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The Roots of Reciprocity: Gratitude and Reputation in Generalized Exchange Systems

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Abstract

Social scientists often study the flow of material and social support as generalized exchange systems. These systems are associated with an array of benefits to groups and communities, but their existence is problematic, because individuals may be motivated to take from the system without giving back to it. Researchers have identified two broad processes governing prosociality in generalized exchange systems: generalized reciprocity (a person who receives help from someone pays it forward by helping a third person) and indirect reciprocity (a person who helps another establishes a prosocial reputation and, as a consequence, later receives help from a third person). Although generalized exchange systems can be based on either process, generalized and indirect reciprocity are based on different mechanisms and, with few exceptions, have been investigated independently. Here we present an integrated approach to generalized exchange that (1) specifies when each process is most likely to promote prosocial behavior, (2) details the implications for resource inequalities in generalized exchange systems, and (3) describes how generalized and indirect reciprocity jointly influence prosocial behavior. Results from four new experiments strongly support the theoretical arguments.

Keywords

cooperation, altruism, prosocial, generalized reciprocity, indirect reciprocity

A drive-through customer pays for the order of the next customer in line, sparking a cascade of nearly 400 customers paying it forward (Phippen 2014). A farmer helps build a neighbor's barn without payment, confident that neighbors will help him when the need arises, a tradition with roots in colonial America and still practiced in Amish and Mennonite communities (Kadushin 2012). A prisoner shares his drugs with fellow inmates, not knowing whether or when they will reciprocate (Mjåland 2014). A researcher agrees to do a time-intensive peer review, with the understanding—or perhaps hope—that future papers she submits will receive similarly careful reviews. A hunter-gatherer gives meat to others, without

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expectation of payment or direct reciprocity, to cope with fluctuation in resource availability (Cashdan 1985). Similar means of handling financial uncertainty have been documented in communities of the working poor in the contemporary United States (Desmond and Gershenson 2016; Uehara 1990).

Sociologists, anthropologists, and other researchers study such flows of valuable resources through groups and communities as *generalized exchange systems*. In these systems, material, social, or other forms of support flow unilaterally between three or more actors, rather than bilaterally between only two actors (Baker and Bulkley 2014; Ekeh 1974; Lévi-Strauss 1969; Takahashi 2000; Uehara 1990; Willer, Flynn, and Zak 2012; Yamagishi and Cook 1993). Generalized exchange systems have been documented across a diverse array of contexts, from the ceremonial gift exchange system, or Kula ring, of the Trobiand Islanders (Malinowski [1922] 1953) to information sharing in large, anonymous, online communities of software developers (Faraj and Johnson 2011).

Perhaps the ubiquity of generalized exchange systems is not surprising, given that they are associated with a range of important benefits in groups and broader communities. Within organizations, generalized exchange systems are considered the foundation of group-oriented "organizational citizenship behaviors" (Baker and Dutton 2007). These behaviors have been linked to increased job performance, lower rates of turnover, higher productivity, and other positive organizational outcomes (Baker and Dutton 2007; Koys 2001; Podsakoff et al. 2009). At the community level, generalized exchange is central to most approaches to social capital (Adler and Kwon 2002; Coleman 1988; Portes 1998; Putnam 2000). As Adler and Kwon (2002:25) put it in their influential review of the social capital literature, generalized exchange "resolves problems of collective action and binds communities. It transforms individuals from self-seeking and egocentric agents with little sense of obligation to others into members of a community with shared interests, a common identity, and a commitment to the common good." In such communities, the existence of generalized exchange systems can also protect against fluctuation in the availability of critical resources (Cashdan 1985; Uehara 1990) and reduce resource inequalities (Bearman 1997; Uehara 1990).

Of course, these benefits of generalized exchange are only realized if it gets off the ground and is sustained. Early approaches (e.g., Ekeh 1974; Lévi-Strauss 1969) viewed the existence of generalized exchange as largely non-problematic. More recent work recognizes that these systems pose a conflict between individual and collective interests (Takahashi 2000; Yamagishi and Cook 1993). For instance, a researcher may prefer to enjoy the benefits of a high-quality peer review system without putting in the time to contribute to it. But if all researchers act on this preference, the system would collapse. Thus, core questions for generalized exchange research center on the mechanisms governing it. This includes how exchange emerges and persists over time, despite the incentive for people to take from the system without giving back to it.

Past work has identified two distinct processes governing the flow of resources in generalized exchange systems, namely *generalized reciprocity* and *indirect reciprocity*. Generalized reciprocity (GR) occurs when an actor who receives benefits or help "pays it forward" by helping a third party (*you help Jane because I helped you*). Indirect reciprocity (IR) occurs when an actor who provides benefits to another is subsequently helped by a third party (*Tom helps me because I helped you*). Either process could form the basis of generalized exchange, but they are based on very different mechanisms, with GR being driven primarily by *gratitude* and IR being rooted in *reputation* processes, as we will describe in detail.[1]

Importantly, except for two studies discussed below (Baker and Bulkley 2014; Boyd and Richerson 1989), research on generalized and indirect reciprocity has proceeded completely independently of one another. As a

consequence, we do not know the conditions under which one process versus the other is more likely to affect the likelihood or level of prosocial behavior. The first goal of our research is to specify these conditions.

Most importantly, we go beyond prior work by conceptualizing the two processes as the core components of an integrated generalized exchange system. Our approach reveals new insights about when and why generalized exchange systems generate prosociality and social solidarity. For instance, existing research on generalized reciprocity does not account for the emergence of generalized exchange, assuming instead that a system is already in place. Our integrated approach shows how indirect reciprocity processes can "jumpstart" prosociality that continues via subsequent acts of generalized reciprocity, bridging the strategic and affective bases of generalized exchange. Our approach also shows how indirect and generalized reciprocity can reinforce one another. For instance, a community member who accepts help from others, but fails to give help to others in need once she is able, will be held in much lower regard than people who give as much as they have received, suggesting that indirect reciprocity can promote and sustain generalized reciprocity. We present experimental evidence that supports these arguments.

In addition to clarifying and integrating the two processes that drive generalized exchange, we also aim to provide a more systematic account of how they operate in both forms of generalized exchange systems, namely *chain generalized exchange* and *pure generalized exchange.* In chain generalized exchange, resources flow along the same pattern of ties in networks and eventually circle back around to the initiator (Bearman 1997; Yamagishi and Cook 1993; Ziegler 1990). The most famous examples are the Kula ring studied by Malinowski ([1922] 1953) and matrilineal cross-cousin marriages (Bearman 1997; Homans and Schneider 1955). By contrast, resources in pure generalized exchange (Takahashi 2000; Willer et al. 2012) do not cycle through the same stable pattern of ties. For instance, a sequence of persons paying forward help received from strangers, or from colleagues at work, does not require that the sequence eventually loop back to the initiator.

As others have noted (Takahashi 2000; Yamagishi and Cook 1993), despite the differences between chain and pure generalized exchange systems, most generalized exchange research at least implicitly assumes they are governed by the same mechanisms. No work, to our knowledge, explicitly addresses both types. Although somewhat secondary to our core objectives, here we aim to explicate how the effects of IR and GR on prosocial behavior depend on whether they occur in chain or pure generalized exchange systems. As we show, this helps shed light on apparent inconsistencies in prior studies.

Summing up, this research makes two key contributions. First, we clarify key conditions under which indirect reciprocity versus generalized reciprocity will lead to more prosociality, and we test these arguments with the first controlled experiments assessing the relative impact of IR and GR on generosity. We do so for both chain (Study 1) and pure (Studies 2, 3, and 4) generalized exchange. Second, in contrast to prior work, which treats GR and IR as separate processes, we introduce and test (Studies 2, 3, and 4) an integrated account of generalized exchange systems. Our account highlights why pure generalized exchange is more apt to be initiated by IR processes. But once prosociality is set into motion by IR processes, GR processes can be just as likely to sustain generosity as IR. We also show how IR processes magnify the effects of GR on prosocial behaviors. Before detailing our arguments, we provide an overview of existing research on the two foundations of generalized exchange systems.

TWO BASES OF GENERALIZED EXCHANGE SYSTEMS

In sociology and classical anthropology, research into generalized exchange has primarily focused on *generalized reciprocity* (GR; Ekeh 1974; Uehara 1990; Willer et al.

2012). For instance, ethnographic work from anthropology and sociology provides evidence of GR, where those who receive a valuable resource from one party "pay it forward" to another party (Bearman 1997; Malinowski 1922 [1953]; Uehara 1990). Similarly, social exchange experiments have demonstrated that networks characterized by GR promote high levels of trust and social solidarity among network members (Molm, Collett, and Schaefer 2007), supporting a core contention of classical theorizing (Ekeh 1974; Lévi-Strauss 1969).

Classic ethnographic work often explained generalized reciprocity as being driven by norms (Ekeh 1974; Lévi-Strauss 1969). Other work, however, finds limited evidence that people can identify norms governing generalized reciprocity (see Bearman 1997). Although the goal of early experimental work by Yamagishi and Cook (1993) was not to identify the mechanisms driving generalized reciprocity, the researchers assumed it was driven by a rational choice process, whereby one person "pays it forward" to another, with the expectation that giving will eventually come back around to her.

More recent work has focused on prosocial emotions, specifically gratitude, as the primary mechanism driving generalized reciprocity (Baker and Bulkley 2014; Bartlett and DeSteno 2006; DeSteno et al. 2010). That is, the gratitude one experiences as a result of receiving help from another leads one to help a third person in need. Importantly, this work shows that gratitude plays a much stronger role than alternative mechanisms, such as adherence to reciprocity norms (DeSteno et al. 2010), general positive mood (Bartlett and DeSteno 2006), or merely knowing that others are helping third parties, without being the beneficiary of help oneself (Tsvetkova and Macy 2014). In short, generalized reciprocity may have multiple causes, but existing research identifies gratitude as its core mechanism.

Other researchers have primarily focused on *indirect reciprocity* (IR) as the basis for generalized exchange systems (Alexander 1987; Nowak and Sigmund 1998). Laboratory studies (Barclay and Willer 2008; Milinski, Semmann, and Krambeck 2002) and field experiments (Yoeli et al. 2013) show that people respond strategically to the presence of others, cooperating at much higher levels when reputational benefits and possibilities of IR exist.[2] Third parties do, in fact, reward those who act prosocially toward others (i.e., they indirectly reciprocate benefactors), as shown in both laboratory studies (Milinski et al. 2002; Simpson and Willer 2008) and ethnographic work (Smith and Bird 2000). The tendency to indirectly reciprocate others who give (or punish those who do not) is generally explained via prosocial norm enforcement (e.g., Fehr, Fischbacher, and Gächter 2002). But it may also result from the expectation that rewarding another's generosity will, in turn, be rewarded by other observers. Indeed, because so much of human behavior occurs in the presence of reputational opportunities, evolutionary theorists argue that the foundations of human morality are rooted in indirect reciprocity and reputational processes (Alexander 1987).

Both generalized reciprocity (GR) and indirect reciprocity (IR) can be bases of generalized exchange. Furthermore, both processes are assumed to be fundamental to patterns of cooperation and solidarity. But, as noted earlier, they rely on different mechanisms. These different mechanisms, in turn, assume actors have access to different types of information and, by extension, direct our attention to distinct (but not mutually exclusive) determinants of prosocial behavior. Table 1 details the two processes and the information requirements of each.

As Table 1 shows, for gratitude to drive GR, a person only needs to know that she has been given to. The gratitude that results from this knowledge is predicted to lead to a greater likelihood or level of giving to a third person. Consider the structure for GR in Table 1, where A gives to B and B then gives to C. As we have seen, gratitude explains the second action (B giving to C, conditional on receiving from A). But how does the sequence begin?

Table 1. A Table of Two Theories: Comparing Generalized Reciprocity and Indirect Reciprocity

	Generalized Reciprocity	Indirect Reciprocity
Sequences of resource flows	Ann helps Bill at *t1*; then, Bill helps Cara at *t2*	Ann helps Cara at *t1*; then, Bill helps Ann at *t2*
Illustrative structure	$A \rightarrow B$ $\downarrow$ C	$A \rightarrow C$ $\uparrow$ B
Core mechanism	*Gratitude*: Receiving resources from others leads to gratitude. Gratitude leads to prosocial behavior.	*Reputation*: Presence of others who are sources of future rewards leads to concern for maintaining good reputation. Concern for reputation leads to prosocial behavior.
Whose generosity does core mechanism explain?	B (second mover)	A (first mover)
How does generalized exchange *emerge*?	The prospect that one's generosity will be paid forward by those one helps.	The prospect that one's generosity will be rewarded by observers.
Information requirements for A (first mover)	The presence of C, to whom B may pay forward A's generosity.	The presence of B, who may reward A's generosity to C.
How does generalized exchange *persist*?	Gratitude leads to paying forward help received.	We reward those who have helped others.
Information requirements for B (second mover)	Whether A helped B.	Whether A helped C.

Current theoretical accounts are silent on the emergence of generalized exchange from GR. The core mechanism in these theories (gratitude) assumes that the focal actor has already benefited from a generalized exchange system. However, one potential process through which generalized exchange may get off the ground has been suggested outside the academic literature, namely that one's generosity may spark a giving cascade, thus increasing its impact or reach.[3] If so, the knowledge that a person one can help may, in turn, be more likely to help a third person could increase giving. As Table 1 shows, this mechanism requires that, when deciding whether to help B, A knows of C's existence. It is not clear that the belief that one can initiate a giving cascade is a common or significant factor motivating prosocial behavior. We include this process because it allows a complete account of the emergence and continuation of generalized exchange via GR. But as we will explain, we expect the emergence of generalized exchange systems is more likely to occur as a result of IR processes.

The reputation mechanism in IR depends not on information about whether the focal actor has benefited from others in the past, but on how she might benefit from them in the future. Receiving benefits in IR is therefore contingent on developing or maintaining a prosocial reputation. Specifically, as Table 1 shows, giving by the first mover (A) depends on knowledge of an audience (B), who may reward A for her generosity. By extension, IR explanations of why B rewards A's generosity require knowledge of A's prior behaviors, via either direct observation (Simpson and Willer 2008) or gossip (Feinberg et al. 2012).

As the foregoing suggests, at the most basic level, IR and GR require similar *amounts* of information. For instance, in deciding whether to help another, an employee in an organization where generalized exchange is governed by GR only needs to know whether (or how much) she has been helped by others. In IR, one only needs to know whether (or how much) the prospective beneficiary has helped others. But the information in GR is highly "localized" (e.g., "What has a person done for me?"), whereas IR requires information about the broader network ("What has this person done for others?"). In large networks or organizations, this greater informational

complexity of IR processes may moderate its effects (Baker and Bulkley 2014).[4] But in the studies presented below, informational demands are minimal (and comparable to those in the GR conditions), given the small number of others that participants need to take into account.[5]

Generalized and indirect reciprocity have been studied by researchers in different disciplines. Hence, insights into the two processes have developed independently of one another, with some researchers assuming GR is *the* basis of generalized exchange systems, and other researchers assuming IR is. The only studies that have considered both IR and GR reached different conclusions about their relative impact on prosocial behavior. Boyd and Richerson (1989) used mathematical models to compare the effects of IR and GR to each other and to direct reciprocity (i.e., between two actors). They found that prosocial behavior is more viable under IR than under GR. Yet an innovative study of helping behaviors among a group of MBA students found evidence that prosocial behavior was more likely to be driven by GR than IR (Baker and Bulkley 2014).

There are a number of possible explanations for why these two studies arrived at different conclusions. The most obvious is that Boyd and Richerson's study was based on mathematical models, rather than behavioral data. Alternatively, the more extensive informational demands of IR, discussed earlier, may have reduced the effects of IR versus GR on helping in Baker and Bulkley's study.[6] Perhaps most importantly, Boyd and Richerson investigated chain generalized exchange, characterized by fixed patterns of relations along which help could flow, whereas Baker and Bulkley investigated pure generalized exchange, where giving need not flow along a particular pattern or cycle. But as we will argue, there are good reasons to expect the effects of GR and IR on prosociality will vary depending on whether the processes occur in chain versus pure generalized exchange systems. As such, the arguments outlined below may help reconcile the otherwise contradictory findings from these two studies.

INTEGRATING GENERALIZED AND INDIRECT RECIPROCITY

Recall that the key mechanism driving GR is the experience of gratitude (Bartlett and DeSteno 2006; DeSteno et al. 2010). Because GR depends on gratitude as a motivating force, theories of GR primarily describe what *maintains* generalized exchange, once established. These theories do not explain how generalized exchange systems emerge in the first place.

One possible explanation, discussed earlier, is the expectation that one's generosity will grow in reach or magnitude as it "sparks" a sequence of generosity that spreads through a group or network. We argue that other mechanisms will play a larger role in the emergence of generalized exchange systems. Research on cooperation and prosocial behavior typically explains initial acts of giving as rooted in expectations of either direct or indirect reciprocity (Rand and Nowak 2013; Simpson and Willer 2015). The former puts us in the territory of *bilateral*, or direct, rather than generalized exchange (see Lawler, Thye, and Yoon 2008; Molm et al. 2007; Willer et al. 2012). And in the latter process, a greater tendency to help when in the presence of observers who can reward one's generosity drives *indirect reciprocity* rather than generalized reciprocity. Thus, all other things being equal, we argue that generalized exchange systems will be more likely to get off the ground when giving is governed by IR versus GR, a point we explore in greater detail when we turn our attention to pure generalized exchange systems.

Chain Generalized Exchange Systems

The extent to which it "pays" to invest in a reputation depends on the presence of an audience who can observe and reward one's generosity. All else being equal, these conditions are especially prevalent in chain generalized exchange. In such settings, the observer of one's behavior is stable and salient, increasing the importance of maintaining a good reputation (Emler 1990). At the same time, there are good reasons to expect that stable

network relations decrease the level of gratitude experienced as a result of another's generosity. For instance, a central premise of research by Yamagishi and colleagues (e.g., Yamagishi and Yamagishi 1994) is that we are more likely to attribute prosocial behavior in stable networks to the structure itself (e.g., expectations of reciprocity, or reputational processes) while attributing prosocial behaviors that occur outside these networks to benefactors' good intentions. If so, repeatedly benefiting from the same group or community member, as would happen in chain generalized exchange, may lead to relatively lower levels of gratitude over time.

Additionally, prior work shows that the tendency to experience prosocial emotions, including gratitude, depends on baseline prosocial dispositions (Boone and Buck 2003; Feinberg et al. 2012; Frank 1988; Penner et al. 2005). That is, more egoistic persons are less likely to experience prosocial emotions like gratitude than the altruistic. Thus egoists might be expected to constitute "weak links" in chain generalized exchange systems governed by GR. On the other hand, IR processes should be less affected by the presence of egoistic people. This is because egoists should be especially motivated to establish and maintain prosocial reputations in order to obtain the benefits of IR (Simpson and Willer 2015; Willer et al. 2010). Indeed, Simpson and Willer (2008) found that while altruists showed much higher rates of prosociality than did egoists when behaviors had no reputational consequences, the behaviors of altruists and egoists were virtually identical when reputation formation via indirect reciprocity was possible. In short, in chain generalized exchange, GR processes should be more vulnerable to egoistic "weak links" that can disrupt the flow of prosocial behavior through the network.

Summing up, for chain generalized exchange governed by IR, routine monitoring by the same prospective benefactor keeps contributions high. Moreover, compared to chain generalized exchange governed by GR, a local breakdown in prosociality in one part of the chain is less likely to precipitate a global breakdown in prosocial behavior, because group members downstream of the weak link are still motivated to maintain prosocial reputations. We therefore expect the following:

> *Hypothesis 1:* IR processes will lead to higher levels of prosocial behavior than will GR processes in chain generalized exchange networks.

Another implication of the previous argument is that prosociality resulting from IR, compared to GR, will lead to less *inequality* in chain generalized exchange. As already noted, more egoistic people may be less apt to experience the prosocial emotions that drive GR processes, resulting in accumulation of resources without paying them forward. On the other hand, as noted earlier, the presence of observers and reputational consequences makes the behavior of egoists and altruists nearly identical (Simpson and Willer 2008). Thus, compared to generalized exchange systems governed by IR, those governed by GR may be more exploitable, such that more egoistic group or network members can take the benefits of the system without contributing to it. If so, the resources that flow through the generalized exchange system will be distributed less equally. This is important, because chain generalized exchange systems high in solidarity and stability should thus not only have high levels of prosociality but also low levels of inequality.

> *Hypothesis 2:* In generalized exchange systems, IR processes will lead to lower levels of inequality than will GR processes.

We also test Hypothesis 2 in the context of pure generalized exchange systems, which we turn to next.

Pure Generalized Exchange Systems

Unlike chain generalized exchange, in pure generalized exchange resources do not flow repeatedly through the same cycle, nor do they necessarily come back around to the person who initiated the sequence. Thus, one

would not benefit from the same group member repeatedly over time (for GR), nor would the audience of one's prosocial actions be consistent over time (for IR) as they would be in chain generalized exchange. For these reasons, some researchers have suggested that pure generalized exchange systems may be especially prone to free-riding, that is, taking from the system without giving back to it (Takahashi 2000).

A straightforward extension of our arguments on chain generalized exchange suggests that, in pure generalized exchange, IR will lead to more prosociality than will GR, due to the vulnerability of GR to "weak links." But we test a competing claim, based on our earlier discussion, that the relative impact of IR versus GR will be moderated by whether the focal actor is the (potential) initiator of the generalized exchange. As noted earlier, there is limited basis for expecting that GR processes will play a significant role in the emergence of generalized exchange. On the other hand, the presence of an audience who can reward one's giving, as in the case of IR, can dramatically increase prosociality (Barclay and Willer 2007; Nowak and Sigmund 1998; Simpson and Willer 2008). Thus, we expect that, in pure generalized exchange, the initiation of prosociality will be higher when it is based on IR than when it is based on GR.

But once a sequence of giving gets off the ground, we expect GR processes will play a larger role (relative to IR processes) in motivating prosociality in pure generalized exchange. This is for two reasons. First, as noted earlier, IR will promote prosocial behavior when one has more to gain from a prosocial reputation. But as one moves further out in a sequence of giving, the likelihood that she will be rewarded for prosocial behavior decreases. For instance, individuals at the periphery of a group or network will gain fewer, if any, reputational benefits from acting prosocially, given their limited social visibility (Anderson and Shirako 2008). Second, the gratitude mechanism that promotes GR will become more salient as we move past the first mover: being the target of relatively unexpected generosity in pure generalized exchange systems is likely to lead to feelings of gratitude, and thus the tendency to pay that help forward (Bartlett and DeSteno 2006; DeSteno et al. 2010). In short, whereas conditions become less favorable to IR after the first mover in a sequence, they become more favorable to GR. Thus, in contrast to Hypothesis 1 for chain generalized exchange networks, we expect the following for pure generalized exchange systems:

> *Hypothesis 3:* In pure generalized exchange systems, (a) prosocial behavior will be higher for first movers when giving is governed by IR versus GR, but (b) once a generalized exchange is started, GR is more likely than IR to sustain it in subsequent movers.

Hypothesis 3 highlights the value of viewing IR and GR as interdependent parts of a more integrated system. Generalized exchange may be initiated by the prospect of reputational gains (IR), as when an employee agrees to stay late to help a colleague meet a deadline when the boss is around. However, once set into motion, prosociality may spread through networks or populations via gratitude, that is, GR processes: the gratitude a beneficiary experiences as a result of her colleague's help leads her to offer assistance to a different colleague. An integrated account of generalized exchange also sheds light on how IR processes can reinforce GR processes. Specifically, being seen as a community member in "good standing" entails maintaining a balance of help received and help given. An able person who is frequently helped by neighbors but does not pay it forward to others when the need arises will eventually be viewed negatively. This implies that the prospect of reputational benefits will strengthen the tendency to pay forward any help received to others who need it. We thus expect people will be more likely to engage in GR in the presence of a prospective indirect reciprocator. Our fourth hypothesis thus predicts that IR strengthens the effects of GR:

> *Hypothesis 4:* Targets of generosity will be more likely to "pay it forward" in the presence (versus absence) of an indirect reciprocator.

Table 2. Overview of Experiments

	Study 1	Study 2	Study 3	Study 4
Chain or Pure Generalized Exchange	Chain	Pure	Pure	Pure
Total Participants	100	61	209	200
Type of Experiment	Lab	Lab	Online	Online
Measure of Generosity	Continuous	Binary	Continuous	Continuous
Key Hypotheses Tested	H1 H2	H2 H3a H3b H4	H3a H3b H4	H3b
Alternative Explanations or Additional Tests	Are findings moderated by level of information?[a]		Is GR (but not IR) driven by gratitude?	Are results for IR or GR driven by normative information? Are IR effects driven by any observer, or by observers who can indirectly reciprocate generosity?

[a]Part B of the online supplement gives details and findings from Study 1 on how level of information affects prosociality.

Finally, we also address whether people do in fact reward (i.e., indirectly reciprocate) individuals who pay it forward.

Overview of Experiments

We report results from four experiments designed to test our hypotheses, including two laboratory experiments (Studies 1 and 2) and two web-based experiments (Studies 3 and 4). Table 2 gives an overview of all studies and the hypotheses we test with each.

STUDY 1: CHAIN GENERALIZED EXCHANGE SYSTEM

Participants and Design

Participants were recruited from the general student population at a large public university in the southeastern United States. In total, 100 participants (73 percent female) completed the study in exchange for monetary payment. Participants completed the study in groups of four. The design used a chain generalized exchange system (see Figure 1), which varied based on whether it was governed by generalized reciprocity (GR) or indirect reciprocity (IR).[7] Each four-person group was exposed to each condition, in random order.

Procedure

Once a participant arrived at the laboratory, she was escorted to a private subject room and completed a consent form. Thereafter, she began the instructions for the task. These instructions and the actual experiment were programmed in Z-Tree version 3.3.11 (Fischbacher 2007). The first phase began when all four participants had completed the instructions and quiz questions for that phase.

Study 1 used a chain generalized exchange network, where each person decides how much of their 10-token endowment to give to another participant in the chain (Figure 1). Participants were told they would take turns indicating how many tokens they wished to transfer to another participant, and how many tokens to keep for themselves, in a series of rounds. Tokens received (but not tokens kept) would be doubled. Thus, earnings in a given round consisted of the doubled number of

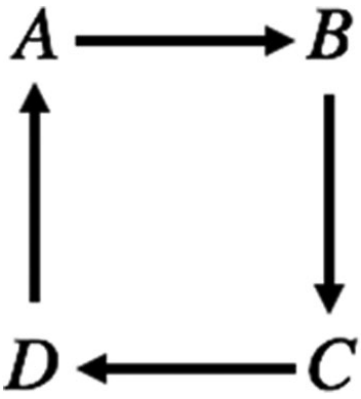

Figure 1. Four-Person Chain Generalized Exchange System, Study 1
Note: Figure displays who could give to whom across the 20 rounds of Study 1: for example, A always gave to B and B always gave to C. In generalized reciprocity, the chain proceeded such that A gave to B, then B gave to C, and so on. In indirect reciprocity, the chain moved backward, such that A gave to B, then D gave to A, and so on. See also Table 1.

tokens received from another participant, if any, plus tokens kept, if any. Participants were told that their final earnings in the study would be their earnings from one randomly selected round in the session, but they were not explicitly told to maximize their earnings.

The main manipulation was whether the generalized exchange system was governed by GR or IR. In GR, a given participant (B) decided how much, if any, of her 10-point endowment to give to C, after being informed how much she had been given by A. In the IR condition, B decided how much to give to C after being informed how much C had given to D. Importantly, participants did not receive any additional information. For instance, participants in the IR condition were not told how much, if any, others gave them. Likewise, in GR cycles participants only knew what they had received from the participant behind them, but not what others (including the target of their own generosity) had given. Thus, in each condition, participants had exactly one piece of information about another's giving behavior. (See Part C of the online supplement for the full text of the instructions for all studies.)

Each round represents a complete cycle through the chain in Figure 1. For each phase (condition), groups completed five rounds. After five rounds, the instructions explained changes to the procedures, and participants completed a series of quiz questions designed to ensure that they understood procedures for the subsequent phase.[8] Participants were told (correctly) that their own and others' positions (A, B, C, or D) in the chain would be reassigned randomly at the conclusion of the phase. Thus, participants could not connect information or behaviors in one phase to the subsequent one. In addition, reassigning participants to a new position for each phase prevented them from making giving decisions toward any specific position in the chain (A, B, C, or D) for more than one phase. After completing all phases, participants were paid based on their earnings from one randomly selected round, plus a $5 show-up fee (final earnings could range from $5 to $35, M = $19.96). Study 1 took approximately one hour.

Study 1 Results

Analyses were based on 25 groups of four. Because the data were nested (rounds within phases within participants within groups), all analyses were conducted using four-level multilevel models with random intercepts for phase (condition), participants, and groups.[9] The full models for results from all studies are presented in Tables S1 through S5 in Part A of the online supplement.

We first address whether indirect or generalized reciprocity leads to higher levels of prosociality, as evident in overall levels of giving. Hypothesis 1 predicts that IR structures will lead to more prosocial behavior than will GR structures. This hypothesis was supported: participants were more generous with their resources in IR structures, compared to GR structures (Table S1, Model 1, b = .37, SE = .11, $p < .001$). This pattern was observed controlling for round and for the order in which the condition was completed.

Aside from increased giving in indirect reciprocity structures, following Hypothesis

2, we also considered whether IR structures were associated with reduced inequality in outcomes. To assess this, we computed group-level Gini coefficients (Allison 1978) for earnings at the end of each round. The Gini coefficient measures statistical dispersion across values in a frequency distribution; possible values range from 0 (maximum equality) to 1 (maximum inequality). Inequality in outcomes was lower in the IR rounds (M = .11, SD = .10, N = 226) than in the GR rounds (M = .13, SD = .11, N = 250) (Table S2, Model 1: b = –.02, SE = .01, p = .05). Thus, indirect reciprocity structures promote prosociality while minimizing inequality.

Discussion of Study 1

The results of Study 1 support our key predictions. First, we found that indirect reciprocity led to more giving compared to generalized reciprocity in a chain generalized exchange system, which supports Hypothesis 1. And consistent with Hypothesis 2, we found lower levels of inequality when giving followed indirect reciprocity.

These chain generalized exchange networks show us that cycles of IR lead to higher levels of giving while minimizing inequality. However, they do not show us how or why these exchange systems emerge, given that the structure of the chain ensures there is always someone behind me to reward my reputation or, eventually, pay it forward to me. But this is not always so in real world situations, as when strangers pay forward one another's generosity. We conducted Studies 2, 3, and 4 in pure generalized exchange systems to better understand how such systems are initiated and maintained.

In addition, Study 1 carefully controlled the amount of information participants were given before making their choices. In IR, participants were only told how much the person ahead of them in the chain had given; in GR, participants knew how much they had received. But in small groups like those in Study 1, we cannot know for certain that giving behavior was solely influenced by the behavior of the person ahead (IR) or behind (GR) the decision-maker. In these small closed systems, what goes around literally comes around. For instance, a member of a four-person chain may help her beneficiary in GR in response to the help she has received from others. But she may also attempt to help strategically—that is, in an effort to establish a cooperative chain that would eventually cycle back to her. A similar process could occur for IR. That said, Yamagishi and Cook (1993) did not find any difference in generosity in four- versus eight-person chain generalized exchange networks, suggesting that the differences we observed in GR versus IR giving would not be limited to small (four-person) chains. Nevertheless, the next studies of pure generalized exchange systems will allow more insight into the specific mechanisms governing prosociality in IR and GR.

STUDY 2: PURE GENERALIZED EXCHANGE SYSTEM

Participants and Design

Participants for Study 2 were recruited from the same general student population as those of Study 1. We had 61 participants (62 percent female) complete the study in exchange for monetary payment. Study 2 uses a pure generalized exchange system, where each decision is made in the context of a "one-shot" interaction. Specifically, participants in Study 2 made a total of 21 decisions, 13 of which are relevant to our current purposes. (Descriptions and results from the remaining eight conditions are available upon request.) As Table 3 shows, each decision corresponded to a unique condition. As we will explain in detail, these conditions differed by the set of relations in which the focal participant was embedded, and the amount and type of information the participant had about ostensible others' choices. With the exception of a baseline condition, which all participants were exposed to first, the order of conditions was randomized for each participant.

Table 3. Description of Conditions and Observed Giving, Study 2

Condition		Central Question	Structure	Did Other(s) Give?	Percent Giving
1	Control		Ego → P2		60.7
2	Generalized reciprocity	Do people give when they can start a chain of giving?	Ego → P2 → P3		75.4
3		Do people pay it forward?	P1 → Ego → P3	Yes	78.7
4				No	39.3
5	Indirect reciprocity	Do people give when they can be rewarded for doing so?	Ego → P2 (P3 → Ego)		90.2
6		Do people reward reputations?	P1 →P2 (Ego → P1)	Yes	82.0
7				No	18.0
8	Integrated generalized and indirect reciprocity	Do people pay it forward when they can be rewarded for their reputation?	P1 → Ego → P3 (P4 → Ego)	Yes	83.6
9				No	55.7
10		Do people reward those who pay it forward?	P1 → P2 → P3 (Ego → P2)	Yes, Yes	82.0
11				Yes (P1), No (P2)	18.0
12				No (P1), Yes (P2)	78.7
13				No, No	29.5

Note: Table lists each of the 13 decisions participants (Ego) made in Study 2. Others (P1, P2) were simulated; any decisions they made that Ego learned about, if any, are given in the "Did Other(s) Give?" column. Participants' giving behaviors by condition are listed in the "Percent Giving" column.

Procedure

Once a participant arrived at the laboratory, she was escorted to a private subject room and completed the consent process. Thereafter, the participant began the experimental instructions. Although multiple participants were scheduled for each session, unlike Study 1, all others' choices were simulated to maximize experimental control.

In contrast to Study 1, which used a continuous measure of giving, participants (as well as ostensive others about whom they were given feedback) faced a binary decision to give or not.[10] That is, for each decision, participants were given an endowment of 10 tokens and could either keep it all or pass it all on to a designated other. If the participant decided to pass it on to the other, it was doubled. As in Study 1, participants were told they would be paid based on one randomly selected interaction.

Condition 1 (Table 3) was the baseline condition, in which participants made a decision about whether to give to a dependent other, about whom she had no information and with whom she had no possibility of IR or GR. This gives us a "pure" or baseline measure of the participant's generosity. Conditions 2 through 4 place participants in a basic generalized reciprocity (GR) structure, either as the first mover (Condition 2) or the second mover when the first mover gave (Condition 3) or did not give (Condition 4). As Table 3 shows, the parallel conditions for indirect reciprocity (IR) are 5 through 7. Conditions 8 through 13 correspond to the integrated model that contains both indirect and generalized reciprocity relations. For instance, Condition 10

measures a participant's tendency to indirectly reciprocate someone who pays forward received generosity.

Participants were paid after they made all 13 decisions. Because participants in Study 2 interacted with simulated alters, rather than paying them based on others' choices, we paid all participants $15. This is the average of what the participant would have received for a selfish choice (when they did not give their endowment to a dependent other), and a situation in which an alter was generous toward the participant. After being paid, participants were probed for suspicion and debriefed. The study took approximately 45 minutes.

Study 2 Results

One goal of Study 2 is to examine differences between IR and GR giving among first and second movers in a pure generalized exchange system. Specifically, we address whether initial (first mover) giving is higher in indirect reciprocity structures (Hypothesis 3a) and whether subsequent (second mover) giving is higher in generalized reciprocity structures (Hypothesis 3b). In addition, we test an integrated model of generalized and indirect reciprocity: whether people are more likely to pay it forward when in the presence of an indirect reciprocator (Hypothesis 4). All analyses were conducted using two-level (repeated observations nested in participants) logistic regressions. Again, detailed results are presented in Part A of the online supplement.

We first address whether giving is more likely to be initiated in IR versus GR. Results revealed that participants gave more often as first movers in IR (90.2 percent gave) than as first movers in GR (75.4 percent, Table S3, Model 1: $b = 1.86$, $SE = .75$, $p < .05$), supporting Hypothesis 3a. Notably, both IR and GR processes generated more giving than did the baseline condition (60.7 percent), where participants gave in an independent dyad. Participants were significantly less likely to give in this baseline condition than in the first-mover GR condition (i.e., the reference category; Table S3, Model 1: $b = –1.24$, $SE = .57$, $p < .05$). These results are consistent with the notion, described earlier, that people will be more apt to give when they can initiate a sequence of giving. In turn, as noted above, giving was higher in first-mover IR than in first-mover GR. That is, although we find evidence that people are more likely to give when they can "spark" a sequence of generosity (first-mover GR) than when their efforts will benefit only one other (independent dyad), we also find that they are even more likely to give as first movers in IR—when in the presence of someone who can reward them.

Next, we look at the downstream consequences of first-movers' decisions to give or not by looking at second-movers' generosity in GR versus IR structures (Hypothesis 3b). When the first mover gave, participants paid it forward 78.7 percent of the time in GR and rewarded a giver 82.0 percent of the time in IR, a nonsignificant difference (Table S3, Model 2: $b = .29$, $SE = .54$, $p = .59$). Thus, we do not observe the higher giving in GR that Hypothesis 3b would lead us to expect. Nor do we observe significantly higher giving in IR versus GR as Hypothesis 1 predicts for chain generalized exchange networks. These results are therefore inconclusive with respect to Hypothesis 1 versus 3b, a point we take up in the next study.

When the first mover did not give, second movers in GR gave 39.3 percent of the time. Said differently, they "paid forward" selfishness 60.7 percent of the time. For IR, second movers gave to those who did not give to a dependent other only 18 percent of the time. That is, they indirectly reciprocated selfishness 82 percent of the time. Thus, consistent with results from the first study showing lower levels of inequality in IR, we find that the first-mover's decision had a stronger impact on the participant's generosity in IR versus GR. Specifically, second movers in IR were less likely to behave prosocially when the first mover did not give, compared to those in GR (Table S3, Model 3: $b = –2.51$, $SE = .93$, $p < .01$). This provides further support for Hypothesis 2, which predicts lower levels of inequality for IR than for GR, because consistent giving (or consistent *non*-giving) results in reduced inequality.

To address whether IR processes promote GR processes (Hypothesis 4), we assessed

whether participants pay it forward more often when in the presence of an audience who can indirectly reciprocate their generosity. To do so, we compared our basic GR conditions, where participants decide whether to pay it forward in the absence of an indirect reciprocator, with our integrated IR/GR conditions, where participants decide to pay it forward in the presence of an indirect reciprocator. Consider, for instance, B in an A→B→C chain. How did the presence of an audience, D, who could indirectly reciprocate B's generosity, alter B's giving? We find that both the first-mover's (A) giving behavior (Table S3, Model 4: $b = 2.39$, $SE = .53$, $p = .000$), and whether an indirect reciprocator, D, is present ($b = .93$, $SE = .45$, $p = .04$) affect B's giving behavior, with no interaction ($b = –.51$, $SE = .69$, $p = .46$). These results are consistent with Hypothesis 4: people do engage in GR (paying forward others' generosity), but they are also more generous in the presence of a prospective indirect reciprocator.[11] Indeed, the lack of an interaction suggests that IR can promote generosity regardless of whether GR gets off the ground: that is, the presence of an indirect reciprocator promotes giving whether a decision-maker has been helped—or not—in the past. Prior work shows that people tend to pay forward not only generosity but also selfishness (Gray, Ward, and Norton 2014), but the current finding suggests that the presence of IR structures can reduce the tendency for one instance of selfishness to "spread."

In addition to investigating whether people are more apt to pay it forward in the presence of indirect reciprocators, we also investigated whether indirect reciprocators give more to those who pay it forward. That is, following the labels from the previous result, we look at D's generosity, conditional on patterns of generosity in the GR chain. We find that participants gave the least to B when A gave to B, but B did not pay it forward (Table S3, Model 5: $b = –1.42$, $SE = .69$, $p < .05$; compared to the reference category of neither giving). When B gave (regardless of whether A gave to B), participants gave to B significantly more than when she did not. These results thus support our argument that IR processes reinforce GR processes—indirect reciprocators reward those who pay it forward, and punish those who do not—underscoring our contention that the two should be considered jointly.

Discussion of Study 2

The results of Study 2 show that, in pure generalized exchange systems, giving is more apt to get off the ground as a result of IR versus GR processes. But the results for second movers do not allow us to say whether, once established, giving is higher in GR or in IR. Part of the reason is that, once initiated, second-mover giving was so high that a ceiling effect might have interfered with our ability to detect differences between conditions (78.7 percent of participants gave when they were given to in GR; 82.0 percent of participants gave when their potential beneficiary had given in IR). To address this, we used a continuous measure of giving, rather than a binary "give or don't give" decision, in Study 3.

Another goal of Study 3 was to gain greater insight into the mechanisms that govern GR and IR, by examining the role that feelings of gratitude play in promoting giving behavior. As described earlier, the standard explanation for GR chains, in particular, is gratitude (Bartlett and DeSteno 2006; DeSteno et al. 2010). Half of participants in Study 3 answered questions about their emotions, including feelings of gratitude, prior to making their giving decisions. Finally, as we will describe, we drew on a different sample for Study 3, which allows us to assess the robustness of our results.

STUDY 3

Participants and Design

Study 3 participants were recruited via Amazon's Mechanical Turk (MTurk). Although not representative of the general population, MTurk samples are substantially more diverse than many other types of convenience samples, including those ordinarily used in laboratory experiments (see Weinberg, Freese, and

McElhattan 2014). Furthermore, previous work shows that MTurk samples yield reliable, high-quality data (Berinsky, Huber, and Lenz 2012; Buhrmester, Kwang, and Gosling 2011; Paolacci and Chandler 2014).[11] A total of 209 participants (54 percent female) completed the study in exchange for a $1 flat fee plus a bonus of up to $1, based on their own and others' decisions during the task.[12]

Like Study 2, Study 3 used a pure generalized exchange system, where participants made decisions in the context of a one-shot interaction. Participants made a total of five decisions, where each decision represents a separate condition. These five conditions were also included in Study 2 and described in detail in the previous section: first-mover GR, first-mover IR, second-mover GR, second-mover IR, and our integrated IR/GR condition, measuring whether people pay it forward in the presence of an indirect reciprocator.

Procedure

Study 3 differs from Study 2 in that it used a continuous measure of giving rather than a binary (give or not) decision. For each decision, participants were given an endowment of 10 points and could give any portion of it to a designated other. Any amount transferred to another participant was doubled. Points would be translated into money and determine participants' bonuses at the end of the study. Participants were told they would be paid based on their outcome from one randomly selected interaction.

To maximize experimental control, others' choices were simulated. To assess the robustness of our findings across different levels of giving by others, each participant saw one ostensive other give 0, one give 5, and one give 10, in random order, across the three decisions in which she received information about others' choices (second-mover GR, second-mover IR, and IR/GR). The order of decisions was randomly determined.

We also measured gratitude in Study 3. Half the participants completed the measure before making their decisions (but after learning what others had given, if applicable). Assigning only half of our participants to report their emotions allows us to ensure that any differences in giving behavior were due to differences between conditions (e.g., second-mover giving in IR versus GR), rather than to the emotions questions "priming" gratitude and then driving differences between conditions. Following prior work (Bartlett and DeSteno 2006), participants indicated how grateful they currently felt on a scale from 1 ("not at all grateful") to 5 ("very grateful"). They also answered additional filler emotions questions (happy, inspired, nervous, upset, alert).

Once they completed all five decisions, participants answered several open-ended questions to gauge their suspicion and were then debriefed. Because participants in Study 3 interacted with simulated others, we paid all participants $2, that is, the $1 flat fee plus the maximum advertised bonus of $1. The study took approximately 15 minutes.

Study 3 Results

Like Study 2, Study 3 allows us to test whether initial giving is higher in IR (Hypothesis 3a) and subsequent giving is higher in GR (Hypothesis 3b). We also assess whether reputation processes promote GR processes (Hypothesis 4). In addition, we examine whether feelings of gratitude drive second-mover GR decisions. All analyses in Study 3 modeled giving in a two-level multilevel regression, with random intercepts for decisions nested in participants. (Detailed results are given in Part A of the online supplement.)

Replicating the results of Study 2, for first movers in the sequence, we find that participants gave more of their 10-point endowment as first movers in IR than as first movers in GR (Table S4, Model 1: $b = .61$, $SE = .19$, $p < .01$, $M_{IR\ giving} = 5.56$, SD = 3.90, $M_{GR\ giving} = 4.90$, SD = 3.89). Again, this supports our earlier argument that giving is more likely to get off the ground with IR (versus GR) in pure generalized exchange (Hypothesis 3a).

Next, we turn to second-movers' generosity in IR versus GR structures (for now, we

omit the integrated IR/GR condition and focus on pure IR or pure GR decisions). Controlling for the first-mover's giving behavior (which itself affected second-mover giving, Table S4, Model 2, $b = .38$, $SE = .03$, $p < .001$), participants gave more when they were paying it forward (GR), compared to when they were rewarding a giver (IR; $b = .78$, $SE = .25$, $p < .01$). These results support Hypothesis 3b: once prosociality gets off the ground, subsequent movers in GR are more generous than subsequent movers in IR in pure generalized exchange systems.

Prior to making their decision, but after they had learned what the first mover gave to them (in GR) or to someone else (in IR), half of the second movers were asked how grateful they were. We examined whether the ostensive first-mover's giving behavior influenced the participant's giving behavior, and whether this was mediated by gratitude in the GR condition in particular. After all, there is no reason to expect IR will be mediated by gratitude. Rather, gratitude should mediate the impact of others' giving on whether participants give in GR. First-mover giving behavior predicted second-mover giving behavior ($b = .42$, $SE = .08$, $p < .01$); this pattern did not differ between IR and GR (Table S5, Model 1: $b = –.08$, $SE = .12$, $p = .50$). However, a moderated mediation model (Muller, Judd, and Yzerbyt 2005) revealed that feelings of gratitude partially mediated the relationship between first-mover and second-mover giving in GR, but not in IR. In GR, first-mover giving behavior was associated with feelings of gratitude ($b = .14$, $SE = .04$, $p < .001$); as expected, this was not the case in IR (Table S5, Model 2: $b = .02$, $SE = .02$, $p = .31$). Gratitude, in turn, predicted subsequent giving behavior (Table S5, Model 3: $b = .49$, $SE = .27$, $p = .07$).

Finally, we look at results that speak to Hypothesis 4: whether participants pay it forward more often when an audience (D) can indirectly reciprocate their generosity. Our results replicate those from Study 2. Second movers in GR give more when in the presence of an indirect reciprocator, D (Table S4, Model 3: $b = .51$, $SE = .24$, $p = .04$, $M_{\text{No Indirect Reciprocator}} = 4.95$, $SD = 4.09$, $M_{\text{Indirect Reciprocator}} = 5.46$, $SD = 3.83$). This finding holds regardless of what second movers receive from the first mover A, which itself predicts giving behavior ($b = .24$, $SE = .03$, $p < .01$). As in Study 2, the interaction between the presence of an indirect reciprocator and A's giving was not significant ($b = –.10$, $SE = .09$, $p = .25$): rather, across all values of A's giving behavior when initiating a chain of GR, subsequent movers behave more generously when an indirect reciprocator is present to reward them. That is, Studies 2 and 3 both demonstrate that people pay it forward (giving more when they receive more from a first mover), but they are also more generous when an indirect reciprocator is present.

Discussion of Study 3

The results of Study 3 provide strong support for all hypotheses tested. First, we found further support for Hypotheses 2, 3a, and 4. Additionally, although Study 2 was inconclusive with respect to the prediction that GR results in higher levels of giving than IR once a pure generalized exchange system is initiated (Hypothesis 3b), Study 3 found strong support for the hypothesis. Finally, Study 3 provided more explicit evidence for the mechanisms governing GR and IR. Specifically, we found that giving is driven by gratitude in GR but not in IR.

We conducted a final experiment to rule out possible alternative interpretations for some of our findings. First, we aimed to show that information about others' giving in IR and GR goes above and beyond basic normative influence effects. That is, knowledge of what others in a generalized exchange system have given not only provides information relevant to IR or GR processes; it also provides information about whether generosity is "typical" in this particular group or setting. Prior work shows that the effects of others' behaviors on generosity in GR go beyond normative influence (Tsvetkova and Macy 2014). However, to our knowledge, no research has shown that the impact of others' giving on ego's

generosity in IR is not totally attributable to normative influence. This is especially important given our Study 3 finding that second movers give less in IR than do second movers in GR. We therefore wanted to ensure that another's decision has a stronger effect on a person's behavior when it is embedded in an IR or GR structure, compared to when it simply provides information about what is "typical" in the group (e.g., when it occurs in the context of an independent relation).

Second, we wanted to ensure that the effects we documented for IR are driven by the theorized mechanism—that is, the prospect of indirect reciprocity—rather than merely the concern that one's generosity (or selfishness) will be seen and evaluated by a third party. Study 4 allows us to address these remaining issues and provides an additional test of Hypothesis 3b.

STUDY 4

Participants and Design

Study 4 included 200 MTurk participants (51 percent female).[13] Except where specified, the procedures were identical to Study 3. As in Study 3, participants made decisions in a series of one-shot interactions. Specifically, all participants made a decision as (1) second mover in GR, (2) second mover in IR, and (3) in a normative information condition, where the participant first learned how much an ostensible (simulated) other had given in an independent relation. These conditions allow us to infer whether information about others' behaviors have larger effects on one's own behavior when they are embedded in GR and IR processes, compared to when they merely provide normative information. (The second-mover GR and IR conditions also provide an additional test of Hypothesis 3b.)

Additionally, participants either made a decision while being observed by an ostensible other who would know about and could indirectly reciprocate the participant's generosity (i.e., first-mover IR) *or* while being observed by an ostensible other who would know about but could not indirectly reciprocate the participant's generosity. In this latter "observer" condition, the participant believed the observer would subsequently interact with another person in an independent dyad. Comparison of generosity in these two conditions allows us to assess whether higher rates of giving in IR are driven merely by being observed.

Study 3 participants were told that ostensible others gave 0, 5, or 10 in random order across the three decisions for which they received feedback about others' choices. To assess the robustness of our findings across different levels of generosity by others, Study 4 participants saw the other give a randomly assigned value between 0 and 2 ("low giving") or 8 and 10 ("high giving") across each of the three decisions in which they received information about others' decisions. The order of all decisions was randomly determined.

Study 4 Results

We modeled giving using multilevel regressions, with random intercepts for decisions nested in participants. First, as expected, we found that (1) others' giving behavior has a significant effect on participants' giving in both the normative information condition and the GR condition (Table S6, Model 1: $b = .19$, $SE = .05$, $p < .001$), but (2) others' giving has a *stronger* effect on participants' giving in the GR versus the normative information condition ($b = .15$, $SE = .06$, $p = .01$). That is, information about others' giving matters, but it especially matters when that other gave (or did not give) to the decision-maker—that is, when deciding to pay it forward. We observe parallel effects for second movers in the IR condition ($b = .30$, $SE = .06$, $p < .001$)—others' giving behavior matters more when rewarding a first mover in IR than when receiving normative information and giving to a third party.

Similarly, supporting the core assumption that prosocial behavior increases in the presence of an indirect reciprocator rather than in the presence of a mere observer, giving was higher among participants whose audience could reward them, compared to those whose

audience would subsequently give to a third party (Table S6, Model 2: $b = 1.20$, $SE = .55$, $p = .03$).

Finally, we replicated the results relevant to Hypothesis 3b, comparing second-mover IR and second-mover GR giving. Specifically, controlling for the first-mover's giving behavior, participants gave more when they were paying it forward, compared to when they were rewarding a giver (Table S6, Model 3: $b = .61$, $SE = .25$, $p = .02$). Thus, these results support our claim that once prosociality gets off the ground, subsequent movers in GR are more generous than subsequent movers in IR in pure generalized exchange systems.

In summary, Study 4 rules out several alternative explanations for our earlier findings and provides additional support for the hypothesis that, once pure generalized exchange gets off the ground, GR processes can result in higher levels of giving than IR processes.

DISCUSSION

Investigations of generalized exchange systems have centered on one of two broad processes. One research stream has focused on generalized reciprocity (GR), where targets of generosity experience gratitude, leading them to "pay it forward" to third parties (Gray et al. 2014; Tsvetkova and Macy 2014; Willer et al. 2012). A separate line of work has focused on indirect reciprocity (IR), where benefactors gain prosocial reputations and, as a consequence, are indirectly rewarded by third parties (Barclay and Willer 2007; Milinski et al. 2002; Yoeli et al. 2013). Here we go beyond prior work by conceptualizing these affective and strategic processes as core components of an integrated generalized exchange system. This account provides several new insights about when and why GR or IR will lead to higher levels of prosociality, and how the two processes reinforce one another.

First, we investigated the relative impact of GR and IR on inequality and resource flows in both chain (Study 1) and pure (Studies 2, 3, and 4) generalized exchange systems. Consistent with Hypothesis 2, we found lower levels of inequality in resources when giving was characterized by indirect reciprocity. That IR would lead to lower inequality may seem counterintuitive, given that GR is driven by prosocial emotions, whereas IR is driven by a more strategic, self-interested response to the presence of an audience who can reward one's generosity. But our results show that GR processes are more exploitable, such that network members can more readily take from the system without giving back to it. Thus, resources that flow through generalized exchange systems governed by GR tend to be distributed more unequally. These results point to the important role of reputations in reducing inequalities within groups (see also Uehara 1990).

Results also supported our core arguments for the relative impact of GR versus IR on prosociality in chain (Hypothesis 1) and pure (Hypotheses 3a and 3b) generalized exchange systems. We found that the incentive to maintain a prosocial reputation in chain generalized exchange leads to higher levels of prosocial behavior, compared to chain generalized exchange governed by GR processes (Study 1). In contrast, the relative effects of GR and IR processes on a focal person's prosocial behavior varied with her position in a pure generalized exchange system (Studies 2, 3, and 4). These findings underscore the importance of theorizing chain and pure generalized exchange as related, but distinct, processes. Doing so helps reconcile otherwise contradictory findings from the previous studies that considered the relative impact of GR and IR processes on prosocial behavior (Baker and Bulkley 2014; Boyd and Richerson 1989).

More broadly, this research not only puts prior work on the isolated effects of GR or IR into context; it also explains their joint impact on the flow of valued resources in groups or networks. For instance, the GR literature takes the existence of generalized exchange systems as given, but we show how IR processes can set generalized exchange into motion, which can then spark a cascade of generalized reciprocity. Similarly, we noted that the decision to pay forward help received often occurs in the presence of an audience and thus can carry large reputational

consequences. Consistent with Hypothesis 4, we found especially high levels of GR when there was an observer who could indirectly reciprocate one's generosity.

The integrated account offered here takes us a long way toward understanding why generalized exchange systems are widespread, despite posing a "social dilemma," or tension between the interests of the group and each of its members (Simpson and Willer 2015; Yamagishi and Cook 1993). GR and IR can each reduce this tension, but a generalized exchange system governed by only one or the other is necessarily more prone to exploitation—and thus dissolution—than one governed by their joint effects. For instance, GR processes are vulnerable to weak links, who receive help from others but do not pay it forward. Conversely, IR processes depend on knowledge of others' reputations and the existence of an audience who will take note of a prosocial act and indirectly reciprocate it in due time. The account of generalized exchange offered here thus illustrates how each mechanism can fill otherwise exploitable holes left by weaknesses in its complementary mechanism.

One question is whether the theory and results reported here imply that, in practice, the two processes and their associated mechanisms are so intertwined that to continue to distinguish them no longer makes theoretical sense. We contend the distinction between GR and IR remains critical to understanding generalized exchange. Although many instances of generalized exchange systems are governed by both gratitude and reputations, the extent to which one mechanism or the other is more salient depends on context. As one example, Glover and Filep (2015) studied helping among thru-hikers on the 3,500 km Appalachian Trail, a setting where chance encounters among strangers leave little opportunity for investment in long-term reputations. And, indeed, hikers' accounts of generosity on the trail strongly suggest they were primarily motivated by gratitude rather than reputation. Maintaining the distinction between the two mechanisms is also useful for a clear theoretical understanding of contexts where they co-occur. This can be seen in our finding that each mechanism can have variable effects, depending on where in the generalized exchange sequence it is located.

Clearly distinguishing the two mechanisms can also help researchers identify their fingerprints in real world generalized exchange systems. For instance, researchers identify the existence of generalized exchange via the presence of directed triads (e.g., where ties represent the flow of resources from one actor to another) in cross-sectional network data (Faraj and Johnson 2011; Lazega and Pattison 1999). The triad "John helps Ann," "Ann helps Bill," and "Bill helps John" in the cross-section may be evidence of generalized exchange, but it would not tell us whether the generalized exchange is driven by GR, IR, or both. For this, we need information on the *sequence* of resource flows in the triad: the sequence "John helps Ann at *t1* and Ann helps Bill at *t2*" would tell us that generalized exchange is likely driven by GR, whereas the sequence "Bill helps John at *t1* and Ann helps Bill at *t2*" would tell us it is likely driven by IR. Thus, two very different processes can appear identical when we ignore the timing of prosocial behaviors. Distinguishing GR and IR directs our attention to the importance of identifying distinct sequences and, as such, can yield greater insights into what drives generalized exchange in data on real world networks.

Following recent work on generalized exchange, the integrated approach offered above assumes that GR is primarily driven by gratitude, whereas IR is driven by strategic responses to reputational incentives. Our results largely support these assumptions. For instance, in Study 3, we found that the effects of GR, but not IR, were mediated by gratitude. Study 4 found that IR effects occur due to anticipated reputational benefits, rather than merely being observed. Study 4 also found that both GR and IR effects occur above and beyond normative influence effects. When coupled with prior work on mechanisms, these results put us on solid theoretical ground in assuming that gratitude and reputational processes play an especially

powerful role in generalized exchange systems. That said, gratitude only partially mediated GR processes in Study 3, suggesting that other mechanisms also matter. For instance, a motivation to reduce feelings of indebtedness may also increase the likelihood that people pay forward help received.

A broadly applicable theory of generalized exchange would account not only for these additional mechanisms that may promote prosociality, but also those that can undermine it. As one example, Tsvetkova and Macy (2014) found that being the recipient of others' help (GR) or merely observing help between third parties increased generosity. But unlike the effects of GR, which were robust to high levels of receiving help, observing very high levels of giving by others led to lower rates of giving, perhaps because it signaled that one's help was not needed. An important next step for future research is to more fully account for these and related processes.

Summing up, generalized exchange systems are often considered the basis of human morality (Alexander 1987) and the key to widespread social solidarity (Ekeh 1974). Furthermore, investigations into generalized exchange have yielded fundamental insights about how prosociality emerges and spreads through populations. But we have argued and shown that an integrated approach that accounts for both foundations of generalized exchange systems yields a much richer understanding of their reach and limits. We hope that the arguments and findings outlined here will encourage further work that takes a broader perspective on the foundations of generalized exchange systems, social solidarity, and prosocial behavior.

Data Note

The data and a codebook, including model specifications, for all studies reported in this paper are available through Harvard's Dataverse.

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Notes

1. Generalized and indirect reciprocity are often conflated or used interchangeably, but the distinction is an important one, given that they are based on very different causal mechanisms. Furthermore, researchers sometimes use different labels than those used here. For instance, Baker and Bulkley (2014) distinguish between "pay it forward" reciprocity and "rewarding reputation." Others use upward and downward tit-for-tat to denote, respectively, generalized versus indirect reciprocity (Boyd and Richerson 1989; Takahashi 2000). Although the Baker and Bulkley terminology is more intuitive, we stick with the standard terminology.
2. Compared to mechanisms driving generalized reciprocity, researchers have focused less on identifying alternative explanations for indirect reciprocity. Our fourth study rules out two alternative explanations for indirect reciprocity. Although we find that normative influence and merely being observed can promote giving in indirect reciprocity relations, we also find that reputation processes play a much more powerful role. Thus, consistent with all prior work on indirect reciprocity, our theory focuses on reputation.
3. This motivation may be most commonly associated with Benjamin Franklin. Franklin sent money to Benjamin Webb to help Webb start a business. In a letter accompanying the money, Franklin wrote: "I send you herewith a bill for ten louis d'ors. I do not pretend to give you such a sum. I only lend it to you. When you shall return to your country, you can not fail of getting into some business, that will in time enable you to pay all your debts. In that case, when you meet with another honest man in similar distress, you must pay me by lending this sum to him; enjoining him to discharge the debt by a like operation, when he shall be able and shall meet with such another opportunity, I hope it may thus go through many hands before it meets with a knave that will stop its progress. This is a trick of mine for doing a deal of good with a little money. I am not rich enough to afford much in good works, and so am obliged to be cunning and make the most of little" (quoted in Benkler 2011). This motivation is also the basis of the novel (Hyde 2000) and movie "Pay it Forward."
4. For instance, Anderson and Shirako (2008) found that a person's reputation correlated more strongly with her behavioral history—for example, her cooperativeness in negotiations with fellow group members—when she occupied a more central

network position. By extension, more visible members of communities or organizations might be rewarded more by third parties for help they have given, or punished more for their failures to help, compared to their less visible counterparts.

5. As an additional check on whether information level moderates our primary effects, our first study also manipulated the amount of information available to participants. But as we will explain, our main results were not moderated by information level, suggesting they are robust to at least some variation in information complexity. Results on information levels are reported in Part B of the online supplement.
6. The experiments we outline here allow us to more carefully control the level of informational demands across IR and GR conditions.
7. Along with our primary manipulation (IR versus GR), we included an additional manipulation that varied the amount of information about others' behaviors available to participants, to consider whether information level (basic versus extended) moderated the effects of IR versus GR (see also note 4). Although we did not make specific predictions about the effect of extended information, some accounts of IR suggest that extended information should affect IR giving in particular (see discussion in Part B of the online supplement). Results suggested that this additional manipulation did not moderate our effects: all observed differences between IR and GR structures we report here occurred independent of the extent of information about others' giving. We therefore give our detailed discussion of the extended information conditions and results in Part B of the online supplement.
8. Incorrect answers to the quiz questions were followed by a detailed description of the correct answer. The majority of participants were able to answer the quiz questions correctly.
9. Due to a computer error, six groups only completed 1 of the 5 rounds for one condition and were treated as missing for the other four rounds of that condition.
10. Having simulated others and the participant make binary, versus continuous, helping decisions allowed us to more carefully control experimental treatments. In this context, decisions to give or not to give are unambiguously generous and selfish, respectively. A decision to give, for instance, 50 percent of an endowment is more ambiguous, and we could not know how a given participant interpreted an intermediate level of giving. Thus, for Study 2, we began simply with a discrete manipulation—and measure—of giving. Study 3 relaxes the assumption that giving must be all or nothing and allows any proportion of a person's endowments to be passed on to others.
11. One caveat is that because they have often taken part in previous studies, many MTurk participants are less naïve than participants in laboratory experiments (Chandler, Mueller, and Paolacci 2014). As Chandler and colleagues (2014) show, this can lead to higher levels of suspicion in studies that employ commonly used procedures involving deception. Based on a standard procedure for assessing deception, we found relatively low suspicion rates in Studies 3 and 4. Across both studies, 6.6 percent of our participants expressed suspicion that they were interacting with other participants. These comparatively low levels may stem from the fact that the MTurk studies most closely related to ours—namely studies of generalized reciprocity (Tsvetkova and Macy 2014) and cooperation in networks (e.g., Sharido et al. 2013)—did not use deception.
12. We omitted 14 responses from analyses because the participant either completed the survey multiple times (three responses), reported suspicion about whether they were interacting with other participants in the debriefing questions (seven), or failed an attention check question (four). Our analyses are based on the responses of the remaining 195 participants. Due to a programming error, 19 participants did not complete all five decisions (the decision they did not complete was random); they were treated as missing for the decisions they did not complete.
13. We omitted responses from 20 participants who reported suspicion about whether they were interacting with other participants in the debriefing questions. Our analyses are based on the responses of the remaining 180 participants.

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