Computer Communications 000 (2015) 1–5

Contents lists available at ScienceDirect

Computer Communications

journal homepage: www.elsevier.com/locate/comcom

Social exchange in online social networks. The reciprocity phenomenon on Facebook

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ARTICLE INFO

Article history:
Available online xxx

Keywords:
Online social networks
Social exchange
Reciprocity
Online behavior

ABSTRACT

Social exchange theory proposes that social behavior is the result of an exchange process. The purpose of this exchange is to maximize benefits and minimize costs. Online social networks seem to be an ideal platform for social exchange because they provide an opportunity to keep social relations with a relatively low cost compared to offline relations. This theory was verified positively many times for offline social interactions, and we decided to examine whether this theory may be also applied to online social networks. Our research is focused on reciprocity, which is crucial for social exchanges because humans keep score, assign meaning to exchanges, and change their subsequent interactions based on a reciprocity balance. The online social network platform of our choice was Facebook, which is one of the most successful online social sites allowing users to interact with their friends and acquaintances. In our study we found strong empirical evidence that an increase in the number of reciprocity messages the actor broadcasts in online social networks increases the reciprocity reactions from his or her audience. This finding allowed for positive verification of the social exchange theory in online communities. Hence, it can be stated that our work contributes to theories of exchange patterns in online social networks.

1. Introduction

The focus of this paper is on dyadic exchange in online social networks, based on the social exchange theory. One of the core concepts of network exchange theories [29,33] is the primacy of reciprocation. According to this theory, reciprocity is a behavioral response to perceived kindness and unkindness, where kindness comprises both distributional fairness as well as fairness intentions. There is a large body of evidence which indicates that reciprocity is a powerful determinant of human behavior. Experiments and questionnaire studies performed by psychologists and economists, as well as an impressive literature in sociology, ethnology and anthropology, emphasize the omnipresence of reciprocal behavior (see, e.g., [19,27]). In our study, we apply the core concepts of organizational network research [29] to investigate interaction dynamics of long-duration online social networks. Kilduff et al. define a core of key idea that we adopt in this research: the primacy of relationships. We theorize and empirically measure the communication patterns of online social networks using Facebook as a platform for our research.

This paper is organized as follows: in the subsequent section we present related works. Section 3 introduces theory description and research hypothesis. Section 4 contains the experimental part, including research settings and the description of variables. Section 5 discusses the regression models and final results. Section 6 concludes and discusses our experimental findings, ending with a short overview of the potential applications.

2. Related work

Becker [3] asserts that a fundamental virtue represents a trait that is necessary for a rational agent, one who is capable of reasoned choices, to have to achieve excellence in moral behavior. Reciprocity is an avenue to a number of these traits, known as “primary goods”. A primary good is defined as “a state or object, or disposition that is necessary to the conduct of rational agents—that is, to deliberation and choice, or to goal satisfaction per se” [3]. In the sociological literature there is a strong empirical evidence in support of the existence of reciprocity as a norm applicable to all of society [4,13,21]. Its universality is predicated on the assumption that social life operates within a paradigm of exchange. Norms are expectations about behavior that are at least partially shared by a group of decision makers [22].

In the studies associated with the game theory, the reciprocity phenomenon was under close investigation. Falk and Fischbacher [15] present a formal theory of reciprocity, which takes into account that people evaluate the kindness of an action not only by its consequences but also by its underlying intention. The theory is in line with the relevant stylized facts of a wide range of experimental games. Dufwenberg and Kirchsteiger [12] developed a theory of reciprocity

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http://dx.doi.org/10.1016/j.comcom.2015.06.017
0140-3664/

for extensive games in which the sequential structure of a strategic situation is made explicit, and proposed a new solution concept which is sequential reciprocity equilibrium. Wang et al. [37] study the outcome of the public goods game on two interdependent networks that are connected by means of a utility function, which determines how payoffs on both networks jointly influence the success of players in each individual network. They show that an unbiased coupling allows the spontaneous emergence of interdependent network reciprocity, which is capable to maintain healthy levels of public cooperation even in extremely adverse conditions. The comprehensive review of management and economical research on reciprocity is presented in [20].

Currently, there is a significant stream of research based on social networks and online social networks. Rice [35] also found support for direct reciprocity in a study of 24 months of computer conference system use among 10 groups involving over 87,000 total network links. The problem of reciprocity prediction was studied by Cheng et al. [9]. They extract a network based on directed @-messages sent between users on Twitter, and they find that differences in reciprocity can be related to the notion of status. People with similar status often participate in reciprocated interactions (e.g. messages between friends), while those with disparate status often participate in unreciprocated interactions (e.g. messages from fans to celebrities). Leider et al. [31] conducted online field experiments in large real-world social networks in order to investigate altruism and reciprocity behavior. The experimental findings suggest that future interaction affects giving through a repeated game mechanism where agents can be rewarded for granting efficiency-enhancing favors. They also found that subjects with higher baseline altruism have friends with higher baseline altruism. Online social network participation is a social phenomenon, and as in any endeavor governed by human behavioral patterns, we expect participants in online communities to exhibit nonrandom, intentional communication choices. Previous research has found that individuals share their knowledge in online communities because they want to interact with others and exchange knowledge [28,39]. Their actions are influenced by both utilitarian and social influence motivations [24]. A number of individual factors leading to increased participation have been identified: functional role [1], self-interest [23], boundary-spanning roles [18], trust [25], reputation [10], and finally reciprocity ([8,16]), which is related to our research. Chao-Min et al. [8] research holds the facets of the social capital theory like social ties, trust, reciprocity, and identification will influence individuals' knowledge sharing in virtual communities. On other hand Faraj and Johnson [16] research is based on social exchange theory. They discovered that exchange patterns in online community communication networks are characterized by direct and indirect reciprocity patterns.

The reciprocity oriented research has emerged recently on Facebook. In the survey based study Jung et al. [26] were trying to capture relation between participants' propensity to perform signals of relational investment and number of responses to a favor request. Ellison et al. [14] study explores the relationship between perceived bridging social capital and specific Facebook-enabled communication behaviors. According to this study bridging social capital individuals must engage in intentional behaviors that signal attention to components of their network and contribute to expectations of reciprocity.

3. Theory

Social exchange theory proposes that social behavior is the result of an exchange process [21]. The purpose of this exchange is to maximize benefits and minimize costs. According to this theory, people weigh the potential benefits and risks of social relationships. When the risks outweigh the rewards, people will terminate or abandon that relationship. In economics it means minimizing transactions costs and thereby increases adaptability and economic stability [4]. People develop patterns of exchange to cope with power differentials and to deal with the costs associated with exercising power [42]. One of the crucial patterns is reciprocity [17]. The process begins when at least one participant makes a "move," and if the other reciprocates, new rounds of exchange initiate. Once the process is in motion, each consequence can create a self-reinforcing cycle [7]. Reciprocity is crucial for all exchanges because humans keep score, assign meaning to exchanges, and change their subsequent interactions based on a reciprocity balance [13].

Online social networks provide forums for information exchange in open communication networks. Social exchange theory grew out of attempts to formalize the study of interpersonal relations and "social processes such as power and the exercise of influence" (Cook and Rice [11]). A key development in social exchange theory was the incorporation of a network perspective with the view that exchange relations form network structures (Cook and Rice [11]). In order to support development of a general "structural theory of power and dependence in networks" [6], network exchange theory complements social exchange theory through formal investigation of individual and group behaviors in networks. According to Faraj and Johnson [16] online communities are built on the dual aspect of online interactions: they are social exchanges that take place between participants but they occur within a network context. With a focus primarily on individual position in the network and availability of alternative ties among actors, network exchange theorists have used this approach to study the status and relative power of individuals in a network [32,38,40].

In online social networks, social exchange is based on written and graphical communication between users. Before we relate our hypothesis directly to the reciprocity we should understand the interactions between users. It seems to be obvious that reactions from audience should be positively related to the strength of the actor broadcasting activity. According to Amichai-Hamburger and Vinitzky [2] most online social networks users were happy to put on public exhibition a broad range of photos, including those sent to them by others, mostly of themselves in the context of their friends and mostly showing happiness and enjoyment. In an experimental study Tong et al. [36] examined the relationship between the number of friends a Facebook profile featured and observers' ratings of attractiveness and extraversion. A curvilinear effect of popularity and social attractiveness emerged, as did a quartic relationship between friend count and perceived extraversion. Thus, we suggest the following hypothesis:

Hypothesis 1. *An increase in the number of messages the actor broadcasts increases the reactions from his or her audience.*

According to social exchange theory the relationship described by the first hypothesis should be the same and even stronger if there exists a self-reinforcing cycle based on the phenomenon of reciprocity between online social network members. In this context actors are able to easily gain benefits from online relations (for instance to strength friendship), keeping a relatively low cost of online communication. We therefore propose:

Hypothesis 2. *An increase in the number of reciprocity messages the actor broadcasts increases the reciprocity reactions from his or her audience.*

The second hypothesis is referring directly to the research on direct reciprocity in on-line communities [16]. Our study is not only confirming their discovery but showing that concept of the reciprocity-based interactions is much broader. Facebook social network is based basically on the friendship relationship, so rational for reciprocity is social-based, meaning that people mainly would like to create or enhance relationships [34]. In contrast software knowledge networks for professionals (very often anonymous for each other) are focusing on knowledge exchange. In this context our study shows

Please cite this article as: J. Surma, Social exchange in online social networks. The reciprocity phenomenon on Facebook, Computer Communications (2015), http://dx.doi.org/10.1016/j.comcom.2015.06.017

reciprocity from different perspective and proving that this concept is much more general and complex.

4. Method

4.1. The research settings and data collection

Facebook.com is the second most-trafficked website in the world with more than 1 billion active users, and about 50% of active users logging on to Facebook in any given day. Launched in February 2004, Facebook is made up of core site functions and applications. Fundamental features include a person's newsfeed which is a personalized feed of his or her friends' updates. Facebook requires the user to identify themselves with their real names and then allows users to publicly articulate their relationships with others. The profile displays information about the individual he or she has chosen to share, including interests, education and work background, and contact information. Facebook also includes core applications—photos, events, videos, groups, and pages—that let people connect and share in rich and engaging ways. People can communicate directly with each other through chat, messages, likes, comments, and indirectly through wall posts, status updates on the news feed. Actually which content is shown or omitted in the news feed is determined via a ranking algorithm that Facebook continually develops [30]. Additionally, Facebook users have a comprehensive control over the profile visibility and on-line activity.

It is worth mentioning that Facebook become a great laboratory for empirical based research. This is especially important in social sciences in which very often research is based on the self-report rather than natural observation. Bond et al. [5] report research based on a randomized controlled trial ($N = 61{,}000{,}000$). The results show that the messages directly influence political self-expression and real world voting behavior of millions of people. Kramer et al. [30] in a massive ($N = 689{,}003$) experiment show that emotional states can be transferred to others via emotional contagion. The comprehensive review of Facebook research in the social sciences is given by Wilson et al. [41].

The mentioned large scale experiments were possible due to involvement of the Data Science Facebook team that has open and direct access to the Facebook databases. In our study we had much more restricted access to the Facebook data. We tested our hypotheses in the context of this most successful online social platform allowing users to interact with their friends and acquaintances. Upon posting and defining the intended audience, Facebook displays the content to the audience using the News Feed. Users in the intended audience can then click on a link below the post to signify that they "like" it, or they can offer written comments on the posted content. Both the "likes" and the comments are visible to the original poster, as well as to all the other users who can see the original post. To collect data on user behaviors on Facebook, we sought to collect a sample of undergraduate students at a prominent university in Warsaw, Poland. In the spring of 2011 we advertised the project via e-mail, newsletter and student newspapers, describing the project, and asking students to participate in the research study. No course credit was given and students were not compensated for the study. We did, however, offer a free participation in the workshop on social media in business applications. We created a project website which described the project in complete detail, informing the students that we would collect the information on who they were friends with on Facebook, their Facebook status updates, photos, links and videos, comments and likes given to those updates, as well as their usage of the friend list feature. If a student consented to the data transfer, we used the Facebook Advanced Programming Interface to acquire the data (Graph API Protocol). The Graph API presents a simple, consistent view of the Facebook social graph, uniformly representing objects in the graph (e.g., people, photos, events, and pages) and the connections between them (e.g., friend relationships, shared content, and photo tags). Every object in the social graph has a unique identifier. As soon as we received the data, we anonymized it and stored it on a secure server to protect student data confidentiality. Overall, 392 students gave us access to their data. Our research sample was distributed between 221 women and 171 men. The data presented in this study were collected between May 30, 2011 and July 29, 2013 (in total 112 weeks).

Table 1
Descriptive statistics.

Variable	Mean	Std. dev.	Skewness	Kurtosis
Reciprocity Likes Received	29.569	51.497	4.824	39.133
Likes Sent	231.916	300.171	2.984	14.998
Reciprocity Likes Sent	38.176	76.739	5.987	55.328
Gender (woman = 1)	.564	.497	–.257	1.066
Age	25.240	8.613	6.341	55.259
Posts Sent	416.393	661.073	3.434	19.102
Comments Received	272.460	405.446	3.630	21.337
Likes Received	414.745	536.734	2.670	13.139
Friends	315.574	207.795	1.153	4.741

4.2. Dependent and independent variables

We captured reciprocity effect by our key dependent variable *Reciprocity Likes Received* to count the "likes" the user received from friends under condition that earlier this user gave at least one "like" to those friends. In other words this variable is counting the total number of reciprocity based "likes" per user received from all his/her friends. Additionally, we defined *Likes Received* to be the total number of "likes" that user received on all of the content he or she posted. We defined two independent variables. The first *Reciprocity Likes Sent* to count the "likes" the user gave his or her friends under condition that earlier this user received at least one "like" from those friends, and the second *Likes Sent* to count the "likes" the user sent to his or her friends. In order to avoid any misinterpretation, we counted "like" as a reciprocity one only if a time period from previous activity (giving or receiving at least one "like" respectively for *Reciprocity Likes Received* and *Reciprocity Likes Sent*) was not longer than 1 week.

4.3. Control variables

We included two control variables that represent the user: demographics and activity. Firstly, we controlled for user demographics data by including a binary variable *Gender* and an interval variable *Age* measured in years. Secondly, we controlled user activity by *Posts Sent* and *Comments Received* variables. The *Posts Sent* variable to be the count of all status updates, photos videos, links, check-ins, and other objects that the user posted to his or her own profile. The *Comments Received* variable is the total number of comments that the user obtained on all of the content he or she posted. In cases when the same friends commented on the same piece of content numerous times, we only counted the first comment that a particular friend made. Finally, we took into account the size of the social network that is directly measured by the *Friends* variable which counts the number of the user's friends.

5. Results

Tables 1 and 2 presents respectively descriptive statistics and correlations between variables. The correlations (Table 2) were established using the log transformed variables in order to handle a skewed distribution. The largest correlation coefficient (.929) is between *Reciprocity Likes Received* and *Reciprocity Likes Sent*, which supports our main hypothesis. The largest correlation coefficient between two independent variables is .888 (between *Comments*

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Table 2
Correlations.

No	Variable	1	2	3	4	5	6	7
1	*Reciprocity Likes Received*							
2	*Likes Sent*	.793**						
3	*Reciprocity Likes Sent*	.929**	.820**					
4	*Age*	–.029	–.215**	–.033				
5	*Posts Sent*	.642**	.612**	.612**	–.107*			
6	*Comments Received*	.800**	.654**	.743**	–.089	.732**		
7	*Likes Received*	.779**	.670**	.740**	–.125*	.728**	.888**	
8	*Friends*	.313**	.603**	.293**	–.313**	.348**	.455**	.592**

$N = 392$; $^{*}p < .05$; $^{**}p < .01$ in a two-tailed test. Binary variable was omitted;

Table 3
Results of negative binomial regression analysis for *Likes Received* variable.

Model	1	2	3	4
Control variables				
Gender (woman = 1)	.005	–.003	–.040	–.038
	(.105)	(.105)	(.104)	(.103)
Age	–.014**	–.014**	–.013*	–.013**
	(.005)	(.005)	(.005)	(.005)
Comments Received	.002**	.002**	.002**	.002**
	(.001)	(.001)	(.001)	(.001)
Friends	.002**	.002**	.002**	.002**
	(.001)	(.001)	(.001)	(.001)
Independent variables				
Posts Sent		.001*		.001
		(.001)		(.001)
Likes Sent			.001**	.001**
			(.001)	(.001)
Log likelihood	–2573.353	–2570.125	–2565.1324	–2564.229
Pseudo R^2	.048	.049	.051	.051

$N = 392$; $^{*}p < .05$; $^{**}p < .01$ in a two-tailed test. Numbers in parentheses are standard errors. Constant was omitted.

Received and *Likes Received*). The reason is rather obvious. The users publishing intriguing posts generate a twofold feedback by likes and comments. It is worth noting one minor discovery pertaining to the correlation analysis. There is always a negative correlation between *Age* variable and other variables, which show that in general activity in online social networks declines with age.

The research hypotheses were tested using negative binomial regression models that are an adequate method for over-dispersed variables and modeling count data in a longitudinal setting.

Table 3 contains the results from regression analysis in which the dependent variable is *Likes Received*. We tested the hypothesis 1 by introducing variables sequential in the models. The first model includes control variables only, and the remaining models test our first hypothesis. The user broadcast activity is represented by *Posts Sent* and *Likes Sent* variables. Those variables show the user's communication activity with others associated with publishing content on his or her wall (which is then automatically distributed to friends) or what user is directly pointing on someone's post by "like" that is then automatically distributed to her or his friends too. As it is shown in model 2 and 3, the coefficients of *Posts Sent* and *Likes Sent* variables are positive and statistically significant respectively at the level of .05 and .01, confirming the positive relationship between the number of messages the actor broadcasts and the reactions from her or his audience. Therefore, hypothesis 1 is empirically supported. Model 4 pooled all the explanatory variables in one model and yielded empirical results that are consistent with previous models.

Table 4 contains the results from regression analysis in which the dependent variable is *Reciprocity Likes Received*. We tested our main hypothesis (hypothesis 2) in the two models. Model 5 includes control variables only, and the remaining model tests our second hypothesis. The user reciprocity behavior is represented by *Reciprocity Likes Sent* variable. This variable counts "likes" the user sent to her or his friends as a reciprocity act to "like" he or she received from those friends earlier. As it is demonstrated by model 6, the coefficient of *Reciprocity Likes Sent* variable is positive and statistically significant respectively at the .01 level, confirming the positive relationship between the reciprocity messages the actor broadcasts and the reciprocity reactions from his or her audience. Therefore, hypothesis 2—that an increase in the number of reciprocity messages the actor broadcasts increases the reciprocity reactions from his or her audience—is strongly empirically supported.

Table 4
Results of negative binomial regression analysis for *Reciprocity Likes Received* variable.

Model	5	6
Control variables		
Gender (woman = 1)	–.012	.007
	(.100)	(.096)
Age	–.017*	–.019**
	(.007)	(.006)
Posts Sent	–.001	.001
	(.001)	(.001)
Comments Received	.002**	.001**
	(.001)	(.001)
Likes Received	.001	.001
	(.001)	(.001)
Friends	.001	.001
	(.001)	(.001)
Likes Sent	.002**	.001
	(.001)	(.001)
Independent variables		
Reciprocity Likes Sent		.008**
		(.002)
Log likelihood	–1490.580	–1478.093
Pseudo R^2	.102	.110

$N = 392$; $^{*}p < .05$; $^{**}p < .01$ in a two-tailed test. Numbers in parentheses are standard errors. Constant was omitted.

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6. Conclusions and implications

In our study we justified a strong empirical evidence for a reciprocity phenomenon on Facebook. The users seem to interact in accordance to the social exchange theory. By means of online interactions the social network users are able to maximize strength of their relationship and minimize the cost of communication. This is especially noticeable on Facebook because "liking" is a very low cost activity. This finding shows that people in online social networks behave like in real life social situations. Of course, this is valid for Facebook-like sites where users are identified by their real names and maintain contacts mainly with real-life friends. One often-heard conception suggests that people use these platforms to amass numerous on-line friends and then boast to them about their lives without much restraint or concern for social norms. We argue that it is the opposite—people using large on-line networks will behave according to social norms.

Potential future research will be focused on two issues. Firstly to study the existence of reciprocity behavior between company and users on the Facebook Fan Pages. This kind of applied research might be very useful for marketers to manage successfully the company Fan Pages on online social networks. And secondly much more important and challenging study is trying to examine whether reciprocity kind of behavior on Facebook would translate to stronger social relationships and the exchange of real-life support.

Acknowledgments

Financial support from the National Science Centre (Narodowe Centrum Nauki) in Poland under grant number UMO-2011/01/B/HS4/06630 is greatly appreciated. We would like to thank Mateusz Chrzest for his outstanding support in data collection and the anonymous reviewers for their very helpful comments and suggestions during the review process.

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