Original Article

Reputation management: Why and how gossip enhances generosity

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A R T I C L E   I N F O

A B S T R A C T

We advance a framework for understanding why and how gossip may promote generosity and cooperation, especially in situations that can result in greater indirect benefits from others. Drawing on evolutionary theory, we derive novel hypotheses about how two reliably recurring properties of human social networks – they are "small" and contain fewer well-connected people – provide insight about when people may maximize *indirect* benefits of generosity. Across three studies, we find support for the hypothesis that people increase their generosity when the recipient (or an observer) is connected and can gossip to at least one or many others whom they might interact with in the future. Moreover, reputational concern, rather than expected indirect benefits from one's future partners, primarily mediated this observed gossip-based generosity, and the mediation effect of reputational concern was statistically more pronounced for proselfs than for prosocials. We discuss the importance of these findings in the context of evolutionary perspectives on human cooperation, along with some novel insights about how properties of social networks influence social behavior.

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1. Introduction

Reputation exchange through gossip is important for the evolution of human cooperation among genetically unrelated individuals (Milinski, Semmann, & Krambeck, 2002; Nowak & Sigmund, 2005). The functions of gossip and reputation have been studied in various disciplines (Feinberg, Willer, Stellar, & Keltner, 2012; Macfarlan, Remiker, & Quinlan, 2012), and the broad conclusions are that (a) gossip and reputation promote cooperation, (b) people do gossip about others' (un)cooperative behaviors, and (c) people benefit from a cooperative reputation and also condition their cooperation on others' reputation. Yet, the nascent research on reputation-based cooperation has not examined its psychological mechanisms in social networks. The adaptive benefit of reputation-based cooperation is clear (Griskevicius, Tybur, & Van den Bergh, 2010; Sylwester & Roberts, 2010), but the *how* – the proximate mechanisms underlying this phenomenon – has received less attention.

The present research adopts an evolutionary framework to understand how gossip and reputation promote generosity and cooperation. We hypothesize that natural selection may have shaped psychological mechanisms to identify opportunities when cooperation will promote a positive reputation and lead to indirect benefits. This perspective assumes that two properties of social networks – they are densely connected, but unevenly distributed in terms of their members' network connections – can identify specific situations where cooperation results in greater indirect benefits. Therefore, we hypothesize that people would condition their cooperation on whether their partner can gossip to (a) at least one or (b) many others with whom they anticipate future interactions.

While the hypothesized proximate mechanism may function to identify opportunities to promote a good reputation, this mechanism may not involve explicit and conscious calculations of potential indirect benefits. We further examine if the enhanced cooperation in response to these features of social networks can be explained by (a) a motivational concern for one's reputation and/or (b) estimated indirect benefits. Below, we elaborate on the importance of indirect reciprocity in the evolution of cooperation and some hypothesized information processing procedures that may promote generosity and cooperation.

1.1. Indirect reciprocity and the evolution of gossip-based cooperation

Although evolutionary perspectives can explain cooperation among genetic relatives (Hamilton, 1964) and unrelated strangers interacting over time (Trivers, 1971), they have difficulty explaining cooperation among strangers with uncertain future interdependence (for an exception, see Delton, Krasnow, Cosmides, & Tooby, 2011). One solution to this challenge is that human social networks contain systems of indirect reciprocity, where cooperators gain a good reputation and receive future indirect benefits from third parties (Nowak & Sigmund, 2005). Mathematical models demonstrate that cooperation among strangers can flourish when people condition their cooperation on partner reputation (Leimar & Hammerstein, 2001; Panchanathan & Boyd, 2004).

Indeed, people act more cooperatively when their behavior affects reputation (Griskevicius et al., 2010; Van Vugt & Hardy, 2010), or when their partner would gossip (Beersma & Van Kleef, 2011; Piazza & Bering, 2008). People also have a strong tendency to gossip about others to affect their reputation (Foster, 2004). Importantly, people condition their cooperation on others' reputation, and gossip can still exert an influence even when people can observe others' behavior

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(Sommerfeld, Krambeck, Semmann, & Milinski, 2007; for a recent review, see Van Lange, Joireman, Parks, & Van Dijk, 2013).

Yet, prior theorizing has not seriously considered how the psychology of individuals has been shaped through natural selection to harness the fitness benefits and avoid the fitness costs associated with gossip in a system of indirect reciprocity. We suggest that this void may be filled by applying theory from evolutionary psychology to derive hypotheses about how specific characteristics of the social environment promote indirect reciprocity. In particular, we focus on potential psychological adaptations for reputation management.

1.2. Efficient reputation management

According to evolutionary psychology, the human mind contains a collection of specialized information processing procedures shaped through natural selection to encourage behaviors that have adaptively maximized fitness in the ancestral environment (Cosmides & Tooby, 2013; Delton et al., 2011). We generate hypotheses about human behavior from this perspective by specifying reliably recurring situations that posed fitness relevant outcomes in the ancestral past and outlining potential adaptive specializations that have evolved to influence behavior in these situations.

A cooperative reputation is relevant to one's fitness, because it precludes (or, at least, reduces) the costs of exclusion and secures future (in)direct benefits (e.g., food, support, materials, and information) from others in the network. But how can one manage a reputation as a cooperator? One solution would be to always cooperate with others. Yet, unconditional cooperation comes at a great cost, because unconditional cooperators are often taken advantage of (e.g., Kuhlman & Marshello, 1975; Van Lange & Visser, 1999). Indeed, evolutionary game theory suggests that unconditional cooperation is not a viable solution to promoting cooperation. Moreover, when a population contains abundant unconditional cooperators, unconditional defectors can thrive and take over a population (Nowak & Sigmund, 2005).

Hence, natural selection should have favored conditional cooperation with and generosity toward others in situations where those behaviors minimize costs of exclusion and maximize potential indirect benefits via enhanced reputation. Thus, one key fitness-relevant problem for a conditionally cooperative species such as humans involves determining when to selectively cooperate to receive direct and *indirect* benefits.

Properties of social networks might inform people when to cooperate. Recent research has revealed strikingly similar properties of social networks in large-scale modern societies and small-scale hunter–gatherer societies (Apicella, Marlowe, Fowler, & Christakis, 2012; Hamilton, Milne, Walker, Burger, & Brown, 2007; Hill et al., 2011; Porter, Mucha, Newman, & Warmbrand, 2005). In fact, research has derived several properties that characterize almost every social network, including online social networks that retain the essentials of real-world networks (McGlohon, Akoglu, & Faloutsos, 2011). We focus on two properties of social networks at any point in time – (a) they are "small" and (b) people differ in their number of connections – and describe how these properties highlight situations where one's behavior has a stronger effect on reputation and future indirect benefits/costs. Applying this framework, we derive two hypotheses about conditions that encourage generosity.

1.2.1. Single-tie hypothesis

One statistical property of social networks is that they are "small": it only takes a few connections (and often less than 6) to travel from one end of a social network to another (Dodds, Muhamad, & Watts, 2003; McGlohon et al., 2011; Watts, 1999). Given that this is the case for social networks in large modern societies, it was certainly true for hunter–gatherer societies with smaller and less mobile populations. We also note that information transfer, such as gossip about one's behavior, may extend to three degrees of separation in a social network (Fowler & Christakis, 2010; Lind, da Silva, Andrade, & Herrmann, 2007), and thus can easily permeate this small world. Thus, gossip about one's behavior, even from a single person, can potentially circulate and widely affect one's reputation within a social network. Therefore, in social interactions, people should be responsive to information about whether their interaction partner is connected with (and can gossip to) someone else within their network, and condition their behavior on this information. We hypothesize that people may selectively incur a cost to benefit others when the other is connected and can gossip to only one person in the network whom they might interact with in the future (*single-tie hypothesis*).

1.2.2. Multiple-ties hypothesis

Another statistical property of social networks is that there are fewer well-connected people than less well-connected people (Barabási & Albert, 1999; McGlohon et al., 2011; Watts, 2004). That is, the distribution of network members' connections is skewed: only a few people have more connections than the mode. This aspect of social networks has been observed in business firms (Axtell, 2001), scientific collaborations (Redner, 1998; Seglen, 1992), and movie-actor collaborations (Amaral, Scala, Barthelemy, & Stanley, 2000). If this reliable, ubiquitous property of social networks also existed in the ancestral environment, then one's interaction partner's network connections may indicate an opportunity to enhance indirect benefits through a cooperative reputation. Well-connected people have a relatively larger broadcasting potential to disseminate others' reputation, and this is especially the case when newcomers to social networks preferentially connect with well-connected members (Barabási & Albert, 1999). Therefore, people may be more willing to incur a cost to benefit someone who is connected and can gossip to more, compared to fewer, people with whom they anticipate future interactions (*multiple-ties hypothesis*). Indeed, research shows that people are more altruistic to well-connected members in their social networks (Curry & Dunbar, 2011), but the causal link between partner's network connections and generosity is not clear and the underlying mechanism remains to be tested.

1.2.3. Reputational concern and expected indirect benefits

Evolution may have selected for psychological mechanisms that enable people to respond to cues of when behavior affects reputation, so that people can secure a good reputation and acquire indirect benefits. Are people able to explicitly compute the potential benefits from a good reputation, and base their cooperative decisions on this? The hypothesized gossip-based cooperation may work through two potential (non-mutually exclusive) mechanisms: (1) concerns about reputational consequences of one's behavior and (2) estimated indirect benefits from the actions of others who know one's reputation. These two mechanisms represent alternative hypotheses suggested by evolutionary psychology and rational choice models.

From an evolutionary psychology perspective, natural selection may have favored an adaptation to condition cooperation on cues that have, at least in the ancestral past, been reliably related to reputational consequences, and ultimately, indirect benefits. The argument is that humans may have evolved a proximate concern for their reputation in response to recurrent situational cues of others' network connections and thus ability to gossip. Reputational concern involves concerns for others' collective beliefs about oneself — and such concerns can be activated by cues of others evaluating one's behavior (Emler, 1990; Sperber & Baumard, 2012). This perspective would predict that cues of gossip to others within one's social network may proximally activate concerns for one's reputation, which would motivate people to adjust their behavior to secure a good reputation. However, this process does not necessarily involve conscious calculation of potential indirect benefits of cooperation, although a good reputation guarantees opportunities for indirect reciprocity. Thus, reputational concern would be the main mechanism explaining the relation between gossip and generosity (*reputational concern as mediator hypothesis*).

However, rational choice models may stress one's ability to consciously estimate both the direct *and* indirect benefits/costs of different courses of action. For example, the theory of sequential reciprocity suggests that a person's ability to estimate the payoff in a situation is informed by beliefs of others' choices (Dufwenberg & Kirchsteiger, 2004). This perspective can be applied to indirect reciprocity: If people believe that a third party would condition their behavior on knowledge of one's past behavior, then they should adjust their current behavior based on their beliefs on how others will behave toward them. Thus, when the situation affords opportunities for indirect reciprocity, people may use cues of gossip to estimate proximate costs and benefits of various courses of action and then behave in ways to maximize their indirect benefits (Scott, 2000). Thus, this perspective would predict that expected indirect benefits would be the main mechanism explaining the relation between gossip and generosity (*expected indirect benefits as mediator hypothesis*).

Importantly, indirect benefits are often unforeseeable in daily life and it's difficult to estimate (a) how others will evaluate one's behavior, (b) whom others will gossip to, (c) whether one will ever interact with the gossip recipients, (d) whether the gossip recipients will extend benefits to oneself based on that gossip, and (e) whether potential indirect benefits will offset the present cost of generosity. Indeed, people may be unable to consciously estimate indirect benefits that result from a specific interaction (see Levine & Kurzban, 2006). Moreover, it would be difficult to learn through a generalized operant conditioning process on which actions result in delayed indirect benefits. Therefore, people may have difficulties identifying the situation where cooperation would result in indirect benefits. Prior research has not established if people do consciously estimate indirect benefits of behavior and condition behavior on those expectations. Although social situations often lack the information required to consciously estimate indirect benefits, the present studies provide this information to participants, so we can test the rational choice prediction that people estimate potential indirect benefits and behave generously to maximize those benefits.

1.3. Individual differences in reputation management

There may also be individual differences in strategic reputation management. Previous research suggests that people differ in their social value orientations (SVOs): prosocials tend to care more about others' outcomes than proselfs during social interactions (Balliet, Parks, & Joireman, 2009; Van Lange, 1999). Moreover, people who care less about others' outcomes, i.e., proselfs, tend to behave in ways that strategically manage their reputations (Feinberg et al., 2012; Simpson & Willer, 2008). Here we can test if proselfs, compared to prosocials, are more likely to up-regulate their generosity in contexts that could maximize indirect benefits via gossip and reputation. More importantly, we will test whether the mediation effects of reputational concern and expected indirect benefits vary depending on one's SVO, i.e., a two-stage moderated mediation model (see Fig. 1).

1.4. The present research

Across three studies, participants earned lottery tickets based on their decisions. Each lottery ticket represented a 0.05% chance to win a 2-dollar bonus. They decided how much to give to a recipient in a dictator game, where the recipient (Study 1 and 3) or an observer (Study 2) was connected and could gossip to 0, 1, 4 or 8 out of 8 of participants' potential future partners in a trust game. Thus we manipulated either second-party or third-party gossip to examine whether people increase their generosity in response to gossip to (a) at least one of their future interaction partners (vs. no gossip) (*single-tie hypothesis*), and (b) many (vs. fewer) of their future interaction partners (*multiple-ties hypothesis*). We also test (c) whether proselfs, compared with prosocials, are more likely to increase their generosity in response to gossip, and (d) whether the hypothesized changes in generosity
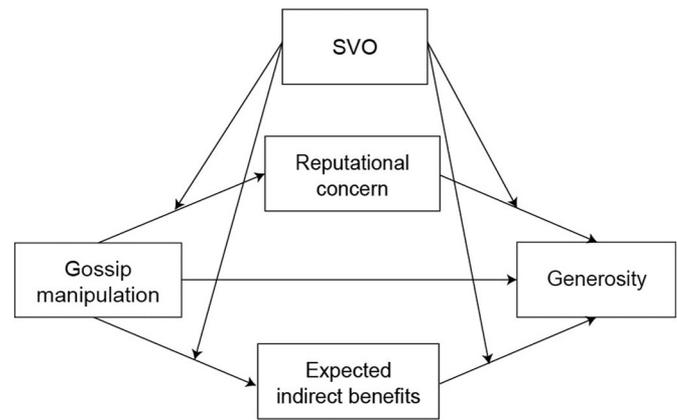

Fig. 1. The two-stage moderated mediation model.

are mediated by reputational concern and/or expected indirect benefits from their future partners, and (e) whether SVO moderates these processes.

2. Study 1: Second-party gossip

2.1. Methods

2.1.1. Participants and design

Participants ($N = 611$, 213 women; $M_{age} = 29.92$ years, $SD = 9.57$) recruited from Amazon Mechanical Turk (MTurk) completed the study for US$0.40. Nineteen participants were paid a 2-dollar bonus based on their decisions. We used a 4 (recipient's social connectivity: 0, 1, 4, 8) × 2 (SVO: prosocial, proself) between-participants design.[1]

2.1.2. Procedure and measures

Participants first completed six primary items of SVO Slider Measure to measure social value orientation (Murphy, Ackermann, & Handgraaf, 2011). They chose their preferred monetary allocation between themselves and an anonymous other. After calculating their index of SVO (i.e., SVO°), we categorized them into prosocials (SVO° > 22.45°) and proselfs (SVO° < 22.45°) (Brucks & Van Lange, 2007; Meleady, Hopthrow, & Crisp, 2013).

Participants learned the study involved 10 participants (i.e., Person A, B, C_1 to C_8). They first selected a number (1 to 10) for the system to assign them a code (Person A) and determine how many of the other 8 persons (C_1 to C_8) to be connected with Person B. Participants (Person A) interacted with Person B and Person C_x (randomly selected from C_1 to C_8) in two decision-making tasks (i.e., a dictator game and a trust game). They were informed that Person B was connected with 0, 1, 4 or 8 of the other 8 persons, and would send an evaluative message about their allocation decision to those connected with him/her. The manipulation check question was: How likely is it that Person C_x will know about your allocation decision in Task 1 (1 = *not at all likely*, 7 = *completely likely*)? Participants had to answer several comprehension check questions correctly before making their decisions in the two tasks.

2.1.2.1. Dictator game. Participants (Person A) acted as an allocator and freely distributed 100 lottery tickets between themselves and Person B (i.e., recipient) in the dictator game (Forsythe, Horowitz, Savin, & Sefton, 1994). The number of tickets they gave to Person B was the measure of generosity. After their decision, they completed a 6-item measure of reputational concern (e.g., "During the decision making task, I thought

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[1] Data for the 1-connectivity condition were collected approximately one month after the other three conditions (0-, 4-, and 8-connectivity). The findings of Study 2 suggest that this sampling procedure did not affect the results in Study 1. Participants were blocked from taking part in more than one of our studies.

about how others would think about me") on a 5-point scale ($\alpha = .84$; $1 = totally\ disagree$, $5 = totally\ agree$) adapted from Beersma and Van Kleef (2011).

2.1.2.2. Trust game. Participants (Person A) acted as the responder, with Person C_x being the investor in the trust game (Berg, Dickhaut, & McCabe, 1995). The investor was initially endowed with 100 lottery tickets and sent any of these to the responder. Any ticket sent to the responder was tripled, but the amount kept for oneself retained the same value. Afterward, the responder sent back any of the tripled amount to the investor. Before the trust game, participants reported their expected number of tickets Person C_x would send them (i.e., expected indirect benefits). They learned that Person C_x sent them 0 tickets, so they made no decision in the trust game. Lastly, participants learned about their earnings and were debriefed.

2.2. Results and discussion

2.2.1. Manipulation check
Participants perceived the likelihood that their future partner would know about their behavior differently across conditions ($Ms = 1.55$, 3.58, 4.41, and 5.79), $F(3, 607) = 123.12$, $p < .001$, $\eta_p^2 = .38$. Thus, the manipulation of recipient's social connectivity was successful.

2.2.2. Generosity
We created three orthogonal contrasts of recipient's social connectivity: Contrast 1 (0-connectivity vs. 1-, 4-, and 8-connectivity), Contrast 2 (1-connectivity vs. 4- and 8-connectivity), and Contrast 3 (4-connectivity vs. 8-connectivity). ANOVA on generosity revealed a significant effect of recipient's social connectivity, $F(3, 603) = 16.96$, $p < .001$, $\eta_p^2 = .08$. Planned comparisons yielded a significant Contrast 1, $F(1, 603) = 46.47$, $p < .001$, $\eta_p^2 = .07$, indicating more generosity when there was connectivity and gossip was possible by the recipient ($M = 42.26$, $SD = 23.91$) than when no connectivity existed ($M = 29.53$, $SD = 25.51$). Contrast 2, $F(1, 603) = 2.88$, $p = .09$, $\eta_p^2 = .005$, and Contrast 3, $F(1, 603) = 1.77$, $p = .18$, were not significant. Prosocials ($M = 47.22$, $SD = 21.33$) were more generous than proselfs ($M = 24.43$, $SD = 24.23$), $F(1, 603) = 161.64$, $p < .001$, $\eta_p^2 = .21$. The Recipient's Social Connectivity × SVO interaction was not significant, $F(3, 603) = 1.48$, $p = .22$.

2.2.3. Mediation analyses[2]
We first tested the two mediations using bootstrapping method (Preacher & Hayes, 2008). The total effect of Contrast 1 on generosity (*total effect* $= 3.19$, $p < .001$) became nonsignificant when both mediators were included (*direct effect* $= 0.69$, $p = .18$). Both reputational concern, $b = 2.23$, 95% CI [1.69, 2.88], and expected indirect benefits, $b = 0.27$, 95% CI [0.03, 0.58], had significant indirect effects, and these two indirect effects were statistically different, *Diff* $= 1.97$, 95% CI [1.31, 2.68].

Analysis of the two-stage moderated mediation (Hayes, 2013, 2015) yielded significant indirect effect of reputational concern for both proselfs, $b = 2.97$, 95% CI [2.08, 3.93], and prosocials, $b = 1.38$, 95% CI [0.87, 2.06], *Index* $= -1.59$, 95% CI [-2.69, -0.51]; the indirect effect of expected indirect benefits was not significant for proselfs, $b = 0.17$, 95% CI [-0.12, 0.64], but significant for prosocials, $b = 0.20$, 95% CI [0.03, 0.54], *Index* $= 0.03$, 95% CI [-0.44, 0.45].

Thus, Study 1 supported the single-tie hypothesis that participants were more generous toward a recipient who could gossip to at least one future partner (vs. no gossip). This effect did not differ between proselfs and prosocials. Support for the multiple-ties hypothesis was

limited: Participants were slightly more generous in response to gossip to multiple future partners. Reputational concern significantly mediated the effect of gossip on generosity, especially for proselfs, whereas the mediation of expected indirect benefits was not so robust, nor did it vary among proselfs and prosocials.

3. Study 2: Third-party gossip

Study 1 examined generosity toward a partner who might gossip to one or several of participants' potential future partners. We sought to extend this paradigm to a context where the gossiper is simply an observer not involved in the game. We refer to this as *third-party gossip*: People do often share information about others, although not personally affected by others' behavior. Thus, Study 2 aimed to examine whether the observed effects generalize from the recipient's social connectivity to a third-party observer's social connectivity (and ability to gossip).

3.1. Methods

3.1.1. Participants and design
Participants ($N = 605$, 310 women; $M_{age} = 33.48$ years, $SD = 11.46$) recruited from MTurk completed the study for US$0.40. Seventeen participants were paid a 2-dollar bonus. We used a 4 (observer's social connectivity: 0, 1, 4, 8) × 2 (SVO: prosocial, proself) between-participants design.

3.1.2. Procedure and measures
The procedure was similar to Study 1 with the following exceptions: The study involved 11 participants (i.e., Person A, B, X, C_1 to C_8). Participants (Person A) first interacted with Person B as an allocator in a dictator game, where Person X was an observer and would know about their allocation after their decision. Next, they interacted with all other Person Cs (i.e., investors) as a responder in a trust game. Before the trust game, they reported their expected average number of tickets sent by all other persons (C_1 to C_8) (i.e., expected indirect benefits). We informed participants that Person X was connected with 0, 1, 4 or 8 of the other 8 persons, and would send an evaluative message about their allocation to those connected with him/her. The manipulation check question was: How likely is it that all the other persons will know about your allocation decision in Task 1 ($1 = not\ at\ all\ likely$, $7 = completely\ likely$)?

3.2. Results and discussion

3.2.1. Manipulation check
Participants perceived the likelihood that all others would know about their previous behavior differently across conditions ($Ms = 1.55$, 2.86, 3.70, and 5.88), $F(3, 601) = 106.55$, $p < .001$, $\eta_p^2 = .35$. Thus, the manipulation of observer's social connectivity was successful.

3.2.2. Generosity
Similar to Study 1, we created three orthogonal contrasts of observer's social connectivity. ANOVA on generosity revealed a significant effect of observer's social connectivity, $F(3, 597) = 13.54$, $p < .001$, $\eta_p^2 = .06$. Planned comparisons yielded a significant Contrast 1, $F(1, 597) = 33.22$, $p < .001$, $\eta_p^2 = .05$, indicating more generosity when there was connectivity and gossip was possible by the observer ($M = 45.26$, $SD = 22.64$), than when no connectivity existed ($M = 34.21$, $SD = 25.58$). Contrast 2, $F(1, 597) = 3.74$, $p = .053$, $\eta_p^2 = .006$, and Contrast 3, $F(1, 597) = 3.20$, $p = .07$, $\eta_p^2 = .005$, were not significant. Prosocials ($M = 48.78$, $SD = 20.54$) were more generous than proselfs ($M = 30.91$, $SD = 25.25$), $F(1, 597) = 100.34$, $p < .001$, $\eta_p^2 = .14$. The Observer's Social Connectivity × SVO interaction was not significant, $F(3, 597) = 1.23$, $p = .30$.

3.2.3. Mediation analyses
Mediation analysis revealed that the total effect of Contrast 1 on generosity (*total effect* $= 2.77$, $p < .001$) became nonsignificant when

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[2] Unless otherwise mentioned, we used bootstrapping method based on 5000 bootstrap samples, with Contrast 1 as the independent variable and the other contrasts as covariates during model testing across our studies. We also report (a) statistical difference (*Diff*) between the two indirect effects, and (b) an index of moderated mediation (*Index*), indicating whether an indirect effect is statistically different among prosocials and proselfs.

both mediators were included (*direct effect* = 1.00, p = .07). Both reputational concern, b = 2.09, 95% CI [1.51, 2.78], and expected indirect benefits, b = −0.32, 95% CI [−0.65, −0.08], had significant indirect effects, and these two indirect effects were statistically different, *Diff* = 2.41, 95% CI [1.77, 3.12].

Analysis of the two-stage moderated mediation yielded significant indirect effect of reputational concern for both proselfs, b = 3.43, 95% CI [2.23, 4.75], and prosocials, b = 1.05, 95% CI [0.46, 1.68], *Index* = −2.38, 95% CI [−3.82, −1.04], whereas the indirect effect of expected indirect benefits was significant for proselfs, b = −0.53, 95% CI [−1.18, −0.07], but not significant for prosocials, b = −0.15, 95% CI [−0.45, 0.07], *Index* = 0.39, 95% CI [−0.15, 1.07].

Thus, Study 2 supported the single-tie hypothesis that participants were more generous when an observer could gossip to at least one future partner (vs. no gossip). This effect did not differ between proselfs and prosocials. We found limited support for the multiple-ties hypothesis: Participants were slightly (but not significantly) more generous in response to gossip to more than one future partner. Again, reputational concern significantly mediated the gossip-based generosity, especially for proselfs, whereas the mediation of expected indirect benefits was inconsistent with Study 1, nor did it vary among prosocials and proselfs.

4. Study 3: Testing an alternative explanation

Previous studies found that both second-party and third-party gossip promote generosity, and this effect was mainly mediated by reputational concern, but less consistently by expected indirect benefits from future partner(s). These results support our perspective that people up-regulate their generosity in response to gossip to future partner(s). Although we interpreted these findings in terms of an evolved information processing system for reputation management, it may be argued that people are selectively generous in the dictator game to gain more benefits in the trust game and maximize self-outcomes. Although the flipping signs of indirect effect of expected indirect benefits provided limited support for this account, we provide an additional test of this account by varying the trust game stake size.

In previous studies, participants could earn 100 and 300 lottery tickets at maximum in the dictator game and trust game. We treated this as a high-stake condition in Study 3, and added a low-stake condition where people earn only 30 lottery tickets at maximum in the trust game. If people act generously in the dictator game because they expect to earn more in the subsequent trust game, then in the low-stake condition they should not be generous or vary their generosity across the gossip conditions. However, if the proximate psychological mechanism has more to do with reputation than expected indirect benefits, then people should be more generous in the gossip conditions (vs. no gossip), even in the low-stake condition.

Study 3 would complement and extend prior studies in two respects. First, we manipulated gossip by informing participants that the recipient has an opportunity to send a note (whatever content) to others (Feinberg et al., 2012; Feinberg, Willer, & Schultz, 2014), rather than explicitly send an evaluative message. Second, we included a more comprehensive five-item measure of expected indirect benefits, which is psychometrically similar to that of reputational concern.

4.1. Methods

4.1.1. Participants and design

Participants (N = 1203, 598 women; M_{age} = 30.87 years, SD = 10.15) recruited from MTurk completed the study for US$0.40.[3] Thirty-five participants were paid a 2-dollar bonus. We used a 4 (recipient's social connectivity: 0, 1, 4, 8) × 2 (trust game stake size: high, low) × 2 (SVO: prosocial, proself) between-participants design.

4.1.2. Procedure and measures

The procedure was similar to Study 1, except for two manipulations: (a) Person B was connected with 0, 1, 4 or 8 of the other 8 persons, and would have an opportunity to send a note to those connected with him/her (*recipient's social connectivity*); (b) Person C_x in the trust game was initially endowed with either 100 (high stake) or 10 (low stake) lottery tickets (*trust game stake size*).

We kept the one-item measure of expected indirect benefits, i.e., percentage of lottery tickets they expected Person C_x to send them, and added an alternative five-item measure (α = .78; e.g., "Person C_x will think that I will respond in kind when he/she trusts me"; 1 = *totally disagree*, 5 = *totally agree*) adapted from validated trust scales (Klapwijk & Van Lange, 2009; Yamagishi & Yamagishi, 1994). As expected, these two measures were positively correlated, $r(1201)$ = .45, p < .001.

4.2. Results and discussion

4.2.1. Manipulation check

Participants perceived the likelihood that their future partner would know about their behavior differently across conditions (Ms = 1.85, 2.89, 3.44, and 3.91), $F(3, 1199)$ = 66.55, p < .001, η_p^2 = .14. Thus, the manipulation of recipient's social connectivity was successful.

4.2.2. Generosity

Similar to Study 1, we created three orthogonal contrasts of recipient's social connectivity. ANOVA on generosity revealed a significant effect of recipient's social connectivity, $F(3, 1187)$ = 13.06, p < .001, η_p^2 = .03. Planned comparisons revealed a significant Contrast 1, $F(1, 1187)$ = 20.22, p < .001, η_p^2 = .017, indicating more generosity when there was connectivity and gossip was possible by the recipient (M = 39.34, SD = 24.95) than when no connectivity existed (M = 31.80, SD = 23.77). Contrast 2, $F(1, 1187)$ = 15.14, p < .001, η_p^2 = .013, and Contrast 3, $F(1, 1187)$ = 3.90, p = .049, η_p^2 = .003, were also significant, indicating more generosity in the 4- and 8-connectivity conditions (M = 41.30, SD = 25.06) than the 1-connectivity condition (M = 35.53, SD = 24.33), and also more generosity in the 8-connectivity condition (M = 42.70, SD = 26.07) than the 4-connectivity condition (M = 39.87, SD = 23.94). Moreover, participants were more generous in the high-stake condition (M = 39.92, SD = 24.54) than in the low-stake condition (M = 34.90, SD = 24.95), $F(1, 1187)$ = 11.41, p = .001, η_p^2 = .01. Prosocials (M = 44.19, SD = 20.93) were more generous than proselfs (M = 24.45, SD = 26.60), $F(1, 1187)$ = 196.20, p < .001, η_p^2 = .14. There were nonsignificant Recipient's Social Connectivity × Trust Game Stake Size interaction, $F(3, 1187)$ = 2.54, p = .06, η_p^2 = .006, or all other interactions (ps > .27). [4]

4.2.3. Mediation analyses

Model testing using the one-item expected indirect benefits indicated that (a) reputational concern had a significant indirect effect, b = 1.48, 95% CI [1.13, 1.88], but expected indirect benefits did not, b = −0.13, 95% CI [−0.30. 0.006], *Diff* = 1.61, 95% CI [1.24, 2.02]; (b) the indirect effect of reputational concern was significant for both proselfs, b = 1.90, 95% CI [1.17, 2.69], and prosocials, b = 0.83, 95% CI [0.53, 1.18], *Index* = −1.07, 95% CI [−1.91, −0.29], whereas the indirect effect of expected indirect benefits was not significant for either proselfs, b =

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[3] Two participants reported impossible numbers for age and were excluded in the descriptive analysis of age.

[4] Auxiliary analyses on the potential age and gender differences in sensitivity to gossip across the three studies revealed that (a) except for a significant interaction between age and Contrast 2 in predicting generosity in Study 1, b = −0.15, $t(601)$ = −2.03, p = .043, there were no significant interactions between age and the other contrast variables in Study 1 (ps > .06), and no significant interactions between age and the three gossip contrasts in Study 2 (all ps > .21) or Study 3 (all ps > .30); (b) there were no significant interactions between gender and gossip manipulation in predicting generosity across three studies (ps > .29). Overall, these findings suggest that people with different ages, or men and women, tended to show similar pattern in generous behavior in response to gossip.

−0.08, 95% CI [−0.35, 0.05], or prosocials, $b = -0.13$, 95% CI [−0.32, 0.01], $Index = -0.05$, 95% CI [−0.29, 0.22].

Model testing using the five-item expected indirect benefits also indicated that (a) reputational concern had a significant indirect effect, $b = 1.43$, 95% CI [1.08, 1.81], but expected indirect benefits did not, $b = 0.11$, 95% CI [−0.005, 0.26], $Diff = 1.32$, 95% CI [0.94, 1.71]; (b) the indirect effect of reputational concern was significant for both proselfs, $b = 1.82$, 95% CI [1.11, 2.62], and prosocials, $b = 0.80$, 95% CI [0.51, 1.17], $Index = -1.01$, 95% CI [−1.83, −0.21], whereas the indirect effect of expected indirect benefits was not significant for proselfs, $b = -0.10$, 95% CI [−0.37, 0.08], but significant for prosocials, $b = 0.16$, 95% CI [0.04, 0.34], $Index = 0.27$, 95% CI [0.03, 0.56].

Alternative analysis with reputational concern and the one-item expected indirect benefits as mediators and trust game stake size as moderator revealed that (a) reputational concern consistently mediated the gossip-based generosity in the high-stake, $b = 1.69$, 95% CI [1.21, 2.24], and low-stake conditions, $b = 1.22$, 95% CI [0.77, 1.74], $Index = 0.47$, 95% CI [−0.22, 1.20]; (b) expected indirect benefits did not mediate this effect in either high-stake, $b = -0.08$, 95% CI [−0.29, 0.07], or low-stake condition, $b = -0.17$, 95% CI [−0.46, 0.02], $Index = 0.09$, 95% CI [−0.18, 0.40]. Model testing using the five-item expected indirect benefits also revealed consistent mediation of reputational concern across the high-stake and low-stake conditions, whereas expected indirect benefits did not.

Thus, Study 3 supported the single-tie and multiple-ties hypotheses. Participants were more generous in response to gossip to at least one or many of their future partners. Moreover, gossip promoted generosity even in the low-stake condition, which does not support a rational choice perspective. In fact, mediation analyses suggest that people were more generous in the gossip conditions out of reputational concern, opposed to the amount they expected to receive in the trust game. These results support our perspective that generosity is promoted by reputational concern activated by cues of gossip, rather than motivation to maximize indirect or overall self-outcomes.

We also found that people were more generous in the initial dictator game when the subsequent trust game involved high (vs. low) stakes. Although the absolute stake size in the dictator game was the same across conditions, the potential future payoff in the trust game was either high (0 to 300) or low (0 to 30). Consequently, people may perceive the maximum payoff of 100 tickets in the dictator game to be relatively *smaller* (vs. *larger*) when the subsequent trust game involved high (vs. low) stakes. Thus, our finding of more generosity in response to high-stake trust game may suggest that higher stake size leads to less cooperation. Indeed, previous research shows that higher stake size either leads to less cooperation or does not affect cooperation (Kocher, Martinsson, & Visser, 2008; Leibbrandt, Maitra, & Neelim, 2015; Novakova & Flegr, 2013; Raihani, Mace, & Lamba, 2013). There is need for future research on this topic.

5. Meta-analytic overview

Our studies complemented each other in the design and operationalization of gossip, but the methods and procedures were comparable (e.g., generosity measure). Therefore, we can conduct meta-analyses to summarize our findings and provide an additional test of the hypotheses. Below we report random-effects meta-analyses by estimating the standardized mean difference in generosity between conditions across three studies.

5.1. Single-tie hypothesis

Participants were consistently more generous in response to gossip to only one of their potential future partners, compared to the no-gossip condition, $d = 0.29$, 95% CI [0.13, 0.45].

5.2. Multiple-ties hypothesis

Participants were more generous in response to gossip to four, compared to one of their future partners, $d = 0.13$, 95% CI [0.02, 0.24]. They were also more generous in response to gossip to all their eight potential future partners, compared to only one, $d = 0.26$, 95% CI [0.15, 0.37], or four future partners, $d = 0.14$, 95% CI [0.03, 0.25].

5.3. Prosocial versus proself orientation

Both prosocials and proselfs tend to be more generous in response to gossip to one of their future partners (vs. no gossip), and this effect was not significantly different between proselfs, $d = 0.40$, 95% CI [−0.06, 0.85], and prosocials, $d = 0.29$, 95% CI [0.15, 0.43], $Q(1) = 0.18$, $p = .17$. When examining the mean difference in generosity in response to gossip to one, compared to eight out of eight potential future partners, we find no significant difference between proselfs, $d = 0.33$, 95% CI [0.14, 0.52], and prosocials, $d = 0.27$, 95% CI [0.13, 0.41], $Q(1) = 0.23$, $p = .63$.

6. General discussion

The present research advances a framework for understanding why and how gossip may promote generosity, especially in situations that can result in greater indirect benefits. We derived our hypotheses from two properties of human social networks: they are "small" and contain fewer well-connected people. Results supported the hypotheses: (a) People were more generous in response to gossip to one of their future partners (vs. no gossip). This was a small to medium positive effect size that generalized across studies ($d = 0.29$); (b) People were relatively more generous in response to gossip to all their eight (vs. one) potential future partners ($d = 0.26$). Moreover, reputational concern consistently mediated the effect of gossip on generosity, and this mediation was statistically more pronounced than that of expected indirect benefits. In fact, a meta-analysis across three studies suggests no mediation of expected indirect benefits, given its nonsignificant relation with the gossip contrast ($r = -.03$, 95% CI [−.07, .01]). Finally, both prosocials and proselfs tend to base their generosity on gossip, and reputational concern served as a significant mechanism explaining this tendency. However, the more pronounced indirect effect of reputational concern for proselfs (vs. prosocials) may suggest that proselfs are more susceptible to gossip cues — they tend to display stronger concerns for their reputation in response to gossip to at least one future partner, and this reputational concern was more predictive of their generosity, compared with prosocials, whose baseline level of generosity was relatively high.

6.1. An evolutionary perspective on reputation management

Prior theorizing suggests that when social interactions involve indirect reciprocity, cooperation can be an evolutionary stable strategy (Nowak & Sigmund, 2005). Yet, this work has not derived testable hypotheses about the proximate workings of specific adaptations humans possess to be selectively cooperative in social networks that, at least in the ancestral past, enabled people to maximize indirect benefits and minimize potential cost of exclusion.

We argued that two reliably recurring features of social networks in our past ancestral environment provide insight into specific situational cues that could have covaried with opportunities to maximize indirect fitness benefits via a cooperative reputation. First, social networks are "small" and densely connected (Watts, 1999), so gossip from even a single person may circulate widely throughout a social network. This implies that people may be more cooperative when their current partner is connected (and can gossip) to even a single member of their social network (single-tie hypothesis). Second, human social networks contain fewer well-connected (vs. less well-connected)

people (McGlohon et al., 2011), who may have more potential to spread others' reputation. Therefore, people may be relatively more generous to others who are more, compared to less, well-connected in their social network (multiple-ties hypothesis).

Across our studies, participants decided how much to give to a recipient in a dictator game, where the recipient (Study 1 and 3) or an observer (Study 2) was connected and could gossip to 0, 1, 4 or 8 out of 8 of participants' potential future partners in a trust game. Supporting the single-tie hypothesis, people were more generous in response to gossip to at least one of their potential future partners (vs. no gossip). Supporting the multiple-ties hypothesis, people were more generous in response to gossip to eight, compared to one or four out of eight future partners.

We suggest that evolution may have selected for an information processing system that uses information about others' network connections (and gossip capacity), which would activate reputational concerns that regulate the amounts of generosity and cooperation toward those others. Indeed, across our studies, we find support for this perspective from evidence that people condition their generosity toward an interaction partner on information about (a) whether this partner (or an observer) is connected and can gossip to at least one person in their network, and (b) this partner or an observer's degree of social connectivity within the network. Moreover, these effects are consistently mediated by concerns for one's reputation, and this mediation was more pronounced for proselfs than prosocials.

Our evolutionary perspective focuses on selection pressures from a system of reputation-based indirect reciprocity in social networks. Moreover, we recognize that social networks may also contain generalized exchange networks not based on reputation (e.g., Fowler & Christakis, 2010), whereby people who receive benefits from others are motivated to benefit other third parties. Levine and Kurzban (2006) suggested that evolution may have shaped specialized psychological mechanisms for conditional cooperation in response to cues that indicate when people can gain tertiary benefits in more dense social networks. Although our gossip manipulation could have potentially manipulated network density, we found that reputational concern was a robust mediator of the effect of gossip-based generosity — a psychological process not specified by a generalized exchange system, but well suited to a system of reputation-based indirect reciprocity. We recommend future research to further examine hypotheses about potential evolved psychological mechanisms on conditional cooperation in generalized exchange networks. Moreover, future research can pit these evolutionary hypotheses against alternative generalized learning accounts that posit that humans can learn through trial-and-error to estimate when current behavior will result in delayed indirect benefits.

6.2. Beyond a rational choice account of maximizing indirect benefits

Our findings could be alternatively explained by a rational choice approach to human behavior. According to this perspective, if people believe that others will condition their behavior on knowledge of one's past behavior, they should adjust their current behavior based on their beliefs about the benefits others will extend to them. Therefore, people may have used cues of gossip to estimate proximate costs and benefits of various courses of action, and then behaved generously in the dictator game to maximize their indirect benefits in the subsequent trust game. According to this perspective, expected indirect benefits would be the primary mechanism explaining why gossip increases generosity. We acknowledge that our first two studies left open this alternative account, because participants could potentially maximize their outcome in the trust game, if they acted generously in the dictator game because of gossip. Here, we provide four pieces of evidence to suggest that this alternative account is not a plausible explanation of our findings.

First, a rational choice account would predict that expected indirect benefits act as a primary mechanism explaining why gossip promotes

generosity. However, across our three studies, reputational concern consistently explains the effect of gossip on generosity, whereas expected indirect benefits less consistently mediates this effect. In fact, a meta-analysis of the three studies found no significant relation between gossip manipulation and expected indirect benefits ($r = -.03$, 95% CI $[-.07, .01]$). That is, people did not use the cues of gossip to update their expected indirect benefits from a future partner.

Second, if people were estimating indirect benefits of current behavior and attempting to maximize their material outcome during the experiment, then we would not expect generosity to vary across the gossip conditions when the subsequent trust game involved low stakes in Study 3. However, we found the opposite effect: People were still more generous in response to gossip to their future partner(s) even when the immediate costs for generosity and building a favorable reputation in the dictator game outweighed the potential indirect benefits in the low-stake trust game.

Third, a rational choice perspective would predict that the psychological process through which people behave generously to gain indirect benefits would be influenced by the potential size of indirect benefits. This would mean that the mediation of reputational concern and/or expected indirect benefits would only occur when the trust game involved high (vs. low) stakes in Study 3. However, we found that the trust game stake size did not affect the strength of the indirect effect of reputational concern, and the indirect effect of expected indirect benefits was not significant across both high- and low-stake conditions.

Finally, a rational choice account would predict that only proselfs, who usually strive to maximize their own outcomes, would be selectively generous in response to gossip, whereas prosocials would not differ (or have less increase) in their generosity across the gossip conditions. However, our meta-analysis suggested that both prosocials and proselfs exhibited greater generosity in response to gossip, and reputational concern was the underlying mechanism explaining gossip-based generosity.

To conclude, rather than a "rational" pursuit of material self-interest, we suggest that our findings are largely consistent with an evolutionary perspective on reputation management. In particular, evolution may have selected for adaptive specializations to detect cues about others' network connections (and gossip capacity) within one's social network, and adjust behavior in ways to enhance one's reputation. However, this process does not involve conscious calculation of potential indirect benefits that are unforeseeable across a lifetime, although a good reputation can promote indirect fitness benefits. Social networks contain a system of indirect reciprocity, which was important across human evolution by enabling people to secure indirect fitness benefits and avoid potential exclusion (Nowak & Sigmund, 2005). According to this perspective, humans have evolved a capacity to (a) extract situational cues about possibilities of gossip to others in their social network, (b) be concerned about their reputation in response to those cues, and (c) up-regulate their generosity and cooperation in response to specific cues of gossip within their social network.

6.3. Strengths, limitations, and directions for future research

We conducted our studies on MTurk with relatively low payment. However, MTurk has proven to be a reliable and valid source of data collection using economic games (Horton, Rand, & Zeckhauser, 2011), and participants' decisions in our studies determined their chance to earn a bonus of a relatively substantial amount for online workers (Amir, Rand, & Gal, 2012). Moreover, we harness two strengths of online studies: (a) larger sample sizes and (b) anonymity. Larger samples have been called for to increase statistical power and improve research practices (Bakker, van Dijk, & Wicherts, 2012). Moreover, the online environment allowed us to study interactions among strangers who either have or do not have the potential to interact in the future, and provided methodological strengths to our studies.

The present research mainly focused on the behavioral effects of gossip, and manipulated gossip by informing participants that the recipient or an observer was connected and could gossip (send evaluation or have an opportunity to send a note) to others in the social network, i.e., participants' potential future partner(s). This manipulation goes beyond previous research by linking gossip with social network connections and future interdependence. Generally, this is a suitable manipulation, because gossip often occurs within social networks and people can anticipate future interactions with others in their social network. Yet, we understand that these interactions are between strangers and that the social networks studied here are small, brief, and fleeting. Besides, we did not investigate how people gossip in such contexts. Extending our findings to behaviors in natural social networks, giving participants opportunities to send and receive gossip, would complement our studies.

6.4. Concluding remarks

Social interactions often take place in overlapping and densely connected social networks, where people exchange and disseminate reputation through gossip that circulates widely and carries important consequences for both gossip targets and recipients. Humans have likely adapted to manage, spread, and respond to their own and others' reputations. We advanced an evolutionary perspective on reputation management. This framework emphasizes that properties of social networks can provide insights about information relevant to interaction partners or third parties that reliably covaried with situations that could maximize the indirect benefits of generosity. Taken together, findings from three studies provided good evidence that (a) people were more generous in response to gossip to at least one or many others in their social network, (b) reputational concern mediated this effect, rather than expected indirect benefits, and (c) the mediation of reputational concern was more pronounced for proselfs than prosocials. Thus, we stress the importance of informal and formal social structures that enable reputation monitoring and spreading to promote cooperation.

Supplementary Materials

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.evolhumbehav.2015.11.001.

Acknowledgments

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