



# Altruistic and selfish communication on social media: the moderating effects of tie strength and interpersonal trust

Tasos Spiliotopoulos <sup>a</sup> and Ian Oakley <sup>b</sup>

<sup>a</sup>Madeira Interactive Technologies Institute, University of Madeira, Funchal, Portugal; <sup>b</sup>School of Design and Human Engineering, UNIST, Busan, South Korea

## ABSTRACT

Individuals share a diversity of content on social media for a variety of reasons. Research has often described and explained disclosure via the application of a subjective cost–benefit analysis framed around reciprocity, suggesting that people communicate selfishly motivated by the expectation of receiving something in return. This paper investigates the moderating effects of tie strength and interpersonal trust on the relationship between expected reciprocity and intensity of communication between two social media connections. A Facebook application presented participants with a random set of their friends and asked them to rate their friendships in terms of these values. Overall, 90 participants rated 1728 friendships, while the application collected 11 activity variables depicting the actual communication that has taken place in each pair of connections. A principal component analysis was used to distinguish between text- and photograph-related communication, and two moderated multiple regressions were conducted to establish the moderating effects. The results show significant moderating effects of tie strength and trust on the communication around photographs, but not around text. This study contributes to communication research by explicating the ways that tie strength and trust affect patterns of communication on social media. Implications for social media researchers and designers are discussed.

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## 1. Introduction

Social Network Sites (SNSs) are becoming increasingly larger parts of our everyday lives and influence the way we communicate and share information with one another. Facebook, for example, currently reports 2.27 billion monthly active users, with 1.49 billion of them on average logging on the site daily (Facebook 2019). As SNSs become richer in features and more diffused in the population, there are both more types of content and more content overall that is being shared among the users. The ability to create and share user-generated content (Kaplan and Haenlein 2010), to reshare or forward content by others thus creating cascades of information (Bakshy et al. 2012) and to provide feedback to content shared by others, for example in the form of comments, favourites or likes (Levordashka, Utz, and Ambros 2016) have been described as main characteristics and appeals of SNSs. Understanding the specifics of these online interactions can lead to better design of systems and inform social theory.

Digital-mediated communication, and especially the particulars of how and why we share information on SNSs, has attracted a considerable amount of research

attention (e.g. Abramova et al. 2017; Quinn 2016). However, an interdisciplinary review of informational privacy research has shown that the majority of empirical studies tend to view the individual as the salient unit of analysis, something that has been at the expense of our understanding at other levels of analysis (Smith, Dinev, and Xu 2011). Articulating a list of connections (e.g. friends on Facebook) and interacting with these connections around user-generated content distinguishes SNSs from other communication technologies (boyd and Ellison 2007), and thus it is important to study SNS disclosure at the dyadic level as well, that is using pairs of users as the unit of analysis.

Borrowing theoretical frameworks from economics, researchers have often attempted to describe and explain disclosure at the dyadic level via the application of a subjective cost–benefit analysis. This cost–benefit analysis postulates that users act as rational, self-interested actors that constantly engage in a decision-making process where they evaluate the perceived personal benefits of a specific disclosure against the probability and severity of potential privacy risks (Dienlin and Metzger 2016). Such a decision-making process is often expressed as a

function of expected reciprocity, meaning that we engage in communication with a specific person because we want them to communicate back with us in return (Cook et al. 2013). In other words, this strand of research characterises online interactions as predominantly selfish (i.e. motivated by the expectation of reciprocity) and questions the possibility of an otherwise altruistic motivation (i.e. without the expectation of reciprocity) (Kollock 1999). However, further work has argued that a direct application of this cost–benefit analysis that is centred around expected reciprocity may underestimate the importance of other factors that influence our online behaviour, such as social and organisational context (Nissenbaum 2009; Pelaprat and Brown 2012). Research also shows that the disclosure of information is influenced by specific dyadic characteristics, such as tie strength (Wang, Burke, and Kraut 2016) and interpersonal trust (Joinson et al. 2010). For example, when contemplating a potential online interaction with a very close friend or with an acquaintance recently met at a conference, one would consider communicating and eliciting reciprocal communication for different reasons and to different ends in each case.

The purpose of the current study is to further investigate this assumption of a SNS user as a self-interested rational actor. To this end, we focus our attention on the decision-making process that underpins SNS communication and, in particular, the factors that affect the relationship between expected reciprocity and communication. To achieve this, we first model communication between pairs of Facebook friends as a function of expected reciprocity. For each pair, we further hypothesise that the strength of the tie with the other person and the trust in them will have a moderating effect on this relationship between expected reciprocity and intensity of communication. We examine this moderating effect for two types of content, text-related and photograph-related. Explicating the relationships among these concepts can give us useful insights into how SNS users reason about disclosure. In turn, this can inform theories of online social behaviour and provide design recommendations that better support SNS users' privacy, convenience and engagement.

## 2. Related work

### 2.1. Disclosure on SNSs

People make use of SNSs to share a diversity of content to multiple audiences. SNS users share personal information to their connections in the platform not only actively, such as via status updates, comments, and photographs, but also passively through information

revealed in their profiles, such as dates of birth, relationship information and events they are interested in attending. Furthermore, even information that is forwarded or reshared from third parties, although not personal in content, can have personal implications; for example, sharing a specific news story may imply that the sharer endorses or agrees with the content and that a receiver will find it worthwhile for their attention. Thus, communication is often studied in terms of acts of self-disclosure, traditionally defined as 'any message about the self that a person communicates to another' (Wheless and Grotz 1976) with a clear implication that this communication is deliberate (Greene, Derlega, and Mathews 2006). Online self-disclosure can reduce the uncertainty of dyadic interactions (Tidwell and Walther 2002) and it has been shown that people like those who self-disclose to them (Jiang, Bazarova, and Hancock 2011; Kashian et al. 2017). As their friend networks increase in size over time and comprise different and potentially conflicting social spheres, SNS users can find it challenging to manage their sharing strategies and behaviours (Binder, Howes, and Sutcliffe 2009; Marder, Joinson, and Shankar 2011; Vitak 2012). In response to this problem, SNSs allow their users to fine-tune sharing by creating predefined lists or 'circles' of connections, or to select the recipients of their messages on an ad-hoc case-by-case basis (Kairam et al. 2012; Kelley et al. 2011).

#### 2.1.1. Photograph-related sharing

In addition to text communication, photo sharing has emerged as a very popular activity on SNSs. This trend is partly fuelled by the proliferation of smartphones that allow users to take pictures with the camera of their devices and quickly share them on the mobile versions of SNS applications; in fact, a recent report shows that 95.1% of active user accounts access Facebook via smartphone (Statista 2018). Sharing photographs captured by smartphones has been described as a distinct form of self-impression management, in that it allows the dynamic reconfiguration of private/public boundaries by disclosing more information about oneself than verbal communication (Lee 2009). Research suggests distinct but overlapping roles for sharers of photographs online, distinguishing between creators of photographic content (i.e. users that post photos they have taken themselves) and curators (i.e. users that post photos they have found online) (Pew Research Center 2013). Specifically for Facebook, sharing, tagging and viewing photographs have been grouped into a distinct motivation for using the service (Joinson 2008; Spiliopoulos and Oakley 2013). Tosun (2012) has argued that active and passive ways of involvement with photos on Facebook are motivated by separate factors, while other

research has found that different patterns of photo-related activity are associated with different personality characteristics (Eftekhar, Fullwood, and Morris 2014). A qualitative analysis of college students' Facebook photos described photos as a means for strategic representation of a social group and social life with a focus on the connection and effective communication among the students, something that goes beyond merely documenting college life (Mendelson and Papacharissi 2010). An online survey identified six gratifications for digital photo sharing on Facebook, namely affection, attention seeking, disclosure, habit, information sharing, and social influence (Malik, Dhir, and Nieminen 2016). Finally, a recent study found that photograph sharing on Facebook varies with relationship type (Houghton et al. 2018), thus highlighting the importance of the relationship between the discloser and the recipient in photo-related sharing.

## **2.2. Communication as a function of expected reciprocity**

While much evidence suggests that privacy is a universal human need and needs to be upheld, self-disclosure confers numerous objective and subjective benefits (Acquisti, Brandimarte, and Loewenstein 2015). In fact, current privacy and communication scholarship is often traced back to the Rational Choice Theory (RCT) (Scott 2000) and its application to social interactions, the Social Exchange Theory (Cook et al. 2013; Homans 1958), which posit that human relationships are formed by applications of a subjective cost–benefit analysis. This suggests that individuals engage in a decision-making process whereby they weigh the perceived benefits of their disclosure activity against the potential privacy risks (Joinson and Paine 2007; Laufer and Wolfe 1977), a process that has led to the development of a Privacy Calculus model (Dienlin and Metzger 2016; Dinev and Hart 2006; Krasnova et al. 2010). However, the complexity of social relations makes it difficult to assess the costs and benefits of specific online interactions, raising important questions about this rational-actor approach (Pelaprat and Brown 2012). Thus, although research has found both SNS use, in general, and disclosure on SNSs, in particular, to be associated with numerous objective and subjective benefits, not all of these benefits can be explained as results of goal-directed actors making self-interested decisions. Instead, many of these benefits may be considered products or externalities resulting from more complex social processes. Indicatively, studies show that certain motivations and patterns of Facebook use and self-disclosure are associated with increased social capital (Ellison, Steinfield, and Lampe

2007), formation, maintenance and development of relationships (Krasnova et al. 2010; Tosun 2012), social support (Huang 2016), relational intimacy (Park, Jin, and Annie Jin 2011), self-esteem (Steinfeld, Ellison, and Lampe 2008), subjective well-being (Burke, Marlow, and Lento 2010; Huang 2016; Islam and Patil 2015; Kim and Lee 2011), positive emotional states (Neubaum and Krämer 2015), college adjustment (Yang and Brown 2015) and political expression (Yu 2016). What's more, these perceived benefits may be at odds with one another; for example, someone may post their political opinions online in order to attain the personal gratification of political expression, but this action may, in turn, alienate part of their audience. This observation highlights the complexity of the relationship between perceived benefits and intentionality of interaction, and suggests an examination of interaction at the dyadic relationship level.

One way of describing this cost–benefit analysis at the dyadic level is through the assumption that expected reciprocity is a driver for communication; in other words, we disclose information because we want others to disclose in turn (Contena, Loscalzo, and Taddei 2015; Cook et al. 2013; Greene, Derlega, and Mathews 2006; Kollock 1999; Taddicken 2014). For example, Barak and Gluck-Ofri (2007) found positive correlations between the measures of self-disclosure in messages and responses to them in discussion forums and Joinson (2001) found that participants in a study divulged a higher quantity of information about themselves when they had received some self-disclosing information about the experimenter beforehand (albeit their answers were not more revealing or intimate). A recent study on gift exchanges on Facebook found that receiving a digital gift causes individuals to be more likely to give a gift in the future, and that this reciprocal activity is strongly influenced by social factors (Kizilcec et al. 2018). In fact, reciprocity has been established as a distinct gratification users attain from using SNSs and as an antecedent of SNS adoption (Pai and Arnott 2013). Norms of reciprocity were also found to directly influence affective trust and perceived community support (Sánchez-Franco and Roldán 2015). Further research has revealed a positive relation between receiving a great number of likes and comments from Facebook friends and the level of life satisfaction (Mayol and Pénard 2017). On the other hand, receiving few responses from one's Facebook friends was found to threaten the needs for belonging, self-esteem, control, and meaningful existence (Greitemeyer, Mügge, and Bollermann 2014).

Hence, proponents of the rational choice approach for explaining interpersonal communication have put expected reciprocity at the heart of people's decision-

making process. This approach argues that all social phenomena can be explained as the aggregation of discrete, isolated decisions made by individuals, and that these individuals behave as rational actors pursuing their own self-interest (Scott 2000; Sen 1997). At the level of these isolated decisions of interaction, behaviour is considered to be dominated by the expectation of reciprocity (Kollock 1999). Thus, this assumption effectively argues that online interactions are predominantly selfish (i.e. motivated by the expectation of reciprocity from the recipient) and doubts the possibility of otherwise altruistic motivations (i.e. without the expectation of reciprocity). Further work, however, has argued that a rigid, direct application of this cost–benefit analysis centred directly around expected reciprocity underplays the importance of many factors that influence our online behaviour, and that privacy and disclosure online are, in fact, contextually determined (Nissenbaum 2009; Pelapat and Brown 2012; Quinn and Papacharissi 2018). Pelapat and Brown (2012), for example, refer to concepts such as culture, history, relationships and moral commitments that may subvert this assumption of a self-interested rational communicator.

Overall, the main postulation of RCT as applied to online social behaviour suggests an understanding of online disclosure via the application of a subjective cost–benefit analysis framed around reciprocity. In other words, people are theorised to act as goal-directed, selfish actors that share content with their Facebook connections with the expectation of receiving communication in return. While research suggests that such a rational choice approach can provide useful insights into online behaviour, there are indications that this relationship between expected reciprocity and online disclosure is more complex and should be studied more closely. This paper investigates the roles of tie strength and interpersonal trust as potential moderators of this relationship and puts forward pertinent hypotheses in the following sections.

### 2.3. Tie strength

Tie strength was introduced by Granovetter (1973) as a combination of the amount of time, emotional intensity, intimacy (measured as mutual confiding), and reciprocal services devoted to a relationship, with all these factors being independent but correlated. More simply, tie strength can refer to the bonding level or closeness between two people, and a tie is typically characterised as *strong* or *weak*. Strong ties are the people that are structurally (Ellison, Steinfield, and Lampe 2007; Friedkin 1980) and emotionally (Marsden and Campbell 1984; Wellman and Wortley 1990) close to someone,

such as family and close friends, while weak ties are looser or shallower relationships (i.e. acquaintances). With regards to computer-mediated communication, research has argued that strong ties can influence each other to adapt and expand their use of media to support the exchanges important to their tie, but weak ties are dependent on common means of communication and protocols established by others (Haythornthwaite 2002). More recent research has examined how the dimensions of tie strength map onto social media usage (Gilbert and Karahalios 2009; Jones et al. 2013; Luarn and Chiu 2015).

Early seminal research has shown clear and distinct benefits from communicating both with strong and weak ties. Granovetter (1973) demonstrated the value of weak ties; because they are in contact with different social circles, they can be bearers of novel information and can be useful in tasks such as looking for a job. Wellman and Wortley (1990) illustrated the value of strong ties for the provision of different kinds of social support, such as emotional aid, small services, and companionship. Interestingly, more recent studies have provided evidence of a more nuanced and tangled view of the effects of tie strength on SNSs. While sociological studies have indicated that weak ties can provide better and more novel information (e.g. Granovetter 1973), answers to questions that were asked through the status message feature of Facebook from strong ties provided a subtle increase in useful and novel information over answers from weak ties (Panovich, Miller, and Karger 2012). Communication with strong ties was also found to be more predictive of finding employment within three months than communication with weak ties (Burke and Kraut 2013). The same study found that communication with strong ties over social media has been generally associated with improvements in stress levels, social support, and bridging social capital. Tie strength was positively associated with the feeling of happiness and benign envy when browsing Facebook, as opposed to malicious envy which was found to be independent of tie strength (Lin and Utz 2015). Weak ties, on the other hand, play an important role for information diffusion in SNSs due to the bridge structural effect in the network (Zhao, Wu, and Feng 2011). The literature, for the most part, suggests a positive connection between tie strength and the motivation and action of communicating and sharing information online (Haythornthwaite 2002; Wang et al. 2014), a relationship that also holds for the sharing of photographs specifically (Gilbert and Karahalios 2009; Mendelson and Papacharissi 2010).

At the same time, Facebook users will be ostensibly more interested in receiving communication from their closest friends, indicating a link between tie strength



and expected reciprocity. In fact, Granovetter's definition of tie strength makes a reference to the 'reciprocal services which characterize a tie' as a factor in building, maintaining, and measuring tie strength (Granovetter 1973). Reciprocity has been linked to SNS members' common ground (Pai and Arnott 2013), which is a significant factor of tie strength, while the mutual exchange of wall posts has been used for the computational calculation of tie strength in data mining studies (Alhazmi and Gokhale 2016). Furthermore, if we consider question asking as a form of self-disclosure, since the fact that one is interested in something is information about them, then eliciting answers to questions on SNSs also constitutes disclosure with an expectation of reciprocity. In this case, tie strength has been also found to affect reciprocity; a survey study of status message Q&A behaviour on SNSs found that closeness of a friendship was a motivator to answer questions (Morris, Teevan, and Panovich 2010b) and a small study comparing information seeking between search engines and question asking on Facebook found that many participants' questions were answered by friends they rated as close (Morris, Teevan, and Panovich 2010a). It is worth noting, however, that while a positive link between tie strength and expected reciprocity seems intuitive, researchers very early showed that the connection is more nuanced; Altman (1973) noted that the norm of disclosure reciprocity may be stronger early in a relationship than in later stages, and Derlega, Wilson, and Chaikin (1976) reported that strangers display more disclosure reciprocity than friends in a social encounter.

Research shows that tie strength is an important factor that affects online disclosure, in general, and that it is a possible moderator of the relationship between expected reciprocity and online disclosure that is suggested by a rational choice approach. We aim to empirically investigate the moderation effects of tie strength on this relationship. That is, we expect that for differing levels of tie strength the relationship between expected reciprocity and actual sharing will also differ. Furthermore, based on the literature that suggests that photographs are a distinct type of content on Facebook, we also differentiate between two different kinds of communication, text-related and photograph-related. Thus, we propose the following hypotheses:

H1: Tie strength moderates the relationship between expected reciprocity and intensity of text-related communication.

H2: Tie strength moderates the relationship between expected reciprocity and intensity of photo-related communication.

## 2.4. Interpersonal trust

Trust has been characterised as an integral part of human interactions, as it allows people to engage in exchanges that leave both parties better off, as well as reduces the cost of these transactions (Resnick 2002; Riegelsberger, Sasse, and McCarthy 2005). Golbeck and Hendler (2006) have provided a definition of interpersonal trust that is particularly suitable for characterising relationships on SNSs, explaining that 'trust in a person is a commitment to an action based on a belief that the future actions of that person will lead to a good outcome'. Reputation has been described as a useful and important tool for determining the trustworthiness of another person for online interactions (Cheshire and Cook 2004). However, interpersonal trust is inherently a personal opinion that can be influenced by several factors, such as past experiences with the other person and their friends, our opinions of actions the person has taken, rumours, and influence by others' opinions (Golbeck 2005).

A number of studies have consistently shown that trust is a necessary condition for disclosing information and has a positive effect on disclosure either in the case of a website or organisation (Mesch 2012; Wang, Min, and Han 2016; Zimmer et al. 2010), or in the case of dyadic relationships offline (Wheless and Grotz 1977) and on SNSs (Millham and Atkin 2016; Sheldon 2009). Researchers, however, have pointed out that the relationship between trust and self-disclosure may be more complex, suggesting that trust has a mediating or moderating effect on the relationship between privacy and self-disclosure (Joinson et al. 2010; Taddei and Contena 2013). This means that trust can reduce perceived privacy risks, thereby encouraging SNS users to engage in more disclosure behaviours and in the sharing of more personal information with people they trust (Chen, Pan, and Guo 2016; Dwyer, Hiltz, and Passerini 2007; Zimmer et al. 2010). Thus, a high degree of trust in the recipient of the disclosure should be even more important in risky situations, such as sharing content that can be more sensitive in nature, like photographs (Gilbert and Karahalios 2009; Malik et al. 2016). Research has also studied the link between interpersonal trust and expected reciprocity, as Resnick (2002) explains that '[a]n expectation of continued interaction in the future is helpful in maintaining trust'. Pai and Arnott (2013) expand on this link and argue that without some level of trust in the reciprocity of others, SNS users are reluctant to use the platform for communications that are, to a large extent, highly personal and revealing.

In sum, interpersonal trust is an important factor that affects online disclosure in a positive way. Research also

suggests that it may act as a moderator of the relationship between expected reciprocity and online disclosure. This study empirically tests this moderation effect. Thus, we hypothesise that the relationship between expected reciprocity and actual sharing will differ based on interpersonal trust. We also consider two kinds of communication, text-related and photograph-related. So, we have:

H3: Interpersonal trust moderates the relationship between expected reciprocity and intensity of text-related communication.

H4: Interpersonal trust moderates the relationship between expected reciprocity and intensity of photo-related communication.

### 3. Method

#### 3.1. Tool and procedure

Participants were invited to complete an online survey in the form of a Facebook application. The first page of the application included a comprehensive description of the study, clearly framed the experiment as an academic study, explained the data collection process, provided the contact details of the researchers, and requested users' consent. In addition to our description, Facebook displays all data-access permissions granted to an application during installation, thus ensuring that the participants had a comprehensive account of the data captured by the study. Apart from the basic profile information, the application requested a single extended permission, 'Access posts in your News Feed'. Users can deny extended permissions when they install an application, but the study participants were instructed to accept this permission and, in fact, the application was designed so that it would not proceed unless they did so. The participants had the choice to opt out of the study at any time.

After completing demographic questions, each participant was presented with the name and profile picture of a randomly selected Facebook friend and was asked to answer three questions about them, essentially rating their relationship on three dimensions (tie strength, interpersonal trust, expected reciprocity) by moving a horizontal slider for each question, similar to the approach followed by previous studies for measuring tie strength (Gilbert and Karahalios 2009; Luarn and Chiu 2015). The slider for each question had to be moved in order for the application to proceed to the next person as a means to ensure that the participant had rated the friendship before moving on to the next. The position of the slider was internally translated into a value between 0 and 1 with a granularity of 0.01. In the meantime, the application gathered a range of data

about the interactions between the two people via the Facebook Application Programming Interface (API).<sup>1</sup> After rating twenty friends, the participant was presented with summary results (their top friends based on a tie strength algorithm from previous literature) and some light-hearted commentary (e.g. 'The friendship is strong with this one!') about their rated friends in order to incentivise further participation. Participants were then given the option to rate more friends but were also able to quit the application. The application and survey were pilot-tested with two groups of ten participants each for technical or data collection issues and comprehension/ambiguity of the questions, respectively. These twenty participants rated twenty of their friends each (i.e. 400 friendships) and are not included in the main survey.

#### 3.2. Participants

A convenience sample of participants was recruited with a request to complete the online survey through posts in social media, the researchers' institutional student forum, and an online study repository. The survey was implemented and deployed in both the English and Portuguese languages and was targeted to speakers of either language. These are the working languages of the researchers and the institution from which a substantial number of the participants were recruited. Participants with fewer than 20 Facebook friends were excluded because each participant would be later asked to rate 20 friendships and they did not meet this threshold. Participants with more than 1000 Facebook friends were also excluded because they were more likely to be professional accounts. This resulted in a sample of 90 participants (59% male) who rated 1728 Facebook friendships in total. The participants had a mean age of 26.9 years ( $SD = 8.7$ ), and came from 11 countries with the vast majority ( $n = 77$ , 85.6%) from Portugal and 4.4% ( $n = 4$ ) from the USA. They had a mean of 355 Facebook friends ( $SD = 218.9$ , range = 28–872) and reported using Facebook for an average of 13.4 ( $SD = 15.1$ ) hours per week.

#### 3.3. Measures

##### 3.3.1. Survey data

The study design encouraged each participant to rate at least 20 friendships, so it was important to keep each set of questions short in order to prevent fatigue on the part of the participants. Thus, the three constructs of interest were operationalised using single-item measures. Although single-item measures are not ideal, researchers have provided evidence that under certain conditions

single items can function similarly to multiple items in terms of reliability and predictive validity (Alexandrov 2010; Bergkvist and Rossiter 2007; Wanous and Hudy 2001). Tie strength was measured with the question ‘How strong is your relationship with this person?’ with the rating on the slider spanning from ‘barely know them’ to ‘we are very close’ and no intermediate markings. Although Gilbert and Karahalios (2009) considered five questions and created five respective models of tie strength, they deemed this question the most general and representative one and decided to focus on this one question for further analysis. Similarly, Panovich, Miller, and Karger (2012) employed this single question to validate their tie strength model. Interpersonal trust was measured with the question ‘How much do you trust this person?’ with the rating on the slider spanning from ‘I do not trust this person’ to ‘I would trust this person with my life’. This specific single-item measure has also been employed to rate interpersonal trust or trustworthiness in many studies across disciplines, from neuroeconomics (Phan et al. 2010) and organisational science (Evans, Hendron, and Oldroyd 2015) to studies of social networks (Schensul and Burkholder 2005). In order to measure the expected reciprocity, an ad-hoc item was formulated, ‘How much are you looking forward to receiving updates from this person?’, with the rating on the slider spanning from ‘not at all’ to ‘very much’. It is worth noting that in the current study the concept of expected reciprocity is operationalised contextually, that is it refers to actions and attributes within Facebook. Research has shown that single-item measures are appropriate when a construct refers to a concrete, singular object or attribute (Bergkvist and Rossiter 2007), as in this case.

### 3.3.2. Behavioural data

While participants were answering the survey questions for each friend, the application gathered a range of data about the content already shared between the two people. In order to measure text communication between the participant and each of their friends rated we collected six metrics (e.g. the number of timeline posts exchanged), while to measure communication related to photographs we collected five metrics (e.g. the number of likes on a participant’s photographs from a friend). No specific timeframe was imposed for the data collection, but it was limited to participants’ latest 200 photographs. The variable *number of intimacy words exchanged in wall (timeline) posts* is based on a sentiment analysis dictionary from previous research (Nielsen 2011), translated from English to Portuguese and used in both languages. A full list of the metrics

and their descriptive values are shown in the results section (Table 2).

## 4. Data analysis and results

Although participants were encouraged to rate at least 20 friendships, they were allowed to rate as many as they wanted. Participants that rated fewer than five friendships (13 participants, 33 cases in total) were removed from the dataset. Further analysis of the responses showed 334 cases where a participant rated a friendship with zero on the tie strength question. This number is in line with a recent study in which participants could only accurately name 72.7% of their Facebook friends (Croom et al. 2016). Because the current study focuses on the disclosures with Facebook connections that the participants actually know, these cases (19.7% of total) were also removed, resulting in a usable dataset of 1361 cases for further analysis, where 77 participants performed a mean of 17.7 (SD = 9.9) usable ratings each.

### 4.1. Tie strength, expected reciprocity, and interpersonal trust

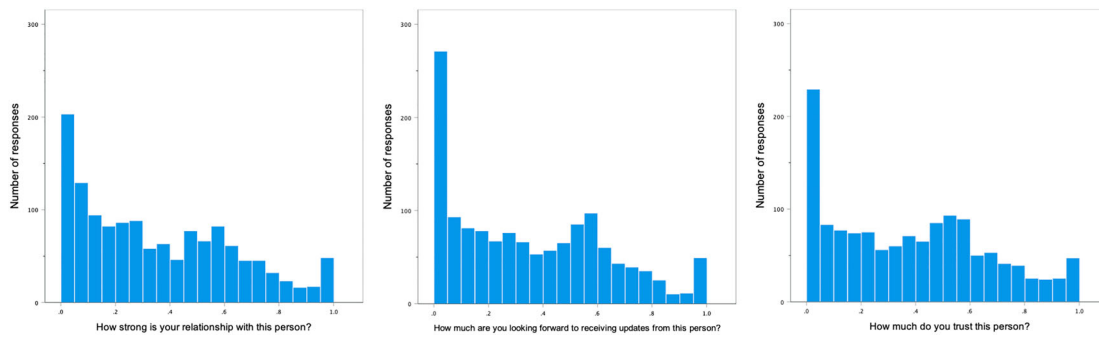
Table 1 shows descriptive statistics of the answers to the three survey questions and Figure 1 the distributions of the answers.

### 4.2. Measuring intensity of communication

Previous research has made a strong point that disclosure behaviours are potentially multidimensional, not only in degree but also in kind, and strongly suggests testing behavioural disclosure data for multidimensionality (Knijnenburg, Kobsa, and Jin 2013). Principal component analysis and other types of exploratory factor analysis are used for classifying intercorrelated variables under more general (latent) variables, something that is useful for reducing the dimensionality of data. For example, previous studies have used factor analysis to identify discrete dimensions of Facebook usage (Spiliotopoulos and Oakley 2015) and network dimensions in social network graphs (Madahali, Najjar, and Hall 2019). In the current study, in order to get an accurate composite measure of

**Table 1.** Measures and answers to the survey questions.

Measure	Survey question	Mean	Median	SD
Tie strength	Q1. How strong is your relationship with this person?	.362	.30	.278
Expected reciprocity	Q2. How much are you looking forward to receiving updates from this person?	.355	.32	.282
Trust	Q3. How much do you trust this person?	.384	.37	.284



**Figure 1.** Distributions of the answers to the survey questions from all study participants ( $N = 1361$ ).

the text and photograph communication characterising the friendships, a principal component analysis with orthogonal rotation (varimax) was conducted on the eleven API-collected metrics and the factor scores were used for further analysis. The correlation matrix revealed one case of extreme multicollinearity, namely the relationship between the number of wall (timeline) posts exchanged and the number of participant-initiated posts ( $r = .968$ ,  $p < .001$ ) leading to the elimination of the latter variable from further analysis. All of the behavioural variables follow power law distributions, and thus we used the logarithm (base ln, after adding a start-value of 1) of these variables to control for skew and then standardised by centring at the mean and dividing by the standard deviation. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the principal component analysis,  $KMO = .712$ . This value confirms the sample size as ‘good’ (Field 2009; Kaiser 1974) for this analysis. Bartlett’s test of sphericity  $\chi^2(45) = 5299$ ,  $p < .001$ , indicated that correlations between the items are sufficiently large and suitable for this analysis (Field 2009). Harman’s single-factor test revealed that the variance explained by a single factor was less than 50% (34.12%), suggesting the data are free from common method bias (Podsakoff et al. 2003).

**Table 2.** Descriptive statistics of items and summary of factors.

Items	Mean	SD	Factor Loadings
<b>Text-related communication (<math>\alpha = .773</math>)</b>			
Number of wall (timeline) words exchanged	3.71	12.74	.89
Wall (timeline) posts exchanged	0.28	0.79	.79
Comments exchanged on wall (timeline) posts	0.10	0.58	.69
Intimacy words exchanged on wall (timeline) posts	0.07	0.41	.65
Likes on participant’s wall (timeline) posts	0.43	4.18	.52
<b>Photo-related communication (<math>\alpha = .762</math>)</b>			
Comments on photos where participant is tagged	0.32	1.59	.77
Likes on photos where participant is tagged	0.26	1.44	.75
Number of participant’s photos where friend is tagged	0.38	1.69	.72
Likes on participant’s photos	0.04	0.37	.66
Comments on participant’s photos	0.06	0.74	.61

Employing an upper threshold of .5 and a lower threshold of .3 for factor loadings, the analysis yielded a two-factor solution. The two factors explain in combination 53.5% of the variance. Both factors exhibit good reliability with Cronbach’s alpha values above .70. The first factor corresponds to text-related communication (i.e. interactions focused around text) and the second factor corresponds to photo-related communication (i.e. interactions focused around photographs). Table 2 shows descriptive statistics of the behavioural data collected by the application and the factor loadings after rotation.

Each participant-friend pair was assigned a score for each of the two factors found in the factor analysis (i.e. one score for text-related communication and one score for photo-related communication). This factor score was calculated based on the ‘regression method’ for calculating factor scores (Field 2009, 634) and is based on the general idea of a weighted average, so that the items with the higher loading on each factor have a stronger effect on the final score. This method produces scores that have a mean of 0 and a specific variance. We define these factor scores as measures of the intensity of communication taking place for each pair of friends, so that the higher the factor score, more communication has taken place.

### 4.3. Testing moderation effects

In order to investigate moderation effects of the tie strength and trust variables on the relationships between expected reciprocity and the two types of communication (text and photo-related), two moderated multiple regression analyses were conducted. Moderated multiple regression includes the interaction of predictors as a term in the regression equation in order to examine whether or not the interaction of the predictors accounts for incremental variance in the dependent variable beyond the variance accounted for by main effects (Baron and Kenny 1986; Hayes 2018). Before running the regressions, predictor variables were centred and



the two interaction variables (expected reciprocity \* tie strength, expected reciprocity \* trust) were created. Thus, two hierarchical multiple regression models were tested predicting the actual text and photo-related interactions (i.e. the factor scores for each friendship) from the measure of expected reciprocity in the first step, with the interaction variables added in the second step of each model. Examination of collinearity diagnostics for the predictors showed VIF values well below 10 and the tolerance statistics above 0.2, indicating no multicollinearity in the data (Field 2009). The Durbin-Watson statistic values were 1.772 and 1.978 confirming that the assumption of independence of errors for the two regressions has been met (Durbin and Watson 1971; Field 2009). Overall, both models including only the main effects were significant and the addition of the interaction terms in the second step of each regression resulted also in significant models and accounted for significantly more variance in both cases. Examination of the beta coefficients and their significance showed that two of the four hypotheses were supported.

The model predicting text-related communication from expected communication reciprocity was significant  $F(3, 1357) = 43.4, R^2 = .087, p < .001$ . Addition of the interaction terms in the second step also resulted in a significant model,  $F(5, 1355) = 27.8, R^2 = .093, p < .001$ , and accounted for significantly more variance,  $R^2$  change = .006,  $p = .016$ , indicating potentially significant moderation of tie strength and trust on the relationship between expected reciprocity and actual text-related communication (Table 3). A positive main effect of interpersonal trust on the measures of communication was found, however, the two interaction effects were not statistically significant and, thus, H1 and H3 are not supported.

The model predicting photo-related communication from expected communication reciprocity was significant  $F(3, 1357) = 17.4, R^2 = .037, p < .001$ . Addition of

the interaction terms in the second step also resulted in a significant model,  $F(5, 1355) = 14.5, R^2 = .051, p < .001$ , and accounted for significantly more variance,  $R^2$  change = .014,  $p < .001$ , indicating potentially significant moderation of tie strength and trust on the relationship between selfish motivation for communication and actual photo-related communication (Table 4). A positive main effect of tie strength on the measures of communication was found and both interaction effects were statistically significant, indicating support for both H2 and H4.

In order to aid visualisation and interpretation of the moderation effects we generated a set of estimates of the dependent variable (i.e. the factor scores for photo-related communication) from combinations of the moderators (i.e. tie strength and trust) and the main effect variable (i.e. expected reciprocity) using the unstandardised coefficients of the variables in the regression models (including the intercept) and plotted the dependent variable as a function of the moderators and the main effects. Per the recommendation of Hayes (2018, 244), we used the 16th, 50th, and 84th percentile values (equivalent to a standard deviation below the mean, the mean, and a standard deviation above the mean if a variable is assumed to be normally distributed) to denote low, mid, and high values in the variables. Figures 2 and 3 show visual representations of the two significant moderation effects. These visual representations show how the relationship between expected reciprocity and intensity of photo-related communication changes for different values of tie strength (Figure 2) and interpersonal trust (Figure 3).

## 5. Discussion

This study examined the moderating effects of tie strength and interpersonal trust on the relationship between expected reciprocity and the actual interactions

**Table 3.** Moderated multiple regression analysis predicting text-related communication.

	Step 1		Step 2		Hypothesis tested
	$\beta$	$t$	$\beta$	$t$	
Expected reciprocity (REC)	.067	1.471	.053	1.158	
Tie strength (TS)	.093	1.820	.078	1.481	
Trust (TR)	.156**	3.142	.157**	3.163	
REC $\times$ TS			-.011	-0.202	H1 (not supported)
REC $\times$ TR			.089	1.668	H3 (not supported)
$R^2$	.087		.093		
Adjusted $R^2$	.085		.090		
$F$ change	43.367***		4.144*		

Notes: Beta coefficients shown are standardised.  $N = 1361$ .

\* $p < .05$ .

\*\* $p < .01$ .

\*\*\* $p < .001$ .

**Table 4.** Moderated multiple regression analysis predicting photo-related communication.

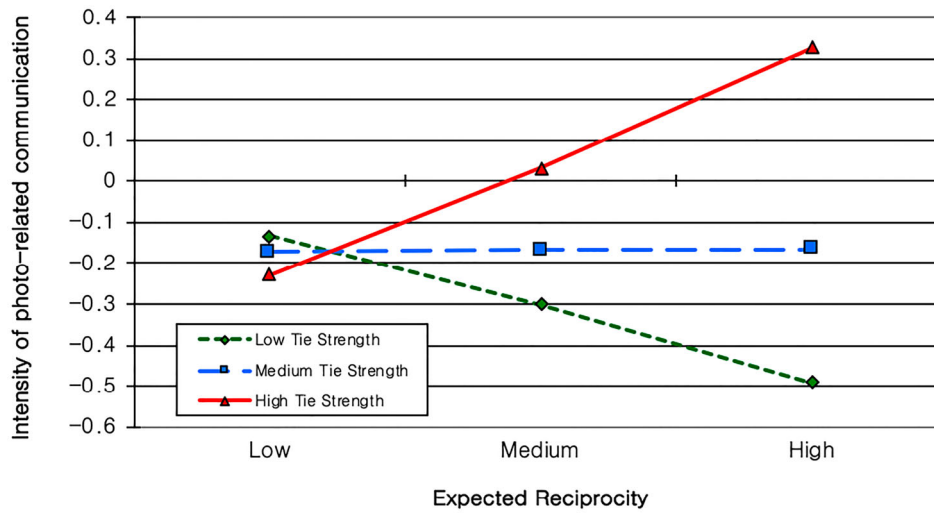
	Step 1		Step 2		Hypothesis tested
	$\beta$	$t$	$\beta$	$t$	
Expected reciprocity (REC)	-.091	-1.941	-.096*	-2.049	
Tie strength (TS)	.232***	4.405	.178***	3.307	
Trust (TR)	.030	0.597	.042	0.830	
REC $\times$ TS			.213***	3.806	H2 (supported)
REC $\times$ TR			-.113*	-2.077	H4 (supported)
$R^2$	.037		.051		
Adjusted $R^2$	.035		.047		
$F$ change	17.370***		9.777***		

Notes: Beta coefficients shown are standardised.  $N = 1361$ .

\* $p < .05$ .

\*\* $p < .01$ .

\*\*\* $p < .001$ .

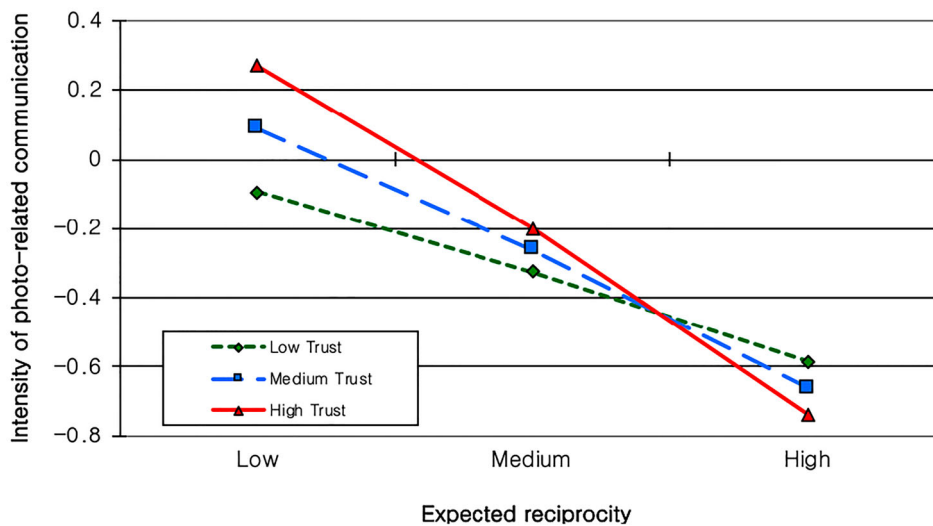


**Figure 2.** The interaction between levels of tie strength and expected reciprocity on the intensity of photo-related communication (Hypothesis H2).

that take place between specific pairs of Facebook connections. Furthermore, we differentiated between two types of interactions based on content, namely text-related and photo-related. Results show significant moderating effects of tie strength and trust on communication in two out of the four examined cases of moderation, namely the two cases predicting photo-related communication. We also find a positive main effect of interpersonal trust on text-related communication and, similarly, a positive main effect of tie strength on photo-related communication.

With regards to the main effects, prior research has generally suggested a positive association between both tie strength and trust with communication intentions and behaviours (e.g. Millham and Atkin 2016; Wang

et al. 2014). Our results, however, show that this positive association may differ for different types of content. In particular, we find only the effects of tie strength on photo-related communication and of interpersonal trust on text-related communication to be statistically significant. An explanation for this may be that people that are close to each other in terms of tie strength are more likely to also be physically close and be tagged together in photographs, or communicate with one another with comments and likes around photographs of common places, activities, interests or friends (Gilbert and Karahalios 2009). On the other hand, this effect may be less pronounced for connections exhibiting high trust. Trusted people are not necessarily close ties, but may be relied upon for advice, information and answers to



**Figure 3.** The interaction between levels of trust and expected reciprocity on the intensity of photo-related communication (Hypothesis H4).

questions, which is more likely to take place in the form of text. For example, Levin and Cross (2004) refer to competence-based trust as especially important for knowledge transfer. While our analysis found only two of the four main effects to be statistically significant, it may be the case that a larger or more homogeneous sample could detect statistically significant effects for the other relationships as well.

Our results show that tie strength moderates the relationship between expected reciprocity and actual sharing of content around photographs. In particular, for low levels of expected reciprocity the intensity of communication is similar across all levels of tie strength. As the motivation for communication becomes more selfish (i.e. for higher levels of expected reciprocity), the intensity of communication rises for strong ties (such as close friends and family), remains steady for contacts in the medium tie-strength category, and actually decreases for weak ties (such as remote acquaintances) (Figure 2). In other words, for the strong ties that we are particularly interested in receiving communication from, more actual communication indeed takes place. However, for the weak ties that we are particularly interested in receiving communication from (e.g. an important person that we are not close to, or specific content creator), the intensity of actual communication that takes place decreases. This means that, with regards to photo-related content, the model of a self-interested rational actor may not provide an adequate understanding and interpretation of behaviour, but instead should take into account measures of tie strength.

Interpersonal trust is revealed as a significant moderator that enhances the effect of the predictor on the outcome. Specifically, the more the participant was looking forward to receiving updates from their friend, the less actual photo-related communication was measured between them, and this effect was amplified by the trust the participant showed for their friend (Figure 3). This moderating effect, however, is weaker than in the tie strength case. The difference in direction between the effects of the two moderators may be due to the structural differences of the two moderators. On one hand, tie strength is considered largely mutual and undirected (Granovetter 1973), for example, two close friends or relatives are expected to mutually report their relationship as strong and two distant acquaintances will report their relationship as weak. On the other hand, interpersonal trust can often be one-sided and directed (Golbeck and Hendler 2006), for example one may show great trust towards a specific Facebook connection, be that a personal friend, a boss or a public figure, while the other person may not feel the same way and, thus, not be eager to reciprocate the

communication. As we collected interaction information that also included two-way communication, this asymmetry in interpersonal trust presents a possible explanation for the moderating effect. Furthermore, the low-reciprocity, low-trust Facebook connections may represent cases where reciprocity is simply not generally expected. Posts about important positive life events, such as having a baby, getting married, or earning a degree are generally shared to larger audiences (Day 2013) and are more likely to include photos (Bevan et al. 2015). Thus, the large audience for these cases may skew the dataset towards a high intensity of communication around photographs for the low-reciprocity, low-trust cases.

Our findings as a whole, reflect criticisms of RCT that have suggested that the relationship between expected reciprocity and the intensity of communication is not as straightforward as the theory suggests. For example, Pelaprat and Brown (2012) make the theoretical argument that '[online] social actions that solicit a return-action seek to neither profit nor benefit, but rather express a desire to draw in others into social life and relationships'. The results in this paper provide empirical support for this argument; we find more actual photograph-related communication taking place between low tie-strength connections when expected reciprocity is low compared to expected reciprocity being high. A similar effect takes place for high trust connections. Weak ties and trusted individuals are persons that we would like to draw further into our social life and relationships, since they can provide novel information and connections (in the case of weak ties), and reduce the risk of disclosure (in the case of trusted individuals).

The experimental set-up and data collection approach of the current study have both benefits and limitations. On one hand, this work answers the call of many scholars recommending the study of people's behaviour in realistic situations instead of lab experiments with self-reported behavioural data (e.g. Knijnenburg, Kobsa, and Jin 2013) by employing a Facebook application to collect objective, accurate and granular data about participants' online interactions. This approach is especially important for the study of online disclosure, as previous research has found significant discrepancies between self-reported and actual Facebook use (Junco 2013), as well as individuals' intentions to disclose personal information and their actual behaviours online (Norberg, Horne, and Horne 2007). Furthermore, this experimental format is particularly suitable for empirically studying online disclosure at the dyadic level, something that is a long-standing limitation of disclosure studies that typically focus on the individual as the salient unit of analysis (Smith, Dinev, and Xu 2011). On the other hand, it is

worth noting that researchers have lately started raising concerns about the quality of API-collected data (e.g. Lomborg and Bechmann 2014; Weiler 2018). In the case of this study, for example, changes to the Facebook API since the data were captured mean that some variables have been replaced or deprecated, and, in fact, API access to friends' data has been limited, making it possible that these kind of studies cannot be easily replicated with high accuracy in the future (Hogan 2018). Furthermore, in order to keep our questionnaire short, we used single-item measures to describe our constructs of interest. Especially in the case of expected reciprocity, further work may be necessary in order to validate this single question and determine how participants interpret it. Finally, even though we attempted to respect and accommodate users' privacy concerns, it is clear that our sample is subject to self-selection bias; not only participants self-selected to be included in the study, but they had to install a custom Facebook application and agree to offer some of their data.

## 6. Implications

### 6.1. Theoretical implications

This work provides insights for communication research by investigating the application of RCT for understanding users' behaviour on SNSs. In particular, this paper puts into question the assumption of a SNS user as a self-interested rational actor and shows that the relationship between expected reciprocity and SNS communication is, in fact, moderated by tie strength and interpersonal trust in specific ways. While previous criticisms of RCT for describing disclosure have emphasised individual differences (Hann et al. 2007), environmental cues (John, Acquisti, and Loewenstein 2010) and platform interface cues (Gambino et al. 2016), our approach contributes to this body of research by focusing on characteristics of dyadic relationships. Our findings are important for social media researchers studying and modelling SNS behaviour. Future studies of dyadic online interactions should keep in mind the ways that tie strength and interpersonal trust influence the links between motivations for communication and actual behaviour, and include such measures in their models or control for the differences between strong ties and weak ties in their sampling and analyses. The findings in this paper are also important to researchers in economics aiming to understand the limits, applications and possible extensions of RCT (see Sato 2013 for discussion on these broader topics). Especially, the fledging research area that focuses on the application of behavioural economic theories and practices (such as soft

paternalism and nudging) for understanding and motivating SNS behaviour can be of particular benefit (Wang et al. 2014).

While our study found significant effects of our variables of interest (tie strength and interpersonal trust) on the relationship between expected reciprocity and actual photo-related communication, this was not the case for text-related communication. This calls attention to the ways that photographic content on SNSs can be inherently different to text content and highlights the need for more studies in this area. This distinction between the two types of content is further supported by our finding that Facebook usage can be effectively dimensionalised into photograph-related and text-related. Both the main effects and the moderation effects in our study support the argument that explanations of online interaction should refrain from treating interaction on a specific platform in a monolithic way, but instead could benefit from focusing on specific modes of interaction, such as text and photographs.

### 6.2. Practical implications

Previous theoretical work has argued for the importance of reciprocal interactions for understanding and supporting online activity (Kizilcec et al. 2018; Pelaprat and Brown 2012). Our findings show that expected reciprocity does not directly translate to actual communication, but is instead moderated by tie strength and interpersonal trust. This means that simply designing for expected reciprocity is not enough to support online communication, but instead the interactions of tie strength and trust with expected reciprocity should be taken into account. Previous research has identified ways to enhance reciprocity by increasing expected reciprocity on social media, such as designing for 'encounter', providing public visibility of specific actions motivated by reciprocity, and facilitating symbolic exchanges (Pelaprat and Brown 2012). The design recommendations arising from the current paper suggest that such design decisions aimed at supporting reciprocity would be more effective when targeted at specific SNS connections based on the characteristics of the relationship with the connection, namely tie strength and interpersonal trust. These recommendations can be used as inputs to drive models of behaviour and algorithms that suggest connections to share specific content with or manage visibility of interactions (e.g. in news-feed-like features). This can enhance the design of SNS platforms and third-party tools that connect to the platforms, as well as SNS users' privacy and convenience. Furthermore, considering that the visibility of actual reciprocal actions is linked to a further desire for



reciprocity among observers (Kizilcec et al. 2018), enhancing the effectiveness of actions aimed at reciprocity could lead to increases in the overall engagement of social media users.

## 7. Conclusion and future research

This study contributes to on-going research on privacy and disclosure on social media by explicating the moderating effects of tie strength and interpersonal trust on different types of disclosure. Adding to the work that argues that social media interactions may be influenced by factors outside the remit of a traditional cost-benefit analysis (e.g. Gambino et al. 2016; Pelaprat and Brown 2012) we investigated the roles of these two fundamental concepts in the decision-making process of online disclosure and their relationship with expected reciprocity. Taken together, our findings suggest ways that future studies of online interaction could benefit by considering the concepts of tie strength and interpersonal trust as important factors that influence online interactions at the dyadic level.

Facebook allows the sharing of a variety of content, both text-based and photograph-based, thus being particularly suitable for studying the differences between the two types of content on the same platform. Future research that takes a broader approach could complement and validate our findings. In particular, the study of sharing practices on a predominantly photo-based SNS platform such as Instagram, of different content (e.g. video), the utilisation of more metrics for characterising interactions (e.g. more extensive use of sentiment analysis), and the inclusion of different demographic groups, could yield additional insights on the relationship between expected reciprocity and information sharing.

## Note

1. It is worth mentioning that Facebook has been increasingly limiting access to social graph data (i.e. the specific connections among persons and between people and digital entities on the platform) via the Facebook API. Most notably, since 2015 a standard third party can only access a user's friends if those friends also use the app. The current study utilises a dataset from July–August 2012, before this change took effect (see Hogan 2018 for further discussion on the details and the implications of these changes).

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## ORCID

Tasos Spiliotopoulos  <http://orcid.org/0000-0002-9573-8360>  
Ian Oakley  <http://orcid.org/0000-0001-5834-8577>

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