

## **The Friend Number Paradox**

Kao Si

University of Macau

Xianchi Dai

The Chinese University of Hong Kong

Robert S. Wyer Jr.

University of Cincinnati

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## Abstract

We identify a *friend number paradox*, that is, a mismatch between people's preferences for the friends they might acquire in social interactions and their predictions of others' preferences. People predict that others are attracted to them if they have a relatively large number of friends. However, they personally prefer to make friends with someone who has a relatively small number of friends. People regard a large number of friends as a signal of social capital that increases their interpersonal attractiveness. However, it can actually be a signal of social liabilities that diminish their ability to reciprocate obligations to others. We conducted a series of studies, including three speed-friending studies in which participants either engaged or expected to engage in actual interactions for the purpose of initiating long-term friendships. These studies provide converging evidence of the hypothesized mismatch and our conceptualization of its determinants.

*Keywords:* social relationship, mismatch, prediction, preference, number of friends

Humans are by nature social animals and they typically consider friendships to be fundamental to their well-being. Friends are a form of social capital that facilitates people's actions within a social network (Adler & Kwon, 2002; Coleman, 1988). Therefore, people not only like to have many friends themselves but also perceive others with a large number of friends to be socially attractive (Eder, 1985; Feld, 1991; Parkhurst & Hopmeyer, 1998). For example, people with a large number of friends are usually attributed high social status (Eder, 1985; Lin, 1999) and desirable personality traits (Parkhurst & Hopmeyer, 1998). In contrast, people with few social connections are often ascribed negative characteristics (Rotenberg, Gruman, & Ariganello, 2002; Tsai & Reis, 2009) and are rejected in social interactions (Lau & Gruen, 1992; Rotenberg et al., 2002).

The notion that having a large number of friends increases a person's social attractiveness might be challenged, however. Research in both sociology and psychology has conceptualized social exchange as the fundamental motive underlying people's engagement in interpersonal relationships (Blau, 1964; Homans, 1958, 1961; Thibaut & Kelley, 1959; Tooby & Cosmides, 1996). Social exchange, which involves the reciprocal fulfillment of obligations between different parties in a relationship, can take many forms, including the exchange of material goods, socio-emotional support, and interpersonal regard. Because fulfilling these obligations consumes people's limited resources (e.g., money, time, and attention), the maintenance of friendships can be a social liability. The liability increases as the number of friends one has becomes larger. As a result, the more friends a person has, the fewer the resources the person can invest in building and maintaining a quality friendship. From a resource perspective, therefore, people should prefer to form a relationship with someone who has a relatively small number of friends and who is thus in a better position to provide benefits in social interactions (Eastwick,

Finkel, Mochon, & Ariely, 2007; Gargiulo & Bernassi, 1999; Hansen, Podolny, & Pfeffer, 2001).

These considerations suggest two diametrically opposed hypotheses concerning the relationship between the number of friends a person has and his or her social attractiveness. In the current research, we investigated the conditions under which each of these hypotheses prevails. We identified a relative mismatch between people's own preferences and their predictions of others' preferences. Specifically, people tend to predict that others prefer to make friends with them when they have a relatively large number of friends than when they have a relatively small number of friends. In fact, however, people typically prefer to make friends with someone who has a relatively small number of friends. We term this phenomenon the *friend number paradox*. In the following sections, we review research bearing on this mismatch and the conditions in which it is likely to occur. We then confirm the validity of the current hypothesis in both scenario studies and actual social interactions.

## **Theoretical Background**

### **Predicting One's Own Social Attractiveness**

The formation of social connections is a fundamental need of social beings (Baumeister & Leary, 1995; Fiske, 2004; Maslow, 1943). Being rejected by others in social interactions can be both psychologically and physically painful (Eisenberger, Lieberman, & Williams, 2003; McDonald & Leary, 2005). Moreover, the lack of social relationships can be detrimental to people's health and well-being. For example, studies suggested that people who have few friends suffer from problems such as increased mortality risk (Berkman, Vaccarino, & Seeman, 1993),

distress (Lee, Draper, & Lee, 2001), low life satisfaction (Myers & Diener, 1995; Oishi & Schimmack, 2010), and decrements in cognitive performance and self-regulation (Baumeister, DeWall, Ciarocco, & Twenge, 2005; Baumeister, Twenge, & Nuss, 2002).

As a result, people often perceive that having a small number of friends carries a social stigma whereas having many friends signals social status and other desirable personality traits (Eder, 1985; Lin, 1999). Therefore, the number of friends that people have can positively influence others' impression of them and their success in social interactions. People with a small social network are characterized as having low self-esteem, low competence, and high levels of depression (Anderson & Harvey, 1988; de Jong-Gierveld, 1987; Lau & Gruen, 1992; Perlman & Peplau, 1981). Furthermore, they are perceived to be unsociable and aggressive in social interactions (Jones, Sansone, & Helm, 1983; Rotenberg et al., 2002; Tsai & Reis, 2009; Twenge, Baumeister, Tice, & Stucke, 2001). In contrast, people with a large number of friends often occupy a central position in social networks (Deri, Davidai, & Gilovich, 2017; Feld, 1991). Based on these considerations, we expect people to predict that others are more attracted to them if they have a relatively large number of friends than if they have a relatively small number of friends.

### **Preference for Others in Social Interactions**

Although the above hypothesis seems straightforward, it overlooks a fundamental feature of social relationships. Several lines of research indicate that people engage in social relationships primarily as a means of exchanging social resources (Blau, 1964; Clark & Mills, 1979; Homans, 1958, 1961; Thibaut & Kelley, 1959). For example, friendships are motivated by the potential balance of both giving and receiving attention and socio-emotional support.

Furthermore, the principle of reciprocity governs social exchange between friends and other types of relationships (Adams, 1965; Axelrod & Hamilton, 1981; Gouldner, 1960; Trivers, 1971; Walster, Berscheid, & Walster, 1973). For example, Blau (1955) observed that agents in a government bureaucracy chose to consult their expert colleagues only infrequently whereas they consulted others of equal expertise fairly often. Blau concluded that the agents' choices of consultation were based on their ability to reciprocate the favor.

Two types of social relationships are often distinguished (Clark & Mills, 1979; Mills & Clark, 1982). In *exchange* relationships (e.g., relationships with strangers or business partners; Clark, 1984), the norm of reciprocity is rather explicit and members are expected to reciprocate others' favors by providing comparable benefits. In *communal* relationships (e.g., friendships, romantic, and family relationships), reciprocity is also important but is often tacit and fulfilled over a relatively long term. In these relationships, people are concerned about each other's well-being and feel obligated to respond to one another's need for social and emotional support. Therefore, at early stages of friendship development, people's perception of a person's ability to satisfy this need is a key determinant of their willingness to build a quality relationship with the person (Clark & Monin, 2006; Laurenceau, Barrett, & Pietromonaco, 1998; Reis, Clark, & Holmes, 2004). Moreover, the quality and efficacy of a relationship deteriorate if reciprocal exchange is not maintained (Adler & Kwon, 2002; Robison, Schmid, & Siles, 2002).

In short, friendships remain viable only to the extent that the individuals can fulfill their obligations to respond to one another's social and emotional needs (Blau, 1964; Homans, 1961; Walster, Berscheid, et al., 1973). In initiating a friendship, therefore, people should prefer others who appear to be more capable of satisfying these needs. Because a person's resources in terms of materials, time, and attention are necessarily limited and must be distributed over the person's

friends, the benefits or support that others can expect to derive from a relationship with someone who has a large number of friends is likely to be low (Gargiulo & Bernassi, 1999; Hansen et al., 2001; Tooby & Cosmides, 1996). To this extent, people who are motivated to receive social benefits from a relationship should prefer to form a quality relationship with someone who has a relatively small number of friends.

Furthermore, people have a strong need for uniqueness and distinctiveness in social interactions (Brewer, 1991; Snyder & Fromkin, 1977, 1980) and they are drawn to others who treat them accordingly (Flynn & Brockner, 2003; Lind & Tyler, 1988; Thibaut & Walker, 1975). In romantic relationships, for example, people show greater desire for a partner who expresses unique and selective liking for them than for one who shows unselective liking for others (Eastwick et al., 2007; Walster, Walster, Piliavin, & Schmidt, 1973). Because the time and attention that a person can give to others are finite, interpersonal valuation and regard are also a form of limited resource. Therefore, when people's motivation to establish a friendship is stimulated by a desire for social attention and regard, they are likely to believe that their need will be better satisfied if they form a relationship with someone who has a relatively small number of friends.

These considerations suggest that people may prefer to make friends with someone with a relatively small number of friends because of their concerns about the quality of the relationship. There could be other bases for this preference, of course. For example, people might feel sympathy for someone with very few friends (Perlman & Peplau, 1981; Scheier, Carver, Schulz, Glass, & Katz, 1978) and might wish to be kind. Alternatively, people might make negative personality inferences regarding a person with an excessively large number of friends (Tong, Van Der Heide, Langwell, & Walther, 2008). These motives could sometimes influence

people's friendship choices as well. However, because the exchange of resources is the key motivation for initiating a relationship (Blau, 1964; Homans, 1958, 1961; Thibaut & Kelley, 1959), we expect a person's resource availability to be the primary determinant of others' desire to establish a friendship with him or her.

### **Egocentric Biases in People's Predictions**

However, people might overlook others' concerns about relationship quality when they predict their relative attractiveness to others. This could result in part from the egocentric bias that is inherent in people's judgments of others more generally (Critcher & Dunning, 2009; Epley, Keysar, Van Boven, & Gilovich, 2004; Nickerson, 1999; Ross & Sicoly, 1979; Van Boven, Dunning, & Loewenstein, 2000). People often infer others' attitudes and values by consulting their own knowledge and this is particularly true when the judgments pertain to themselves (Boothby, Cooney, Sandstrom, & Clark, 2018; Chambers, Epley, Savitsky, & Windschitl, 2008; Gilovich, Medvec, & Savitsky, 2000; Scopelliti, Loewenstein, & Vosgerau, 2015). For example, people are influenced by their personal knowledge of their performance in private when they predict how others evaluate them (Chambers et al., 2008). Similarly, they base their inferences of how much others like them on their own self-evaluations, assuming that others share the same perceptions (Boothby et al., 2018).

We propose that an egocentric bias is likely to operate when people predict the number of friends that others prefer them to have. That is, they do not consider others' concerns about relationship quality and base their prediction on the number of friends they personally consider to be desirable. As a result, they infer that they are more attractive when they have many friends and thus make predictions that diverge from others' actual preferences.



## Overview

In the current research, we focused on relationships that are communal in nature (Casciaro, Gino, & Kouchaki, 2014; Clark & Mills, 1979). In doing so, we examined both face-to-face friendships and those that are formed on the Internet (e.g., online social network sites [SNSs]). Online communications have become an integral part of people's social network activities (Walther, 1996). People are less inclined to use SNSs to meet strangers who are totally disconnected from their everyday life than to "communicate with people who are already a part of their extended social network" (boyd & Ellison, 2008). Online platforms facilitate the development of relationships with real life friends and acquaintances (Peter, Valkenburg, & Schouten, 2005; Zywicki & Danowski, 2008) and are an important avenue through which people maintain their connections with others when they move from one offline community to another (Ellison, Steinfield, & Lampe, 2007).

Therefore, although connections on the Internet are not always based on friendships, we nevertheless expect the dynamics that govern most online friendships to be similar to those that govern face-to-face interactions (boyd & Ellison, 2008; Ellison et al., 2007; Kim & Yun, 2008; Marcus, Machilek, & Schutz, 2006). Supporting this proposition, studies showed that self-claims and presentations in online communications are largely genuine and accurate (Marcus et al., 2006; Vazire & Gosling, 2004). Further, the development and maintenance of online relationships are also bound by cultural and social norms, including reciprocity (Kim & Yun, 2008). Indeed, evidence that people's interpersonal attractiveness in online SNSs can decrease as the number of friends they have increases (Tong et al., 2008; Utz, 2010) is consistent with our hypothesis. We therefore assume that the effect we propose would be evident in both actual and online contexts.

We tested our conceptualization in six studies. In doing so, we focused on the relative discrepancy between participants' predictions and their preferences rather than the absolute number of participants who chose a large or a small number of friends in each condition. We first examined participants' choices in a pair of scenario studies. These studies confirmed the different processes that underlie people's predictions and their preferences by analyzing participants' reasons for their choices (Study 1a) and their rankings of the influence that different personal attributes had on their judgment (Study 1b). Study 2 then provided support for our assumptions that (a) people have greater concerns about the quality of a relationship when they select others to become friends than when they predict others' preferences for them and (b) their preferences for the number of friends others have are driven by their concerns about the resources that those persons can provide in the relationship. Study 3 showed that reminding participants of their reciprocal obligations in social relationships led their predictions to be more in line with others' actual preferences.

Three other studies provided evidence of the ecological validity of the friend number paradox by conducting real life speed-friending events in which the participants engaged (or expected to engage) in actual interactions for the purpose of forming long-term friendships. In Study 4, participants registered for a speed-friending event to be held on campus. This study showed that participants' predictions deviated from others' actual preferences even though they believed that accurate predictions could enhance their likelihood of engaging in an interaction. In Study 5, participants viewed bogus profiles of people in an actual speed-friending event and either ranked their own attractiveness relative to the others or ranked their preferences for the others. This study confirmed that an egocentric bias contributed to participants' predictions.

Finally, participants in Study 6 created genuine profiles of themselves and selected one person in the speed-friending event to build a friendship with based on information in those profiles.

To ensure adequate power, we adopted sample sizes of at least 50 participants per condition in our studies. For all the studies, we conducted our analyses only after the data collection was complete. All data and materials are available via [https://osf.io/rw9j6/?view\\_only=91fa799983cb407a9e5efd82aa82288b](https://osf.io/rw9j6/?view_only=91fa799983cb407a9e5efd82aa82288b). This research received IRB approval.

## Study 1

Study 1a and Study 1b investigated the hypothesized mismatch using scenarios that asked about people's preferences when forming friendships in an online SNS. Although it is difficult to estimate the number of connections a person has in real life, this information is often available to the public in online platforms. Furthermore, both Study 1a and Study 1b provided initial insight into the different processes that underlie people's predictions and preferences. To do so, participants in Study 1a explained the reasons for their choices by responding to an open-ended question while participants in Study 1b ranked the influence that different personal attributes had on their judgments.

### Study 1a

Participants in Study 1a were randomly assigned to either a *prediction* condition or a *preference* condition. In the prediction condition, participants predicted whether someone would be more likely to make friends with them if they had a relatively large number of friends or if they had a relatively small number of friends. In the preference condition, they indicated whether

they were more likely to make friends with someone who had a relatively large number of friends or with someone who had a relatively small number of friends. In each case, participants were asked to provide reasons for their choices.

**Method.** One hundred two participants from Amazon's Mechanical Turk ( $M_{\text{age}} = 35.21$ , 60 males; demographic information for one participant was missing) completed a short survey. We limited participation in our current studies on Mechanical Turk to residents of the United States.

Participants were reminded that Facebook is one of today's most widely used online social network sites. In the prediction condition, they were asked to predict whether others were more likely to make friends with them when their Facebook page showed that they had 500 friends or when it showed that they had 50 friends. In the preference condition, they were asked to indicate if they were more likely to make friends with someone whose Facebook page showed that he or she had 500 friends or with someone whose Facebook page showed that he or she had 50 friends. After participants made their judgments, they answered an open-ended question in which they explained the reasons for their choices. Finally, same as in the later studies, participants provided their demographic information.

**Results.** Participants' choices confirmed the friend number paradox: 71% (36/51) of the participants in the prediction condition predicted that others were more likely to make friends with them when they had 500 rather than 50 Facebook friends. In contrast, only 31% (16/51) of the participants in the preference condition indicated that they prefer to make friends with someone who had 500 Facebook friends,  $\chi^2(1) = 15.69$ ,  $p < .001$ .

Two coders who were blind to our hypothesis sorted the participants' reasons for their choices into three categories. One category consisted of reasons that reflected concerns about the quality of the relationship (e.g., "I know they would have less time for me;" "I like someone with just a few friends who will give each of them some attention;" and "They probably invest more time in having quality relationships and not just tons of friends"). The second category contained inferences about a person's personality traits (e.g., "Having more friends shows that you are popular;" "It would show that I am more sociable and open;" and "It shows that I am more friendly and social"). The third category contained reasons that did not belong to either of the above two groups, and reasons that were trivial or unclear. Differences in the two coders' categorizations were resolved through discussion. One participant did not provide his or her reasons.

Consistent with our conceptualization, the proportion of reasons that concerned relationship quality was greater in the preference condition (43%; 22/51) than in the prediction condition (24%; 12/51),  $\chi^2(1) = 4.41, p = .036$ . In contrast, the proportion of reasons that pertained to inferences about personality traits was greater in the prediction condition (57%; 29/51) than in the preference condition (27%; 14/51),  $\chi^2(1) = 9.05, p = .003$ . The proportion of reasons that fell into the third category did not differ in the two conditions,  $\chi^2(1) = 1.21, p = .272$  (for a complete summary of all the reasons provided by the participants, see Supplemental Information, Appendix A).

## **Study 1b**

In Study 1b, we assessed participants' predictions and preferences using separate ratings instead of choices. Moreover, to provide further evidence of the different processes underlying

participants' predictions and preferences, we gave them a list of attributes that pertained to either relationship quality or personality traits and asked them to rank the attributes in terms of the influence they had on their judgments. We predicted that attributes related to relationship quality should be ranked as more influential in the preference condition than in the prediction condition while the opposite should be true for attributes related to personality traits.

**Method.** Two hundred participants from Amazon's Mechanical Turk ( $M_{\text{age}} = 35.76$ , 90 males) completed a short survey. They were randomly assigned to conditions of a 2 (prediction or preference)  $\times$  2 (number of friends: large or small) between-participants design. They read that the median number of Facebook friends of adults in North America is about 200. Participants in the *prediction* condition were asked to imagine that the number of friends they had on Facebook was either in the 95<sup>th</sup> (large number condition) or in the 30<sup>th</sup> (small number condition) percentile of the population and were asked to predict the extent to which others were likely to make friends with them on Facebook. Participants in the *preference* conditions were asked to imagine that the number of Facebook friends that another person had was either in the 95<sup>th</sup> (large number condition) or in the 30<sup>th</sup> (small number condition) percentile of the population and were asked to indicate the extent to which they were likely to make friends with that person on Facebook. Participants indicated their answer along a scale from 1 (not at all likely) to 7 (very likely).

On the next page, participants in the prediction condition were given five attributes and were asked to rank them in terms of the influence they had on others' willingness to make friends with them. Participants in the preference condition were given the same attributes and were asked to rank them in terms of the influence they had on their willingness to make friends with others. Two of the five attributes ("value attached to friendship quality" and "involvement

in friendships”) pertained to relationship quality and two others (“popularity” and “sociability”) pertained to personality traits. A fifth attribute (“networking resources”) with no direct implications for relationship quality or personality traits was used as a filler to make the contrast between the other attributes less obvious. The attributes were presented to participants in random order. Finally, participants reported the actual number of friends they had on Facebook. We included this variable as an exploratory item in the current study. Please see Supplemental Information for relevant results.

**Results.** A 2 (prediction or preference)  $\times$  2 (number of friends: large or small) between-participants analysis of variance yielded a significant interaction,  $F(1, 196) = 30.95, p < .001$ , partial  $\eta^2 = .14$ , indicating a mismatch between participants’ predictions and their preferences. Participants in the prediction condition predicted that others were more likely to make friends with them when they had a large number of friends ( $M = 5.31, SD = 1.19$ ) than when they had a small number of friends ( $M = 3.72, SD = 1.26$ ),  $F(1, 196) = 34.57, p < .001, d = 1.30$ , 95% CI [1.10, 2.08]. In contrast, participants in the preference condition reported being more likely to make friends with someone who had a small number of friends ( $M = 3.98, SD = 1.44$ ) than with someone who had a large number of friends ( $M = 3.45, SD = 1.46$ ),  $F(1, 196) = 3.92, p = .049, d = .37$ , 95% CI [-0.04, 1.10]. These findings have therefore conceptually replicated the results in Study 1a.

Participants’ rankings of the attributes were reverse-coded so that higher values indicated greater influence. Figure 1 shows the ranked influence of each attribute in the prediction and preference conditions. Consistent with our prediction, the results of Mann-Whitney U tests revealed that the influence of the two attributes pertaining to relationship quality was higher in the preference condition than in the prediction condition (value attached to friendship quality:

4.19 vs. 2.93,  $U = 2745$ ,  $p < .001$ ; involvement in friendships: 3.74 vs. 3.17,  $U = 3520$ ,  $p < .001$ ). In contrast, the influence of popularity and sociability was lower in the preference condition than in the prediction condition (popularity: 1.61 vs. 2.98,  $U = 2377$ ,  $p < .001$ ; sociability: 3.13 vs. 3.51,  $U = 3949$ ,  $p = .007$ ). The rankings of the filler attribute did not differ in the two conditions,  $p = .987$ .

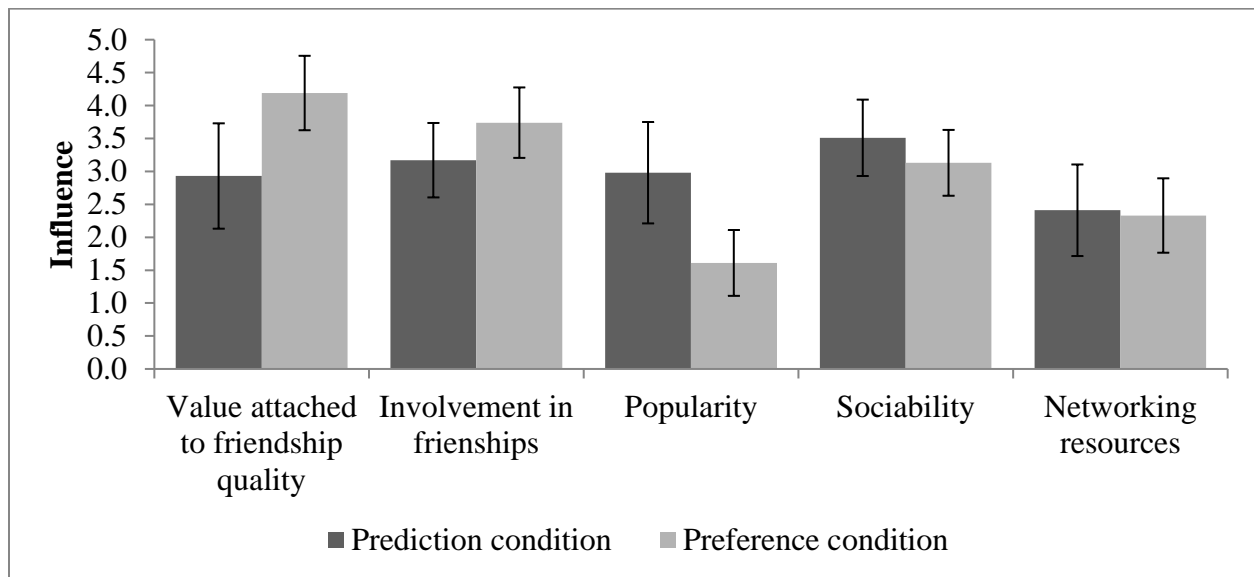


Figure 1. Rankings of the five attributes in terms of their influence (reverse-coded), Study 1b ( $N = 200$ ). The error bars represent standard deviations.

## Discussion

Studies 1a and 1b showed that the friend number paradox occurred in hypothetical scenarios regarding friendship initiation on the Internet. A scrutiny of participants' reasons in Study 1a revealed evidence that was consistent with our assumption that people are more concerned about relationship quality when they select others to initiate relationships than when they predict others' preferences for them. Participants' rankings of different personal attributes in



Study 1b provided further support for our conceptualization. Relationships formed on the Internet do not always induce the expectation of mutual support. Nevertheless, our findings suggest that the hypothesized mismatch is relevant to most online relationship contexts in which people use the Internet to develop and maintain their social network.

## Study 2

Study 2 extended findings in the previous studies in two aspects. First, the scenario focused on friendships in real life situations rather than in online communities. Second, the study provided evidence of the mediating role of concerns about relationship quality. We predicted that participants would report greater concerns about relationship quality in the preference condition than in the prediction condition and that these different concerns would account for the different judgments they made in those conditions.

### Method

One hundred participants from Amazon's Mechanical Turk ( $M_{\text{age}} = 36.59$ , 52 males; one participant reported age that was larger than 200 and was excluded when calculating the mean) completed a short survey. They were randomly assigned to either the prediction condition or the preference condition. They read that the median number of friends for adults is around 100. Those in the *prediction* conditions predicted whether another person was more likely to make friends with them when they had 200 friends or when they had 50 friends. Participants in the *preference* condition indicated whether they were more likely to make friends with a person who had 200 friends or with a person who had 50 friends.

On the next page, participants read that the researchers wished to understand the basis for their responses and were given descriptions of four possible concerns about the relationship. In the preference condition, the items were: (a) “the depth of relationship I expect to have with the individual;” (b) “the quality of relationship I expect to build with the individual;” (c) “the extent to which I expect the individual to value his or her relationship with me;” and (d) “the extent to which I expect the individual to be involved in his or her relationship with me.” The items in the prediction condition were similar with the role of the protagonist being reversed (e.g., “the depth of relationship the individual expects to have with me”). Participants reported the extent to which each of these thoughts had influenced their choices along scales from 1 (did not occur to me at all) to 7 (influenced my choice to a great extent). Their responses to these items were averaged to form a single measure of concerns about relationship quality ( $\alpha = .90$ ).

## Results

**Predictions versus preferences.** Replicating our previous results, 72% (36/50) of the participants in the prediction condition predicted that another individual was more likely to make friends with them when they had 200 friends instead of 50 friends. However, only 22% (11/50) of the participants in the preference condition preferred making friends with the individual who had 200 friends to making friends with the one who had 50 friends,  $\chi^2(1) = 25.09, p < .001$ .

**Mediation.** Consistent with our prediction, participants in the preference condition reported to have greater concerns about the expected quality of the relationship ( $M = 5.20, SD = 1.50$ ) than did those in the prediction condition ( $M = 4.33, SD = 1.44$ ),  $F(1, 98) = 8.88, p = .004, d = .59, 95\% \text{ CI } [0.29, 1.45]$ . The results of a bootstrapping analysis (Hayes, 2013) were consistent with the assumption that participants’ concerns about relationship quality mediated the

effect of condition on their choices: with 10,000 bootstrap samples, the indirect effect of concerns about relationship quality was estimated to be  $-.92$  (boot  $SE = .54$ ), with a 95% bias-corrected confidence interval  $(-2.23, -0.25)$  excluding zero.

### Follow-up Study

To explore whether the observed effect depended on the absolute numbers of friends that were identified as “large” or “small,” we conducted a follow-up study in which we examined the friend number paradox using six combinations of numbers of friends. Six hundred fourteen participants were recruited from Amazon’s Mechanical Turk ( $M_{age} = 36.39$ , 323 males; demographic information for one participant was missing). They were randomly assigned to conditions of a 2 (prediction or preference)  $\times$  6 (number combinations) between-participants design. The procedure was the same as that in the main study. Participants read that the median number of friends for adults is around 100. However, the absolute numbers of friends used in the scenarios varied over six conditions: 2 vs. 5, 2 vs. 50, 30 vs. 50, 2 vs. 200, 50 vs. 200, and 200 vs. 1000.

Table 1  
*Results of the follow-up study, Study 2.*

Combinations of numbers of friends	Number (%) of participants favoring the option with more friends		<i>p</i> -value from chi-square test
	(a) Prediction condition	(b) Preference condition	
(1) 2 vs. 5	44 (86%)	19 (37%)	< .001
(2) 2 vs. 50	43 (84%)	18 (36%)	< .001
(3) 30 vs. 50	34 (64%)	14 (27%)	< .001
(4) 2 vs. 200	32 (63%)	14 (26%)	< .001
(5) 50 vs. 200	26 (52%)	11 (22%)	.002
(6) 200 vs. 1000	25 (50%)	4 (8%)	< .001

The results are summarized in Table 1, which compares (a) the proportion of participants who predicted that others were more likely to make friends with them when they had a large number of friends (in the prediction conditions) with (b) the proportion of participants who indicated that they were more likely to make friends with a person who had a large number of friends (in the preference conditions). In each number combination, the proportion was higher in the prediction condition than in the preference condition, suggesting that the hypothesized mismatch occurred regardless of the absolute numbers of friends being compared.

## **Discussion**

Study 2 demonstrated the friend number paradox using scenarios that concerned friendships in real life. Further, the results of our mediation analysis were consistent with our assumption that different concerns about relationship quality underlie the current effect. In addition, the follow-up study confirmed that the mismatch does not depend on the absolute numbers of friends being considered.

Moreover, findings of the follow-up study could rule out some alternative explanations of the effect. For example, one might speculate that participants would feel pity for someone who has very few friends and chose the person as a friend for this reason (Perlman & Peplau, 1981; Scheier et al., 1978). However, the results in Table 1 indicate that the friend number paradox was evident even when the numbers of friends being compared were large. In fact, participants' preference for the person with relatively fewer friends decreased as the absolute number of the person's friends became smaller.

Another possibility is that people make negative inferences about the personality of someone who has an excessively large number of friends (Tong et al., 2008). The evidence that

participants' preferences for a person with relatively more friends decreased as the absolute number of the person's friends became greater (see Table 1) is consistent with this account. However, the friend number paradox was also observed when the numbers of friends being compared were small. Therefore, inferences about personality are unlikely to account for our findings.

### Study 3

Our conceptualization assumes that the friend number paradox arises partly because people fail to take others' concerns (i.e., the social rewards that the relationship can provide) into account when they predict others' preferences for having them as a friend. If this is true, reminding people of their reciprocal obligations in social relationships should convey the salience of others' concerns about relationship quality and thereby adjust their predictions towards others' actual preferences. To examine this possibility in the current study, we added a condition in which participants were asked to think about what their friends would expect of them before making their predictions. We expected that the proportion of participants who predict themselves to be more attractive when having a relatively *small* number of friends would be greater in the newly added condition than in the prediction condition.

#### Method

Two hundred five participants from Amazon's Mechanical Turk ( $M_{\text{age}} = 33.31$ , 121 males; one participant did not report his or her age) completed a short survey. Participants were randomly assigned to three between-participants conditions. The prediction and the preference conditions were the same as those in Study 2. In the third, *prediction-with-reminder* condition,

participants first read that the researchers were interested in their thoughts about questions such as “what does it require to be a good friend?” They were asked to think about what others would expect them to do as a friend under various circumstances. They provided their answers by completing sentences of the form: *He (She) expects me to \_\_\_\_\_ when \_\_\_\_\_*. (They were provided with an example: “She expects me to listen to her when she breaks up with someone.”) They were asked to provide at least three and at most five answers. They then predicted whether others were more likely to make friends with them when they had 200 friends or 50 friends.

## Results

Participants’ choices varied significantly over the three conditions,  $\chi^2(2) = 31.18, p < .001$ . Replicating our previous findings, 79% (56/71) of the participants in the preference condition preferred a person with 50 friends over one with 200 friends, whereas only 32% (23/71) of the participants in the prediction condition predicted that others preferred to make friends with them when they had 50 friends,  $\chi^2(1) = 31.07, p < .001$ . The proportion of participants who made the same prediction, however, was significantly greater in the prediction-with-reminder condition (57%; 36/63),  $\chi^2(1) = 8.30, p = .004$ , though it still differed from the above-mentioned proportion in the preference condition,  $\chi^2(1) = 7.33, p = .007$ .

## Discussion

Findings of Study 3 were consistent with our prediction. That is, reminding participants of the reciprocal obligations of being a quality friend could draw their attention to the criteria that others would use in friendship selection and consequently decreased the discrepancy between their predictions and others’ preferences. These results therefore provided further support for our conceptualization.

## Study 4

To provide stronger evidence of the ecological validity of the friend number paradox, the next three studies tested our hypothesis in speed-friending events in which the participants engaged (or expected to engage) in actual interactions for the purpose of forming meaningful and potential long-term friendships. In Study 4, university students were invited to register online for a speed-friending event to be held on campus. In the prediction condition, participants in the course of registration created a profile that was ostensibly to be viewed by others. During the process, they were given the option of reporting either a relatively small number of friends or a relatively large number of friends in constructing their profile in order to maximize their attractiveness to others and to increase their likelihood of engaging in interactions in the event. In the preference condition, participants viewed profiles of two others with different numbers of friends during the online registration and chose the person with whom they preferred to interact.

### Method

**Participants.** Students at a major Asian university were invited to register online for a speed-friending event. The invitations were sent via the university's mass mail system over a 4-week period. One hundred twelve students (48 males) completed the online registration.

**Procedure.** Upon entering the registration website, participants read the event outline and completed an online consent form<sup>1</sup>. Those who chose to participate in the event then provided some personal information. Participants were randomly assigned to either the

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<sup>1</sup> All materials and instructions in Studies 4 to 6 were in English.

prediction condition or the preference condition. In the *prediction* condition, participants were instructed to create a personal profile so that other participants could view it and decide whether or not to interact with them in the event. They were explicitly encouraged to make their profile appear as attractive as possible. They first provided both their full name and nickname, and chose the one that they preferred to use in their profile. Next, they were given two definitions of friends. One, *exclusive* definition read:

“Friends can refer exclusively to persons with whom you have established a strong tie in terms of care, regard, and support. They are persons whom you have known for a long time and have many mutual memories. They are persons with whom you can and are willing to share your experiences, be they times of adversity or good times. They are persons who are always there to offer you a hand, caring for your well-being.”

The other, *inclusive* definition read:

“More broadly, friends can refer to any person with whom you are acquainted and have a bond of mutual affection or respect. They can be persons with whom you have established a strong tie (as defined above), and they can also include persons who you meet and interact with from time to time, at certain occasions, or in group situations.”

Participants estimated the number of friends they had on the basis of each definition. They then chose one of these estimates to add to their profile. They were told that the two definitions were equally appropriate and that others who view their profile would not know which definition they were adopting. Next, participants indicated their hobbies from a list of five options (movies, music, reading, sports, and travel) and the types of ethnic foods they liked from another list



(Chinese, Indian, Japanese, Korean, and Thai). Finally, they submitted their profile to the online system.

In the *preference* condition, participants did not create their profile. Instead, they were told that they would view the online profiles of participants who registered the event earlier and select the individuals with whom they prefer to interact in the event. They then viewed the profiles of two persons who differed only in the number of friends they had—one person had 50 while the other had 200—and chose one of them to interact with. To better cover the purpose of the study and to make the survey meaningful to participants, they also chose between two other pairs of profiles that differed either in hobbies or in liked ethnic foods, but had the same number of friends.

In fact, the speed-friending event was not conducted, and a debriefing e-mail was sent to the participants.

## Results

The average number of friends reported by participants in the prediction condition was smaller based on the exclusive definition ( $M = 14.92$ ,  $SD = 17.57$ ) than based on the inclusive definition ( $M = 81.50$ ,  $SD = 161.04$ ), paired- $t(49) = 3.04$ ,  $p = .004$ ,  $d = .43$ , 95% CI [22.55, 110.61] (five participants who provided the same number of friends under each definition were excluded from further analyses). Supporting our hypothesis, 53% (24/45) of the participants in the prediction condition chose to display a relatively large number of friends in their profiles. In contrast, only 26% (16/62) of the participants in the preference condition chose to interact with the person who had a relatively large number of friends,  $\chi^2(1) = 8.44$ ,  $p = .004$ . Participants' answers to the other questions were irrelevant to our hypothesis and were not analyzed.

## Discussion

Study 4 presented initial evidence of the friend number paradox in a real life context. Further, the study demonstrated that the mismatch between participants' predictions and preferences persisted even when they believed that accurate predictions of others' preferences could enhance their likelihood of engaging in interactions in the event. However, the speed-friending event was not actually held and participants responded to the questions without actually seeing and anticipating interacting with the potential friends. We addressed this limitation in our next two studies.

## Study 5

Study 5 provided evidence of the friend number paradox in a real speed-friending event in which participants anticipated interacting with each other. Furthermore, it examined the role of an egocentric bias in people's predictions and provided insight into why people overlook others' concerns when predicting their preferences. Because of the importance of friendships in people's social lives (Baumeister & Leary, 1995; Coleman, 1988), we expected that most people prefer to have a relatively large number of friends. When they predict others' preferences for the number of friends they have, therefore, they are likely to base their predictions on what they personally consider to be desirable (Boothby et al., 2018; Gilovich et al., 2000) and hence expect that others are more drawn to them when they have a relatively large number of friends.

Specifically, Study 5 adopted a 2 (prediction or preference)  $\times$  2 (number of friends: large or small) between-participants design. Participants registered and participated in the speed-friending sessions in groups of four. Before they interacted with each other, they first viewed

bogus profiles of the participants in their session and completed a survey. In the prediction condition, the number of friends described in the participants' own profile was manipulated to be either large or small relative to that of the other three persons in the session. In the preference condition, participants only saw the profiles of the other three persons and the number of friends described in one profile (the *target* profile) was manipulated to be either large or small relative to that of the other two. After viewing the profiles, participants ranked the persons in their session in terms of their attractiveness as a friend in the speed-friending event. The key variable of interest was the participants' ranking of themselves in the prediction condition or their ranking of the target profile in the preference condition.

To evaluate the effect of the egocentric bias, participants reported their general desire to have a relatively large number of friends in the course of their registration. Moreover, in the prediction condition, after viewing the profiles, participants rated the desirability of the description of their number of friends in their own profile. We predicted that participants in the large number condition should perceive their profile to be personally more desirable than those in the small number condition and that this perception should underlie their ranking of their own attractiveness.

## **Method**

**Participants.** The study was conducted at two universities in Asia. Invitations to register for the speed-friending event were sent to the participants via e-mails. Two hundred seventy-two students joined the speed-friending event ( $M_{\text{age}} = 20.58$ , 73 males).

**Registration.** Before joining the event, participants completed an online registration form similar to that described in Study 4. They were told that they would provide some information

about themselves and that we would create their profiles to be used in the event based on the information. They were first given a brief definition of friends:

“Friends refer to persons who have a bond of mutual affection, regard, and support. They include persons who have known each other for some time and have mutual memories or experiences; and/or persons who meet, communicate, and interact with each other frequently; and/or persons who can help each other.....etc.”

They then estimated the number of friends they had. They also reported their hobbies and the types of ethnic foods they liked from two lists, each consisting of ten options<sup>2</sup>.

On the next page, participants answered four questions. Two of the questions were fillers and the other two questions assessed their desire to have a relatively large number of friends (“I wish to have a lot of friends in my life;” and “I hope I can have a large number of friends instead of only a small number of friends in my life”). Participants answered the questions along scales from 1 (strongly disagree) to 7 (strongly agree) and their responses were averaged ( $r = .75$ ).

**Bogus profiles.** In fact, we did not create the participants’ profiles based on the information they provided. Rather, we constructed bogus profiles in which the description of the number of friends that they (in the prediction condition) or another person (in the preference condition) had was manipulated. At the event, each participant received a profile preview page on which four bogus profiles were shown (for samples, see Supplemental Information, Appendix B) and were identified by letters (A, B, C, or D). The profiles included descriptions of three attributes of a person: number of friends, personality (ostensibly derived from the person’s

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<sup>2</sup>The list of hobbies included watching movies, listening to music, reading books, playing sports, travelling, hiking, collecting, dancing, cooking, and photography. The list of ethnic foods included Chinese, Indian, Japanese, Korean, Thai, American, Spanish, Indonesian, Vietnamese, and French.

reported hobbies), and liked ethnic foods. Participants were randomly assigned one of the above four letters as their participant ID before the event and their ID was indicated in the top-right corner of their profile preview page.

In the *prediction* condition, we manipulated the description of number of friends in participants' own profile. The personal profile of half of the participants indicated that they had "quite a large number of friends" whereas the other three profiles indicated that those people had a relatively small number of friends. The personal profile of the other half of the participants indicated that they had "quite a small number of friends" and the other three profiles indicated a relatively large number of friends<sup>3</sup>.

In the *preference* condition, participants' own profile was left blank on their profile preview page and one other profile was selected as the target profile. Specifically, the target profile was always the one next to the participants' (e.g., if a participant's profile was A, then the target profile was B; if a participant's profile was D, then the target profile was A). We manipulated the description of number of friends in the target profile using the method described above. For all the profiles in both conditions, the descriptions of personality were highly similar and non-specific<sup>4</sup> and the descriptions of liked ethnic foods were identical ("mostly like Eastern foods").

**Procedure for the event.** Participants were informed at the beginning of the session that their real identities were to be kept anonymous and that they would be identified by their

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<sup>3</sup> The phrases used to describe the number of friends in the other three profiles were "a couple of", "a few", and "several" in the former condition and "a lot of", "plenty of", and "dozens of" in the latter condition. The last phrase ("several" or "dozens of") in each set was not used in the preference condition as there were only two other profiles in addition to the target profile.

<sup>4</sup> The description in each profile used a combination of three words from the following: artistic, passionate, open, creative, energetic, sensible, enthusiastic, and prudent.

participant IDs throughout the event. They were further informed that they would interact with each of the other persons in the session and decide whether or not to exchange contact information and potentially become a long-term friend with the person.

Before having their interactions, however, participants received their profile preview page and a pre-interaction questionnaire. At this time they only knew their own participant ID but not those of the others. In the prediction condition, participants rank-ordered the persons in their session (including themselves) in terms of their relative attractiveness as a friend in the session, with 1 indicating the person who would be chosen most often by the others as a friend and 4 indicating the person who would be chosen least often. They then answered four questions on the back of the questionnaire, two of which were fillers and the other two assessed their perception of the desirability of the number of friends described in their own profile (“The description about my number of friends looks good to me;” and “The description about my number of friends is consistent with what I desire to have in life”). Participants answered the questions along scales from 1 (strongly disagree) to 7 (strongly agree) and their responses were averaged ( $r = .53$ ). In the preference condition, participants rank-ordered the other three persons in their session, with 1 indicating the person whom they would be most likely to choose as a friend and 3 indicating the person whom they would be least likely to choose.

Next, participants’ pre-interaction questionnaires were collected and their participant IDs were disclosed to each other. Participants then engaged in actual interactions with one another. After each interaction, they indicated on an interaction record whether or not to exchange contact information with the person. They also responded to two questions that assessed the pleasantness of the interaction (“How pleasant was the interaction?” and “Do you think you and your interaction partner can become good friends?”). They answered the questions along scales from 1

(not at all/I don't) to 7 (very/I do) and their responses were averaged. If both persons in an interaction agreed to exchange, we sent their contact information to each other via e-mail after the event.

## Results

**Predictions versus preferences.** No participant reported suspicion about the profiles on the profile preview page when filling the pre-interaction questionnaire. Participants' ranking of themselves (in the prediction condition) or of the target profile (in the preference condition) was normalized using min-max normalization as shown in the below formula:

$$\text{Normalized rank} = \frac{\text{rank} - \min(\text{rank})}{\max(\text{rank}) - \min(\text{rank})}$$

where the minimum rank was 1 in both conditions and the maximum rank was 4 in the prediction condition or 3 in the preference condition. One participant in the preference condition did not provide his or her ranking of the target profile. We then examined the current effect using a nonparametric method suggested by Leys and Schumann (2010). Supporting our hypothesis, the results revealed a significant interaction effect between condition (prediction or preference) and number of friends,  $F(1, 267) = 15.76, p < .001$ , partial  $\eta^2 = .06$ , indicating a mismatch between participants' predictions and preferences. Further results of Mann-Whitney U tests showed that the participants in the prediction condition ranked themselves higher in terms of attractiveness as a friend when their profile showed that they had a large number of friends ( $M_{\text{normalized rank}} = 0.39$ ) rather than a small number of friends ( $M_{\text{normalized rank}} = 0.64$ ),  $U = 1461, p < .001$ . In the preference condition, participants' ranking of the target profile did not significantly depend on whether the target profile indicated a large number of friends ( $M_{\text{normalized rank}} = 0.47$ ) or a small

number of friends ( $M_{\text{normalized rank}} = 0.40$ ),  $U = 1988$ ,  $p = .356$ , though the direction of the results was consistent with our hypothesis.

**Tests of the egocentric bias account.** We first looked at participants' general desire to have a large number of friends. Participants' reported desire ( $M = 4.64$ ,  $SD = 1.48$ ) was significantly greater than the mid-point of the scale,  $t(271) = 7.15$ ,  $p < .001$ ,  $d = .43$ , 95% CI [0.47, 0.82]. The result was therefore consistent with the assumption that most people personally desire to have a relatively large number of friends.

Furthermore, in the prediction condition, participants perceived their profile to be more desirable when it conveyed that they had a large number of friends ( $M = 4.52$ ,  $SD = 1.24$ ) than when it conveyed that they had a small number of friends ( $M = 3.74$ ,  $SD = 1.30$ ),  $F(1, 136) = 13.03$ ,  $p < .001$ ,  $d = .61$ , 95% CI [0.35, 1.21] (one participant in the small number condition did not answer the questions). The results of a bootstrapping analysis were consistent with the assumption that participants' perceptions mediated the effect of condition (large versus small number of friends) on their ranking of themselves: with 10,000 bootstrap samples, the indirect effect of the perceived desirability of profiles was  $-.03$  (boot  $SE = .02$ ), with a 95% bias-corrected confidence interval  $(-0.0757, -0.0007)$  excluding zero. These results are therefore consistent with an egocentric bias account of our findings.

## Discussion

Participants who anticipated actually interacting in a speed-friending event predicted that others would be more attracted to them when they had a large number of friends than when they had a small number of friends. These predictions, which resulted in part from an egocentric bias, were significantly different from others' actual preferences. These results therefore provided



evidence of the friend number paradox in a situation that involved real social interactions. In this study, however, participants' preferences for interacting with others did not depend on the number of friends that the others had. The null result could be due to decreased salience of differences in others' profile information or the influences of other factors (e.g., hobbies) on participants' friendship preferences.

We also examined whether there was any effect of our manipulations on participants' reported pleasantness of the interactions. Because participants in the prediction condition viewed others' bogus profiles that were highly similar with each other, we did not expect our manipulation of number of friends to influence the average pleasantness of their interactions and this was in fact the case,  $p = .222$ . In the preference condition, it was possible that participants' reported pleasantness of interacting with a target person with a small number of friends might differ from that of interacting with a target person with a large number of friends. However, this was not the case,  $p = .268$ . Moreover, in both the small number and the large number conditions, participants' reported pleasantness of interacting with the target person did not differ from that of interacting with the non-target persons,  $ps > .200$  (see Supplemental Information for details).

In Study 5, participants based their judgments on bogus information and their rankings had no impact on their actual interactions in the speed-friending event. Therefore, this study did not demonstrate whether or how the friend number paradox could affect people's actual friendship choices. We addressed this issue in Study 6.

## Study 6

Study 6 confirmed the friend number paradox in a speed-friending event in which the participants created and responded to genuine profiles of one another. They chose one of the other participants with whom they preferred to interact and only those who were mutually selected engaged in a conversation. Besides, each participant indicated his or her preference for the others and predicted the others' preferences as well.

## **Method**

**Participants.** Two research assistants greeted students on the campus of a large Asian university and invited them to take part in a speed-friending event. Those who agreed were escorted to a nearby room in which the event was held. A session began when three participants entered the room. Two hundred thirteen participants (109 males) took part in the event.

**Procedure.** Before each session began, participants were informed that their real identities were to be kept anonymous and that they would be randomly identified as participant A, B, or C. They were given an information sheet with their participant ID indicated in the top-left corner and they did not know the IDs of the other two persons. They provided three pieces of information to be included in their profile: the number of friends they had, their hobbies, and the types of ethnic foods they liked. They were given the same definition of friends used in Study 5 and they selected their hobbies and liked ethnic foods from the same lists used in Study 4. A research assistant then collected the information sheets and copied the profiles on a whiteboard. Participants also indicated their sex and whether or not they knew either of the other two persons. This information, however, was not presented on the whiteboard.

Next, participants viewed the profiles on the whiteboard and received a selection sheet. They were asked to choose one person with whom they wanted to be friends and were informed

that mutually selected persons could interact privately for five minutes and decide whether or not to exchange contact information for future correspondence. They indicated their participant ID on the selection sheet and chose the person with whom they preferred to interact. In addition, they predicted the choices of the other two persons in the session.

The research assistant then collected the selection sheets and determined whether two persons had selected each other. If no mutual selection occurred, the session ended. Otherwise, the assistant politely dismissed the unmatched participant and told the remaining two participants that they could converse freely and privately for about five minutes. After the interaction, they were given an interaction record similar to that used in Study 5. They indicated whether or not to exchange contact information with the other person and reported the pleasantness of the interaction using the same measures as those in Study 5. Their responses were averaged ( $r = .62$ ). As in Study 5, we sent the participants their contact information to each other via e-mail only if both agreed to exchange.

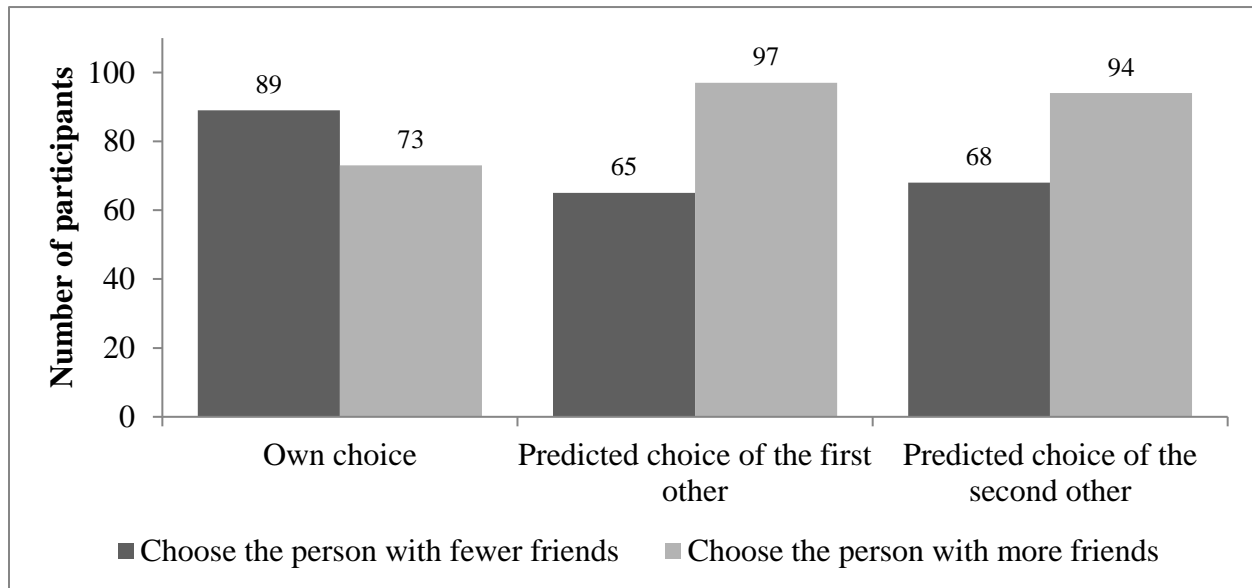
## **Results**

Two participants, each from a different session, did not specify their number of friends (instead writing “many” and “a lot”). The data from the six participants in these two sessions were excluded, leaving a final sample size of 207. Ninety-eight percent (202/207) of the participants indicated that they did not know either of the other two persons in their session.

Participants (a) indicated their choice for the other two persons in the session for engaging in an interaction and (b) predicted the respective choice that the other two persons made. In testing our hypothesis, a participant’s data were not used if he or she chose between two persons who had an equal number of friends or had to predict another person’s choice

between two persons (themselves and the third participant) with an equal number of friends.

Data of these participants and of those who had at least one of these measures missing were excluded from Cochran's  $Q$  test (see below). This led to an exclusion of 45 participants, leaving 162 participants in the analysis.



*Figure 2.* Participants' choice for the other two persons in their session and their predictions of the respective choice that the other two persons made, Study 6 ( $N = 162$ ). The other two persons are here referred to as *the first other* and *the second other* according to alphabetical order of their participant IDs. Because the assignment of participant IDs to participants was random and anonymous, the strategy ensured that participants' predictions were randomly allocated to two repeated measures to fit the format of Cochran's  $Q$  test.

The procedure used in this study ensured that participants' choices and predictions were not affected by the grouping structure and that the data were independent between individuals. Therefore, we evaluated whether there was a difference between participants' choices and their predictions of others' choices using Cochran's  $Q$  test. Consistent with our hypothesis, the results indicated that participants' predictions of others' choices differed significantly from their own choices,  $\chi^2(2) = 8.62, p = .013$  (see Figure 2). Fifty-five percent (89/162) of the participants

chose to interact with the person with fewer friends. In contrast, in only around 40% of the cases did participants predict that others would choose to interact with the individual with fewer friends (for additional analyses of participants' choices and predictions, see Supplemental Information, Tables S1-S3).

## Discussion

Study 6 provided further evidence of the ecological validity of the friend number paradox by examining actual choices of friendships made by the participants. Furthermore, we analyzed the participants' likelihood of engaging in interactions and the results showed that those with the largest number of friends in their session were significantly less likely to engage in interactions than the others in the session,  $p < .001$ . Therefore, having a large number of friends apparently put participants at a disadvantage in the speed-friending event. However, further analysis revealed that participants' reported pleasantness of the interactions did not depend on the relative number of friends they had in the session,  $p = .411$ . Further, participants who chose to interact with the person with fewer friends reported a similar level of pleasantness with those who chose to interact with the person with more friends,  $p = .741$  (see Supplemental Information, Table S4 for details). Thus, there was no evidence that the number of friends that participants had affected the quality of their interactions.

Additional analyses (see Supplemental Information, Table S5) provided evidence that the friend number paradox persisted when attributes other than number of friends were considered. Specifically, participants chose to interact with a person who on average had relatively more hobbies and tastes in ethnic foods that matched with theirs,  $ps < .001$ . In the same vein, they were more likely to predict that the others would choose to interact with the one who had relatively more matched hobbies and tastes in ethnic foods,  $ps < .002$ . The results therefore

suggested that these attributes were taken into consideration by participants both in forming their preferences and in making their predictions. Importantly, the attributes' effects were in the same direction for participants' preferences and their predictions, and therefore participants' considerations of these attributes cannot account for the mismatch we observed. However, as in Study 5, the presence of these factors might have influenced the participants' friendship preferences and attenuated the current effect.

Study 6 was non-experimental in nature. Therefore, one alternative explanation of the findings might be that people who have a large versus a small number of friends differ systematically with respect to certain observable characteristics (e.g., friendliness or sincerity), and that perceptions of these characteristics could drive participants' choices and predictions. We cannot completely rule out this possibility in the current study. However, participants in the current study had a limited opportunity to signal their personal qualities to the others before they made their judgments<sup>5</sup> (though people's perceptions of others' personality can sometimes be accurate based on very brief exposures to the individuals [Ambady & Rosenthal, 1993]). Further, if it is indeed true that people with different number of friends differ in those attributes, then the quality of the interactions should depend on the number of friends participants had. As discussed above, however, our results suggested that this was not the case.

## **General Discussion**

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<sup>5</sup> The research assistant supervising the event remained in the room from the time when the first participant in a session entered and the participants were not allowed to talk with one another before the interaction.

People expect that others prefer to initiate a friendship with them if they have a relatively large number of friends. When they initiate friendships with others, however, they prefer to form friendships with those who have relatively few friends. Our findings confirm this friend number paradox in both scenario studies and real life social events, and show that the effect is robust among diverse samples consisting of participants from different cultures.

Our research provides insight into the processes that underlie this mismatch. When selecting others as friends, people are primarily concerned about the quality of the relationships. They believe that a large number of friends is a social liability that depletes others' ability to build quality relationships with them. Consequently, they prefer to form a friendship with someone who has relatively few friends. When people predict others' preferences for them, however, they exhibit an egocentric bias and overlook others' concerns about relationship quality. Instead, they focus on the positive personality traits that are associated with having a large number of friends (Gilovich, Epley, & Hanks, 2005). As a result, they perceive that a relatively large number of friends is an indication of social capital that increases their attractiveness to others.

The current studies provide support for these propositions. Study 1a and Study 1b showed that people are more likely to base their choice on concerns about relationship quality when they choose others to become friends but are more likely to use personality traits as the basis of their judgment when they predict others' preferences for them. Study 2 confirmed that a difference in concerns about relationship quality accounts for the effect of different perspectives (preference versus prediction) on people's choices. Study 3 showed that people's predictions become more in line with others' preferences when they are reminded of their obligations to reciprocate in social relationships. Study 5 confirmed that people's failure to consider others' concerns about

relationship quality results in part from an egocentric bias when making their predictions. These processes were evident in actual situations in which people have an opportunity to interact with others for the purpose of making long-term friends (Studies 5 and 6).

### **Other Factors Underlying the Paradox**

Our findings confirmed the role of an egocentric bias in the current effect. People's predictions deviate from others' actual preferences partly because they infer that the criteria others use to evaluate them are similar to those they use to evaluate themselves (Critcher & Dunning, 2009; Epley et al., 2004; Nickerson, 1999; Ross & Sicoly, 1979). Previous research also shows that an egocentric bias can lead to errors in predicting others' preferences and hence can hamper social exchange (Flynn & Brockner, 2003; Van Boven et al., 2000; Zhang & Epley, 2009).

Other factors, however, could also contribute to the current phenomenon. For example, people are often motivated to enhance their self-evaluations (Rosenberg, 1979; Sedikides, 1993). To this extent, they tend to interpret information in ways that reflect positively on themselves (Critcher, Helzer, & Dunning, 2010) and this tendency can be reflexive and automatic (Gilovich et al., 2005). Therefore, people's motivation for self-enhancement could also predispose them to focus on the desirability of having a large number of friends and hence to overlook others' concerns about relationship quality.

Moreover, people who desire high status within a social network might perceive that they have a better chance of attaining this status if others in the network have relatively few friends (Clark & Mills, 2012). On the other hand, the preference for forming relationships with persons who have few friends could stem in part from a fear of being rejected (Eder, 1985; Eisenberger et



al. 2003; McDonald & Leary, 2005). Finally, people could derive happiness from their acts of giving (Clark & Monin, 2006; Dunn, Aknin, & Norton, 2008; Harbaugh, Mayr, & Burghart, 2007). In this regard, they might believe that their support is more likely to be solicited and appreciated by individuals with few friends<sup>6</sup>. These factors could contribute to the friend number paradox independently of the mechanism we identified in the current research.

### **When Is the Paradox Likely to Occur?**

The mismatch we propose in this research is restricted to communal relationships in which reciprocal exchange and relationship quality are a central concern (Blau, 1964; Clark & Mills, 1979; Walster, Berscheid, et al., 1973). In instrumental or professional relationships, people initiate the relationships as a means of obtaining other benefits and may attach relatively little importance to interpersonal intimacy or the quality of the relationships (Casciaro et al., 2014). In these cases, they might prefer others who can facilitate their access to a broader social network (Granovetter, 1973; Wolff & Moser, 2009) and should therefore find individuals who have a large number of friends to be more attractive. Even in personal relationships, motives other than the exchange of support can sometimes play a role and potentially offset the current effect. Among adolescents, for example, a wide range of personal attributes (e.g., physical attractiveness) can contribute to an individual's popularity (Parkhurst & Hopmeyer, 1998) and friendships with popular peers are important in gaining social status and visibility (Eder, 1985). Further, individual differences may also have an impact on our findings. For example, the preference we observed might be more pronounced for people with a communion orientation,

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<sup>6</sup> We thank an anonymous reviewer for raising these possibilities.

who attach greater importance to relationship quality, than people with an agency orientation, who may have lower demand for intimacy (Bakan, 1966; Wiggins, 1991).

Moreover, age and gender differences in friendship behavior might be relevant to the current effect (Carstensen, Isaacowitz, & Charles, 1999; Geary, Byrd-Craven, Hoard, Vigil, & Numtee, 2003; Hall, 2011). To examine this possibility, we combined data of Study 1a, Study 2 and its follow-up study, and the prediction and preference conditions in Study 3 ( $N = 958$ ; two participants did not report their gender and four did not report their age) because these studies have adopted a highly similar design and have recruited participants of both genders (55% male) and a wide range of ages ( $M = 35.83$ ,  $SD = 11.67$ ,  $Min = 18$ ,  $Max = 81$ ) from a same population. We first conducted a logistic regression with participants' choice (small number = 0, large number = 1) as dependent variable and their condition, age, and the interaction as independent variables. The results indicated that the interaction was not significant,  $p = .155$ , suggesting that age could not moderate the effect we observed. Result of further analyses showed that age had a marginally significant effect in the preference condition,  $B = -.015$ ,  $Wald(1) = 2.84$ ,  $p = .092$ , but its effect in the prediction condition was non-significant,  $p = .764$ .

Next, a similar analysis was conducted to investigate the effect of gender (female = 0, male = 1). The interaction was not significant,  $p = .432$ , suggesting that gender could not moderate the current effect either. Results of further analyses showed that the coefficient of gender was non-significant in the preference condition,  $B = .303$ ,  $Wald(1) = 2.07$ ,  $p = .150$ , but was significant in the prediction condition,  $B = .531$ ,  $Wald(1) = 7.15$ ,  $p = .008$ . The latter result suggests that males were more likely than females to predict that others would want to make friends with them when they had a large number of friends. Thus, age and gender may have some influences on people's preferences or predictions, as suggested by findings of past research

(Carstensen et al., 1999; Geary et al., 2003; Hall, 2011). However, there was no evidence that age or gender could moderate the current effect.

### **Friendship Implications**

The friend number paradox could have adverse effects on people's efficacy in forming desirable friendships. When initiating a relationship with others, people often engage in self-promotions in an effort to signal their positive attributes. Therefore, although people might attempt to convey the impression of having a lot of friends in their interactions with others, this could actually discourage the others from pursuing a long-term relationship with them. Other research also suggests that people often err in such social signaling, leading others to make negative judgments about them (Berman, Levine, Barasch, & Small, 2015; Scopelliti et al., 2015; Sezer, Gino, & Norton, 2018).

However, some considerations may arise in generalizing our findings to friendship formation in real life. For example, in initiating a relationship with others, people often pay attention to factors in addition to others' network size (e.g., similarity of interests), the impact of which could potentially override the effect we observed. Indeed, these factors have played a role in our speed-friending studies and might in part explain why the results in these studies did not support our hypothesis as strongly as those in studies that used abstract vignettes.

Further, it may be important to keep in mind that people's preferences as we observed result from their *beliefs* about the limited time and energy that individuals with many friends are able to invest in their friendships. Whether these beliefs have a strong basis in reality, however, remains a meaningful question to investigate. To examine this issue, we conducted a supplementary study on MTurk ( $N = 200$ ; see Supplemental Information for details). The study

confirmed participants' belief that people with a relatively large number of friends on average have less time and energy to invest in their friendships ( $p = .001$ ). Further, the average time that participants reported to have spent with each of their friends correlated negatively with the number of friends they had ( $r = -.23, p = .027$ ). These results therefore suggest that people with a relatively large number of friends may indeed have a disadvantage with respect to the time and energy they could invest in building quality relationships.

### **Conclusion**

To conclude, our findings echo those of previous research, supporting the argument that people can be poor at predicting how they are evaluated by others (Chambers et al., 2008; Kenny & DePaulo, 1993). Such errors in prediction can often lead to socially non-adaptive behaviors (Anderson, Ames, & Gosling, 2008; Berman et al., 2015; Scopelliti et al., 2015; Sezer et al., 2018). Consequences of the friend number paradox could be particularly costly because they undermine people's efficacy in initiating and developing social relationships that are fundamental to their well-being. Although our studies focused on friendships, future research is warranted to examine the theoretical and practical implications of the current effect in other relationship contexts.

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