Twitter ($\chi^2(12) = 25.352, p = .013$) than other users. Again, this provides additional support for the previously tested assumption that experienced users are more responsive to taking action in the real world after receiving a call to action on Twitter. The analysis seems to demonstrate that this change in the attitude and behavior of Twitter users happens incrementally over time depending on the length of Twitter use. In addition, Twitter also provides a convenient mechanism for spreading calls to action via retweeting.

Table 4. The relationship between length of use and reported attitude regarding whether Twitter is an influential tool to call for action outside the virtual world

How long have you been using Twitter?	Do you think that Twitter is an influential tool to call for action outside the virtual world?			
	Disagree	Undecided	Somewhat agree	Agree
Less than 6 month	8.7% (n=2)	21.7% (n=5)	39.1% (n=9)	30.4% (n=7)
6 months to 1 year	10.0% (n=5)	4.0% (n=2)	52.0% (n=26)	34.0% (n=17)
1 to 2 years	10.1% (n=15)	8.1% (n=12)	43.9% (n=65)	37.8% (n=56)
2 to 3 years	5.3% (n=10)	3.7% (n=7)	36.4% (n=68)	54.5% (n=102)
More than 3 years	7.5% (n=7)	6.5% (n=6)	43.0% (n=40)	43.0% (n=40)

4.4 Summarized Results from Both Surveys

In Table 5, the key findings from both surveys are summarized. They explicitly emphasize persistent incremental online persuasion patterns on Twitter that can affect user behaviors or attitudes. Thus, these findings provide an answer to research question RQ1.

Table 5. Incremental online persuasion patterns on Twitter [26]

How long have you been using Twitter?	Year 2010 (N=403)	Year 2012 (N=501)
Content generation behavior	$\chi^2(9)=29.789, p=.000$	$\chi^2(12)=34.569, p=.001$
Frequency of tweeting behavior	$\chi^2(6)=18.059, p=.006$	$\chi^2(12)=27.177, p=.007$
Attitude about Twitter being influential	$\chi^2(6)=18.551, p=.005$	$\chi^2(12)=25.352, p=.013$

5 Factors Influencing User Behavior and Attitude on Twitter

In order to find answers to research question RQ2, the sample of 49 repeated respondents was examined. It provided an excellent opportunity for a comprehensive data analysis regarding changes in the behaviors and attitudes of Twitter users on an individual level. Before carrying out the following analysis with repeated respondents, first, it was ensured that the variables and their measurement scales were consistent across both years. Second, for each original variable, two new variables were created, one that implied a general change in an attitude or behavior over time and another that implied a more detailed change in an attitude or behavior over time. For example, when the variable measuring content generation behavior on Twitter is examined, for

each respondent, this variable had two measures, one from the year 2010 and another from the year 2012. To record the change in this behavior over time, a new variable (CONT³) was created. Then, for each of the 49 respondents, their change in terms of this particular behavior was coded into a measurement scale with three categories: behavior decreased (1), remained the same (2), or increased (3) over time. To record more a detailed change in the same behavior over time, an additional variable (CONT⁵) was created. Then, again, for each of the 49 respondents, their change in this particular behavior was coded into a five-point measurement scale: behavior decreased more than one step (1), behavior decreased only one step (2), behavior remained the same (3), behavior increased one step (4), or behavior increased more than one step (5) over time. This was done for all repeated variables.

All other variables used in the following analysis were collected only during the second survey, and they were measured on the following seven-point scale: “Strongly disagree,” “Disagree,” “Somewhat disagree,” “Undecided,” “Somewhat agree,” “Agree,” and “Strongly agree.”

5.1 Analysis of Variance

The dataset containing the 49 repeated respondents was examined with a one-way analysis of variance (ANOVA), which has typically been used to determine significant differences between the means of three or more independent groups. Also, post-hoc testing was done to compare multiple groups. Both Fisher’s LSD (least significant difference) and Tukey’s HSD (honestly significant difference) post-hoc tests are commonly accepted among statisticians, and the logic behind them is the same. However, Tukey’s HSD post-hoc test can be used only when sample sizes are equal, which is not true in the design of this research. Therefore, Fisher’s LSD post-hoc test was selected to determine significant differences between the means of the paired groups.

It was consistently ensured that the data met all six assumptions that should be tested before and while running the one-way ANOVA. It was ensured that all independent variables consisted of three categorical, independent groups; all observations were independent; there were no significant outliers; there was homogeneity of variances; all dependent variables were measured at interval level; and they were approximately normally distributed for each category of the related independent variable. The assumption of homogeneity of variance was tested using Levene’s test, which provides an F statistic and a significance value (p value). When the data failed to meet the homogeneity of variances assumption ($p < .05$), a Welch ANOVA was carried out instead of a one-way ANOVA, and a Games-Howell post-hoc test was carried out instead of a Fisher’s LSD post-hoc test.

The following subsections provide the analysis of Twitter users grouped by changes in their behaviors and attitudes that they had reported at both measurement time points, i.e., whether their reported behavior or attitude had decreased, remained the same, or increased over time. The comparisons of these groups were performed based on their scores for various factors measured in this study. The objective was to reveal significant differences between groups and to uncover the percentage of variance explained (R^2) by other factors in a particular behavior or attitude change.

5.2 User Behavior Associated with Content Generation on Twitter

The differences between groups of Twitter users were studied based on changes in their behaviors associated with content generation (CONT³), i.e., whether their specific behaviors had decreased, remained the same, or increased over time (Table 6).

First, the comparison of the aforementioned groups revealed that the frequency of tweeting (FREQ⁵) was significantly increased for Twitter users who reported an increase in content generation behavior. Second, the comparison of the same groups revealed that the attitude change associated with credibility on Twitter (CRED⁵) was significantly increased for Twitter users who reported increased, rather than decreased, content generation behavior.

Table 6. Content generation behavior on Twitter (CONT³)

	Levene's	ANOVA	Decreased	Remained	Increased	p	R ²
FREQ ⁵	2.5 (.093)	3.1 (.053)		2.83±0.53	3.44±0.88	.017*	12%
CRED ⁵	2.9 (.064)	5.1 (.010)	2.60±0.52		3.89±1.17	.003**	18%
INFL ⁵	1.8 (.164)	4.3 (.019)	2.70±0.67	3.27±0.52		.005**	16%
SC	4.7 (.014)	5.9 (.009)	5.60±0.70	4.40±1.61		.007**	11%
NI	4.5 (.016)	4.9 (.019)		4.70±1.75	5.78±0.83	.042*	9%
SF	1.8 (.172)	2.2 (.124)	5.80±0.92		4.56±1.67	.043*	9%

Levene's test and ANOVA results are reported as: F statistic (p value)
 Post-hoc test results are in columns: Decreased, Remained, Increased
 Significance values of post-hoc test results are in columns: p ** < .01, p * < .05

Third, the comparison of the groups revealed that the attitude change regarding whether Twitter is an influential tool to call for action outside the virtual world (INFL⁵) was significantly increased for Twitter users who reported the same or decreased content generation behavior. Fourth, the comparison of the groups based on their reported attitude at the second measurement point regarding whether Twitter allows them to compare their behaviors with those of other users (SC) revealed that this attitude was significantly increased for Twitter users who reported decreased, rather than the same, content generation behavior.

Fifth, the comparison of the groups based on their reported attitude in the second measurement point regarding whether there are norms on Twitter that should be followed (NI) revealed that this attitude was significantly increased for Twitter users who reported an increased, rather than the same, content generation behavior. Sixth, the comparison of the groups based on their reported attitudes at the second measurement point regarding whether they can discern other active users on Twitter (SF) revealed that this attitude was significantly increased for Twitter users who reported decreased, rather than increased, content generation behavior.

5.3 User Behavior Associated with Frequency of Tweeting

The differences between groups of Twitter users were studied based on their changes in behavior associated with the frequency of tweeting (FREQ³), i.e., whether their

behaviors had decreased, remained the same, or increased over time (Table 7). First, the comparison of the abovementioned groups revealed that the view that followers form interest groups on Twitter (GROU³) was significantly increased for Twitter users who reported an increased, rather than a decreased, frequency of tweeting. Second, the comparison of the same groups based on their reported attitude at the second measurement point regarding whether they can cooperate with other users on Twitter (CR) revealed that this attitude was significantly increased for Twitter users who reported the same, rather than a decreased, frequency of tweeting.

Table 7. Frequency of tweeting (FREQ³)

	Levene's	ANOVA	Decreased	Remained	Increased	p	R ²
GROU ³	0.5 (.584)	3.1 (.057)	2.82±0.98		3.88±0.99	.018*	12%
CR	0.2 (.860)	3.8 (.030)	5.09±1.14	6.00±0.91		.010*	14%
RE	6.2 (.004)	8.3 (.002)	2.82±1.25		4.50±0.53	.003**	16%
FUTU	1.8 (.172)	2.2 (.124)	6.27±0.65	6.73±0.45		.014*	13%

Third, the comparison of the groups based on their reported attitude at the second measurement point regarding whether Twitter users receive public recognition for their merits (RE) revealed that this attitude was significantly increased for Twitter users who reported an increased, rather than a decreased, frequency of tweeting. Fourth, the comparison the same groups based on their reported attitude at the second measurement point regarding whether they will use Twitter hereafter (FUTU) revealed that this attitude was significantly increased for Twitter users who reported the same, rather than a decreased, frequency of tweeting behavior.

5.4 User Attitude Associated with Interest Groups on Twitter

The differences between groups of Twitter users were studied based on their attitude changes regarding whether followers form interest groups on Twitter (GROU³), i.e., whether their attitude regarding this being true had decreased, remained the same, or increased over time. First, the comparison of the aforementioned groups revealed that the attitude changes regarding whether there are unwritten behavioral and communication rules on Twitter (RULE⁵) were significantly increased for Twitter users who reported an increased, rather than the same, attitude regarding whether followers form groups of interests on Twitter (Table 8). Second, the comparison of the same groups based on their reported attitude at the second measurement point regarding whether they can compete with other users on Twitter (CT) revealed that this attitude was significantly increased for Twitter users who reported an increased, rather than the same, attitude regarding whether followers form interest groups on Twitter.

Table 8. Attitude associated with interest groups on Twitter (GROU³)

	Levene's	ANOVA	Decreased	Remained	Increased	p	R ²
RULE ⁵	0.9 (.410)	3.5 (.040)		2.48±0.87	3.21±0.89	.018*	13%
CT	3.2 (.049)	6.1 (.011)		3.26±1.80	5.36±1.39	.004**	20%

5.5 User Attitude Associated with Credibility on Twitter

The differences between groups of Twitter users were studied based on their attitude changes associated with credibility on Twitter (CRED³), i.e., whether their specific attitudes had decreased, remained the same, or increased over time (Table 9).

Table 9. Attitude associated with credibility on Twitter (CRED³)

	Levene's	ANOVA	Decreased	Remained	Increased	p	R ²
RULE ⁵	2.1 (.138)	3.5 (.038)	3.23±0.72	2.38±1.02		.012*	13%

The comparison of these groups revealed that the attitude change regarding whether there are unwritten behavioral and communication rules on Twitter (RULE⁵) was significantly increased for Twitter users who reported a decreased, rather than the same, attitude regarding credibility on Twitter.

6 Discussion and Contribution

In the current study, the factors affecting users' behaviors and attitudes on Twitter were explored, focusing on incremental online persuasion patterns, interrelating factors, and social influence design principles [25]. Initially, two behaviors and one attitude of Twitter users were found that changed along with the length of Twitter use. These findings revealed the same online persuasion patterns that were discovered in the initial study two years earlier [26]. Thus, this study provided additional support for the presence of these patterns on Twitter.

Two patterns indicated that both users' content generation and tweeting frequency behaviors were significantly associated with their length of Twitter use. Respondents with longer Twitter experiences reported stronger confidence in being real content generators and more frequent tweeters. Zeng and Wei [31] have described user-generated content as the lifeblood of social networks. Similarly, organizations can benefit from engaging customers in content-generation behaviors [21]. At the same time, they can expect incremental social networking activity from users with longer experiences on Twitter. In particular, users' behaviors associated with tweeting frequency can serve as content relevance indicators for organizations [28]. Finally, organizations can target more experienced Twitter users to facilitate the adoption of a product, service, or opinion [12]. The third pattern indicated that users with more experience on Twitter had stronger attitudes regarding this social network being influential in terms of calls for action outside the virtual world. This finding demonstrated that there is evidence for a significant link between such attitudes among more experienced Twitter users and their potential behaviors in the real world. Marketers can differentiate the way they approach this group to increase the effectiveness of future campaigns. Inside organizations, such people can play key roles in accelerating organizational changes, including the adoption and use of novel information systems and mobile applications.

To reveal the factors behind these patterns and changes in users' behaviors and attitudes, a comprehensive analysis was conducted that produced many interesting and relevant findings. First, it was found that changes in content generation behavior were influenced by six factors: one behavioral factor, changes in tweeting frequency; two attitudinal factors, changes in Twitter credibility and shifts in opinions about Twitter being an influential tool in terms of calls for action outside the virtual world; and three social influence factors, namely social comparison, normative influence, and social facilitation. Second, it was found that changes in tweeting frequency were influenced by four factors: two attitudinal factors, namely intentions to use Twitter in the future and shifts in opinions regarding interest groups on Twitter, and two social influence factors, namely cooperation and recognition. Third, it was found that changes in respondents' attitudes about interest groups on Twitter were influenced by shifts in their opinions about unwritten behavioral and communication rules on Twitter, as well as the social influence factor of competition. Finally, it was found that changes in respondents' attitudes about Twitter's credibility were influenced by shifts in their opinions about unwritten behavioral and communication rules on Twitter.

There were found two types of relationships between factors: those that maintained a change with the same direction for both related factors, e.g. if one factor increased, then the other increased as well, and those that had changes with opposite directions, e.g., if one factor increased, then the other factor decreased. This principle was applied to only those groups in each factor that revealed significant differences between two groups in terms of the dependent variables. Almost all the discovered relationships implied unidirectional changes, with the exception of the following three: (1) the relationship between attitudes about credibility and unwritten behavioral rules on Twitter, and (2) the relationship between content generation behavior and social comparison, and (3) that between content generation and social facilitation.

Especially interesting were the findings that revealed significant differences between neighboring groups, such as decreased-remained and remained-increased, rather than the maximum-distance relationships of the decreased-increased differences. Consequently, the relationship between attitudes about credibility and unwritten behavioral rules has revealed that Twitter users who thought that Twitter was less credible after two years had stronger opinions about the presence of unwritten behavioral and communication rules on Twitter than those that did not change their opinion about credibility over that time period. Similarly, those respondents who decreased their content generation behavior over the two years had stronger opinions about the presence of social comparison on Twitter than those who did not change their content-generation behaviors.

Finally, the same respondents also had stronger opinions about the presence of social facilitation on Twitter than those who increased their content generation behavior. These findings have shown a potential negative effect for social comparison and social facilitation on content generation behaviors. The effect of social comparison can be partially explained by a human tendency to compare themselves with others when social norms are not available [13]. However, social facilitation typically has a negative effect when complicated tasks are performed [30]. Those respondents who increased their content generation behavior over two years also expressed stronger

opinions about the presence of normative influence on Twitter than those who did not change their content generation behavior. Humans tend to seek norms and follow them [9].

Twitter users who decreased their tweeting frequency over the two years also scored lower regarding the presence of cooperation on Twitter than those who did not change their tweeting frequency behaviors. Those respondents who increased their tweeting frequency over the two years also scored higher regarding the presence of recognition on Twitter than those who decreased their tweeting frequency. Finally, Twitter users who came to agree with the view that interest groups exist on Twitter over the two years also scored higher regarding the presence of competition on Twitter than those that did not change their attitudes regarding interest groups on Twitter. These aforementioned social influence principles, namely cooperation, competition, and recognition, have been described as interpersonal motivating factors. The first two are driven by the human tendency to cooperate and compete, but the latter reflects people's enjoyment of having their accomplishments recognized and appreciated by others [20].

7 Conclusions

During this second phase of an ongoing longitudinal research initiative, the initial survey [26] instrument was improved, and another online survey was conducted to collect data about the behaviors and attitudes of Twitter users. Altogether, 501 responses were collected, of which 49 were identified as repeated respondents at both measurement times. Within the full sample, significant evidence was found for three incremental online persuasion patterns that persisted on Twitter over a period of two years. Then, within the smaller sample, factors were found that influence these patterns and other opinions about Twitter and were measured.

Although this research has highlighted several notable findings, some limitations should be acknowledged. Both of the surveys were carried out in Latvia, so cultural factors might limit the generalizability of findings. Both samples were similar in terms of their characteristics and sufficient in terms of their size, but larger samples containing more respondents with shorter experiences on Twitter, especially those containing older age groups, would strengthen the results of such a study.

In conclusion, this study has provided valuable and interesting findings that can be used as building blocks for further studies related to online persuasion techniques, incremental behavior change patterns in social networks, interrelated attitudinal changes on Twitter, and the effects of social influence design principles [25] on users of information systems. In particular, some of the preliminary data analysis results indicated a potential interplay between social influence factors on Twitter. This provides relevant insights for the next phase of this longitudinal research initiative. For practitioners, these findings could be instrumental in harnessing social influence through online social networks, outlining social media strategies for online persuasion, and designing socially influencing systems.

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