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What is reciprocity? A review and expert-based classification of cooperative transfers

Diego Guevara Beltran ^{a,*}, Jessica D. Ayers ^b, Andres Munoz ^a, Lee Cronk ^c, Athena Aktipis ^a

^a Department of Psychology, Arizona State University, Tempe, AZ 85287-1104, United States

^b Department of Psychological Science, Boise State University, Boise, ID 83725-1715, USA

^c Department of Anthropology, Rutgers University, New Brunswick, NJ 08901-1414, USA

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ABSTRACT

After decades of research on the topic of reciprocity, there is still no consensus about the meaning of the term. Instead, there has been a proliferation of reciprocity terms with varied definitions, some of which overlap in ways that lead to confusion for scholars studying cooperation. In this paper, we provide a summary of 34 reciprocity terms and their definitions from across a variety of disciplines. We then report the results of a survey of cooperation experts spanning biology, anthropology, economics, sociology, and psychology ($N = 85$) about the extent to which they consider 30 of these definitions of reciprocity to be truly reciprocity. Experts also rated the extent to which they considered seventeen hypothetical scenarios to be examples of reciprocity. We used exploratory factor analysis and found that responses clustered around four dimensions of transfers: Balanced (e.g., Balanced reciprocity), Reputation-based (e.g., Generalized reciprocity), Debt-based (e.g., Calculated reciprocity), and Unconditional (e.g., Negative reciprocity). Although researchers agreed that the term reciprocity was useful and necessary, there was low agreement among scholars about what should be considered reciprocity. However, there was high agreement that unconditional transfers, which are characterized by a lack of expectations of repayment, should not be considered reciprocity. We propose that scholars of cooperation consider using these four dimensions when referring to cooperative transfers rather than using reciprocity terms in order to facilitate communication across disciplines, resolve issues related to ambiguous definitions of reciprocity, and provide a solution to the lack of consensus about what constitutes reciprocity.

I learn to do service to another, without bearing him any real kindness, because I foresee, that he will return my service in expectation of another of the same kind, and in order to maintain the same correspondence of good offices with me and others. And accordingly, after I have serv'd him and he is in possession of the advantage arising from my action, he is induc'd to perform his part, as foreseeing the consequences of his refusal.

-David Hume, 1740, *A Treatise of Human Nature*, Book III: Of Morals, part two, section five

1. Introduction

The concept of reciprocity has been part of the social sciences since the eighteenth century. The term became prominent in the twentieth century thanks to the work of various scholars, from anthropologists to

economists to evolutionary biologists. Bronislaw Malinowski, one of the founders of sociocultural anthropology, argued that reciprocity was the basis of economic exchange, law, politics, and social structure in small-scale societies. In his work in the Trobriand Islands, he wrote: "As a rule two communities rely upon each other in other forms of trading and other mutual services as well. Thus every chain of reciprocity is made all the more binding by being part and parcel of a whole system of mutualities" (1926:23). Marcel Mauss (2002), in his book *The Gift*, saw reciprocity as a fundamental principle in ancient and modern small-scale societies. Lévi-Strauss (1969) emphasized reciprocity's role in marriage systems in which descent groups exchange marriage partners over the generations. Economist Karl Polanyi argued that systems of economic distribution come in three types: reciprocity, redistribution, and the market (Polanyi, 1944). Marshall Sahlins (1965) and other anthropologists embraced Polanyi's framework, but Sahlins argued that

* Corresponding author.

E-mail address: dguevar3@asu.edu (D. Guevara Beltran).

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reciprocity needed to be broken down into three types: generalized, balanced, and negative (Table 1).

Robert Trivers (1971) brought the concept of reciprocity into evolutionary biology, in the process of coining the phrase “reciprocal altruism.” Political scientist Axelrod (Axelrod, 1984; Axelrod & Hamilton, 1981) combined reciprocity with game theory by holding a tournament in which different computer programs competed in a Prisoner’s Dilemma game. The winning strategy, Tit-for-Tat (i.e., first cooperate, and then do whatever the other player did in the previous round) subsequently came to epitomize the meaning of reciprocity for many scholars (Carter, 2014; Cronk & Leech, 2013). Biologist Richard Alexander (1977, 1987) proposed the term indirect reciprocity to refer to situations in which the actor’s reward for an act of kindness comes not from the recipient but rather from a third party observing the act. Indirect reciprocity was subsequently championed by Martin Nowak and Karl Sigmund as the key to the puzzle of human cooperation (Nowak & Sigmund, 2005). And economist Herbert Gintis (2000) suggested the term strong reciprocity to refer to uncompensated acts of generosity favored by selection at the level of the group.

As shown in Table 1, this is just a small part of the history of the term. By our count, scholars have proposed 34 different definitions of reciprocity (excluding Reciprocation, which is found in the Oxford English Dictionary). In some instances, the same term is used by different scholars to mean different things (e.g., generalized, weak, and strong reciprocity). Many terms, such as upstream indirect reciprocity, weak reciprocity I, and generalized reciprocity I share substantial overlapping meanings. Some reciprocity terms are in widespread use (e.g., indirect reciprocity) and others are less common (e.g., homeomorphic reciprocity). Some types of reciprocity resemble the kind of back-and-forth exchange imagined by Malinowski and other early scholars, while others do not. For example, neither generalized reciprocity nor strong reciprocity necessarily includes any return benefit to the original actor.

For scientific communication to be effective, the concepts scientists use must be clearly defined, and there must be a consensus among scientists regarding those definitions. The diversity of reciprocity-related concepts creates an opportunity to explore the degree to which there is a consensus among scientists about them. To that end, we conducted a survey of scholars who have contributed to the study of reciprocity and other forms of cooperation. The survey presented the various definitions of reciprocity terms, as well as vignettes about reciprocal scenarios, and asked scholars how well each one exemplified what they mean by the term “reciprocity.” Although Table 1 shows 35 reciprocity terms, our survey included 30. This discrepancy stems from three things. Trivers (1985) used two sentences to define reciprocal altruism, and we treated them as separate definitions in the survey. We were unaware of serial reciprocity (Moody, 2008), social reciprocity (Floyd et al., 2018), and pay-it-forward reciprocity (Horita et al., 2016) when we designed the survey. And we failed to include strong reciprocity I (Price, 1962), and weak reciprocity I (Price, 1962) due to an oversight.

2. Method

2.1. Participants

We searched for peer-reviewed articles in psychology, biology, anthropology, economics, sociology, and communications that had either the word “reciprocity” or “cooperation” in their titles, identifying a total of 127 peer-reviewed articles. From these articles, we retrieved 222 valid email addresses for the authors and co-authors. We then posted our survey on Facebook and Twitter to recruit researchers we may have missed during the web scraping process, allowing participants the opportunity to share the survey with other academics. Combined, 130 people completed the survey. Forty-five participants were excluded because they indicated they were not researchers, at which point the survey ended ($n = 27$), or because they had 50% or more missing responses ($n = 18$), yielding an effective $N = 85$ (49.4% men, 10.6%

Table 1
Scholarly definitions of the term reciprocity.

Term	Citation	Description/definition
Reciprocation	Oxford English Dictionary (2023)	Action or practice of offering a response in kind, or of doing one thing in return for another (first use appears in 1549)
Reciprocity I	Malinowski, 1926:40	“[A] chain of reciprocal gifts and counter-gifts, which in the long run balance, benefiting both sides equally”
Reciprocity II	Thurnwald, 1932:106	“To-day’s giving will be recompensed by to-morrow’s taking”
Heteromorphic reciprocity	Gouldner, 1960	Exchange of things that are concretely different but of equal value
Homeomorphic reciprocity	Gouldner, 1960	Exchange of things that are the same
Weak reciprocity I*	Price, 1962	Distribution of resources among individuals in producing groups in the form of sharing
Strong reciprocity I*	Price, 1962	Distribution of resources among individuals in producing groups in the form of exchange
Balanced reciprocity	Sahlins, 1965	Transfers of equal value
Generalized reciprocity I	Sahlins, 1965	Non-conditional sharing and giving of assistance
Negative reciprocity I	Sahlins, 1965 ^a	Acquisition of benefit without intent to repay
Reciprocity III	Lévi-Strauss, 1969	Gifts exchanged immediately or on the condition that return gifts will be given in the future
Indirect reciprocity	Alexander, 1977	Return is expected from someone other than recipient of benefit
Tit-for-tat reciprocity	Axelrod, 1984	Cooperate if other party cooperates, defect if other party defects in iterated Prisoner’s Dilemmas
Delayed reciprocity	Wiley & Rabenold, 1984 ^b	Reciprocity with delay between initial transfer and repayment
Reciprocal altruism I	Trivers, 1985 ^c	Acting altruistically towards another who has already acted altruistically
Reciprocal altruism II	Trivers, 1985	The trading of altruistic acts
Pseudoreciprocity	Connor, 1986	When “the return benefit for a beneficent act is a by-product or incidental effect of egoistic behaviour by the recipient of the beneficent act.”
Direct reciprocity	Alexander, 1987	Return is expected from the recipient of benefit
Upstream indirect reciprocity	Boyd & Richerson, 1989	An act of altruism causes the recipient to perform a later act of altruism in the benefit of a third party
Downstream indirect reciprocity	Boyd & Richerson, 1989	The performer of an act of altruism is more likely to be the recipient of a later act of altruism
Interpersonal reciprocity	Burgoon, Dillman, & Stem, 1993	“... one responds, in a similar direction, to a partner’s behaviors with behaviors of comparable functional value.”
Positive reciprocity	Suranovic, 2000	An action that has a positive effect upon someone else is reciprocated with an action that has approximately equal positive effect upon another
Negative reciprocity II	Suranovic, 2000	An action that has a negative effect upon someone else is reciprocated with an action that has approximately equal negative effect upon another
Risk reduction reciprocity	Bird, Bird, Smith, & Kushnick, 2002	Giving with the expectation of equivalent return

(continued on next page)

Table 1 (continued)

Term	Citation	Description/definition
Strong reciprocity II	Gintis, 2000	Non-conditional altruism, including costly punishment, favored by group selection
Symmetry-based reciprocity	Brosnan & de Waal, 2002	Mutual affection between two parties prompts similar behavior in both directions without the need to keep track of give-and-take, so long as the relationship remains satisfactory (we're buddies)
Attitudinal reciprocity	Brosnan & de Waal, 2002	Parties mirror one another's attitudes, exchanging favors on the spot (if you're nice, I'll be nice)
Calculated reciprocity	Brosnan & de Waal, 2002	Individuals keep track of the benefits they exchange with particular partners, which helps them decide to whom to return favor (what have you done for me lately?)
Generalized reciprocity II	Pfeiffer, Rutte, Killingback, Taborsky, & Bonhoeffer, 2005	General tendency to be altruistic to others when others have been altruistic to you
Network reciprocity	Nowak, 2006	Non-conditional altruism favored by selection on social networks
Contingent reciprocity	Gurven, 2006	Giving contingent on past giving
Serial reciprocity*	Moody, 2008	"... when people reciprocate for what they have received ... by providing something to a third party, regardless of whether a return is also given, or makes its way back to, the original giver."
Weak reciprocity II	Guala, 2011	In contrast to strong reciprocity, this requires that actors receive a benefit
Pay-it-forward reciprocity*	Horita, Takezawa, Kinjo, Nakawake, & Masuda, 2016	Forward kindness received from others to strangers
Social reciprocity*	Floyd et al., 2018	Mutual exchange of goods, services and support among individuals, allowing for the distribution and augmentation of human agency in ways that individuals could not achieve alone

Note. This table summarizes the first uses of various reciprocity terms. * = definition was not included in the survey.

^a Sahlins incorrectly attributed this term to Gouldner (1960), who actually used the phrase "negative norms of reciprocity" to refer to instances of homeomorphic reciprocity in which the thing exchanged is some sort of harm (e.g., an eye for an eye).

^b Although this is the earliest scholarly reference to the phrase "delayed reciprocity," anthropologists have long known that a delay between transfers is an important part of many gift-giving systems (e.g., Mauss 1922).

^c Trivers' original article on reciprocal altruism was published in 1971, but in that article he did not define the term. These definitions are from his 1985 textbook.

women, 40.0% no-response). We recruited 43 via email, 18 via social media, and three via snowball sampling (21 did not indicate how they were recruited). Overall, participants were experienced researchers who were familiar with the literature on reciprocity and cooperation (Table 2).

2.2. Measures and procedure

Participants were asked the extent to which (1) the term reciprocity is useful in the scientific literature (1 = *not at all useful*, 7 = *very useful*),

Table 2

Sample characteristics.

Academic training	Freq.	%	Interest in reciprocity	Freq.	%
PhD	63	74.1	Primary interest	8	9.4
Master's	2	2.4	Top two interests	10	11.8
Bachelor's	1	1.2	Top five interests	37	43.5
No-response	18	21.2	Not among primary interests	12	14.1
			no-response	18	21.2
Academic field	Freq.	%	Interest in cooperation	Freq.	%
Biology	16	18.8	Primary interest	17	20.0
Psychology	16	18.8	Top two interests	23	27.1
Economics	12	14.1	Top five interests	22	25.9
Anthropology	6	7.1	Not among primary interests	5	5.9
Sociology	5	5.9	no-response	18	21.2
Mathematics	3	3.5	Publications		
Political Science	2	2.4	100 or more	10	11.8
Communications	2	2.4	50–99	17	20.0
Computer Science	2	2.4	30 to 49	9	10.6
Philosophy	2	2.4	20 to 29	6	7.1
Evolutionary Social Science	1	1.2	10 to 19	12	14.1
No-response	18	21.2	1 to 9	10	11.8
			No-response	21	24.7

(2) there is consensus about the use of the term reciprocity among academics within their field, (3) among academics in other disciplines, (4) and among non-academics (1 = *no consensus*, 7 = *absolute consensus*). Participants were then shown 30 definitions of reciprocity taken from the scholarly literature (Table 1), and asked to rate the extent to which each definition was reciprocity (1 = *definitely not reciprocity*, 7 = *definitely reciprocity*). Participants were also asked to describe each of the definitions (i.e., *What word would you use to describe this? (optional)*). Participants were never shown the technical term (e.g., Reciprocal altruism).

Next, participants were shown seventeen hypothetical scenarios. For each scenario, participants were asked to rate the extent to which the scenario presented was reciprocity (1 = *definitely not reciprocity*, 7 = *definitely reciprocity*). Participants were also given the opportunity to describe each of the scenarios (i.e., *What word would you use to describe this? (optional)*). We created some of these scenarios to map onto definitions from the scholarly literature. For example, Homeomorphic Reciprocity (i.e., *exchange of things that are the same or of equal value*) (Gouldner, 1960) was represented by "Skyler is hungry and has no food. Chris gives Skyler some bread. On the next day, Chris is hungry and has no food. Skyler gives Chris some bread." However, some of the hypothetical scenarios could map onto more than one scholarly definition. For example, Reciprocity II (i.e., *today's giving will be recompensed by tomorrow's taking*) (Thurnwald, 1932) could be represented by the scenario described above based on the definition of Homeomorphic Reciprocity as well as this scenario based on the definition of Delayed Reciprocity: "Skyler gives Chris some juice. Three months later, Chris gives Skyler some bread."

This study was not preregistered. We report sample size considerations, measures, and data exclusions. Data and analysis code are available here (osf.io/53pzj/?viewonly). We ran analyses with the *Psych* package for R Studio V. 1.3.1 (Revelle, 2018), and SPSS V.28. This study was approved by the institutional review board at Arizona State University.

3. Results

As shown in Table 2, 18 participants failed to report their academic training, current academic field, interest in cooperation and reciprocity, and number of publications (an additional three participants failed to report their number of publications but reported on the other items). We

were concerned that these participants may not truly be experts, and we therefore conducted additional analyses removing these 18 participants to assess the robustness of our results.

3.1. Perceived usefulness, need, and consensus of the term reciprocity

Researchers agreed that the term reciprocity was useful ($M = 5.89$, $SD = 1.07$), and necessary ($M = 5.80$, $SD = 1.30$) (SI S1.1; Table S1). Researchers also believed there was more consensus about the use of the term reciprocity among academics in their own fields than among academics in other fields ($p < 0.001$, $d = 0.99$), or among the public ($p < 0.001$, $d = 0.55$); but researchers believed there was equal consensus about the use of the term reciprocity among the public compared to among other academic fields ($p = 0.47$, $d = -0.08$) (Table S2). Results did not change after removing participants who failed to report their academic expertise (Table S2). A sensitivity analysis in G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) (paired-samples t , $n = 82$, $\alpha = 0.05$) showed we could detect effects as small as $d = 0.28$ with 80% power. Researchers across fields did not differ in the perceived consensus of the term reciprocity (SI S1.1; Table S1).

3.2. Scholarly definitions of reciprocity

3.2.1. Exploratory factor analyses (scholarly definitions)

We ran EFAs on the extent to which researchers believe the definitions are truly reciprocity. We allowed factors to correlate with one another, employing principal axis factoring ($n = 70$). Based on Eigenvalues and visual inspection of scree plots extracted from a principal component analysis, we ran EFAs with 1–5 factor solutions. A 4-factor solution explaining 46% of the variance yielded the most interpretable results ($\chi^2(321) = 350.55$, $p < 0.12$, TLI = 0.93, RMSR = 0.06, RMSEA = 0.03, CI_{90%} [0, 0.06]) (Table S3; Fig. 1). Adequate sample size for factor analyses range from $N = 50$ –75 when extracting four factors, there is a ratio of seven variables per factor (our case was 7.5 per factor), and communalities are wide (i.e., 0.20–0.80) (Mundfrom, Shaw, & Ke, 2005). Given these considerations, our sample size is within the recommended range. Results remained when removing participants who did not report their academic expertise (Table S4).

Eight definitions (e.g., Heteromorphic Reciprocity: *exchange of things that are concretely different but of equal value*) loaded on the first factor, which we labeled “Balanced Transfers,” and explained 14% of the variance. Six definitions (e.g., Reciprocal Altruism I: *acting altruistically towards another who has already acted altruistically*) loaded on the second factor, “Reputation-based Transfers,” and explained 13% of the variance. Five definitions (e.g., Direct Reciprocity: *when return is expected from the recipient of the benefit*) loaded on a third factor, “Debt-based Transfers,” accounting for 11% of the variance. Four definitions (e.g., Network Reciprocity: *non-conditional altruism favored by selection on social networks*) loaded on the fourth factor, “Unconditional Transfers,” accounting for 7% of the variance.

Balanced Transfers positively correlated with Debt-based Transfers ($r = 0.40$, $p < 0.001$), and Reputation-based Transfers ($r = 0.27$, $p = 0.02$). Reputation-based Transfers positively correlated with Debt-based Transfers ($r = 0.32$, $p = 0.01$). Unconditional Transfers did not correlate with Balanced ($r = 0.15$, $p = 0.21$), Reputation-based ($r = 0.21$, $p = 0.08$), or Debt-based Transfers ($r = 0.01$, $p = 0.92$).

3.2.2. Reciprocity ratings based on extracted factors (scholarly definitions)

We computed mean scores for Balanced, Reputation-based, Debt-based, and Unconditional Transfers. Variables with loadings lower than 0.40 are generally considered to not contribute meaningfully to latent factors (Knekt, Runyon, & Eddy, 2019) and were thus excluded from composites. Researchers did not differ in the extent to which they considered Balanced, Reputation-based, and Debt-based Transfers to be reciprocity (Table S5; Fig. 2). However, researchers considered Unconditional Transfers to be less reciprocity than all other reciprocity factors

(Table S5; Fig. 2). Results did not change after removing participants who failed to report their academic expertise (Table S6). A sensitivity analysis (paired-samples t , $n = 69$, $\alpha = 0.05$) showed we could detect effects as small as $d = 0.34$ with 80% power. Supplemental analyses show economists rated Balanced Transfers lower than psychologists and biologists, psychologists rated Unconditional Transfers higher than economists, and biologists rated Debt-based Transfers higher than economists (SI S1.2.1; Table S7–S8).

3.2.3. Researcher agreement about the term reciprocity (scholarly definitions)

To further explore the extent to which researchers agreed that the scholarly definitions were reciprocity, we transformed responses to reflect three categories: 1–3 = Is not reciprocity, 4 = Somewhat reciprocity, and 5–7 = Is reciprocity. We then ran a series of Fleiss' Kappas using the RSRP software (Release 7.6) (Zaiontz, 2020). Fleiss' Kappa is a test of inter-rater agreement for categorical responses, ranging from 0 (no agreement) to 1 (full agreement). A Fleiss' Kappa of 0.75 or above is typically considered an acceptable level of agreement (Fleiss & Cohen, 1973). No definition reached an acceptable level of agreement regarding what should be considered reciprocity (Table S9). Two definitions reached an acceptable level of agreement that they should not be considered reciprocity: Negative Reciprocity I ($k = 0.92$, CI_{95%} [0.89, 0.96]) and Strong Reciprocity II ($k = 0.83$, CI_{95%} [0.80, 0.85]). Results remained after removing participants who failed to report their academic expertise ($n = 67$): Researchers agreed Negative Reciprocity I ($k = 0.91$, CI_{95%} [0.87, 0.95]) and Strong Reciprocity II ($k = 0.83$, CI_{95%} [0.80, 0.86]) is not reciprocity; all other definitions did not reach agreement (k 's < 0.71).¹

3.3. Hypothetical scenarios of reciprocity

3.3.1. Exploratory factor analyses (social scenarios)

We also explored the extent to which experts considered some social scenarios –devoid of academic jargon– to be reciprocity. Based on Eigenvalues and visual inspection of scree plots extracted from a principal component analysis, we ran EFAs with 1–5 factor solutions. We allowed factors to correlate with one another employing principal axis factoring ($n = 76$). Our sample size was within the adequate range to extract 1–3 factors (Mundfrom et al., 2005), see Table S11 for the three-factor solution. However, a four-factor solution accounting for 42% of the variance yielded the most interpretable results ($\chi^2(74) = 102.64$, $p < 0.01$, TLI = 0.80, RMSR = 0.06, RMSEA = 0.07, CI_{90%} [0.03, 0.10]) (Table S10; Fig. 3), and was most consistent with the four-factors extracted from the scholarly definitions.

Six scenarios (e.g., *Skyler gives Chris some juice. Three months later, Chris gives Skyler some bread*) loaded on the first factor, “Balanced/Debt-based Transfers,” which accounted for 15% of the variance. Two scenarios (e.g., *Chris punches Skyler and Skyler punches Chris in response*) loaded on the factor “Retaliation,” which accounted for 10% of the variance. Four scenarios (e.g., *Skyler is hungry and has no food. Chris gives Skyler some bread. Skyler gives Chris a smile*) loaded on a third factor, “Unconditional Transfers,” which accounted for 10% of the variance. Two items (e.g., *Chris gives Skyler some bread and Alex sees the exchange taking place. Then, Alex gives Chris some bread*) that loaded on the fourth factor, “Reputation-based Transfers,” accounted for 6% of the variance.

Balanced/Debt-based Transfers was positively correlated with Retaliation ($r = 0.27$, $p = 0.02$), and Unconditional Transfers ($r = 0.33$, $p = 0.004$), but not Reputation-based Transfers ($r = 0.22$, $p = 0.07$).

¹ A robustness check where we coded responses to 1–2 = not reciprocity, 3–5 = somewhat reciprocity, 6–7 = is reciprocity yielded more conservative results. Only Negative reciprocity I reached an acceptable level of agreement that it should not be considered reciprocity ($k = 0.92$, CI_{95%} [0.89, 0.96]), Strong reciprocity II ($k = 0.70$, CI_{95%} [0.67, 0.73]), all other definitions (k 's < 0.58).

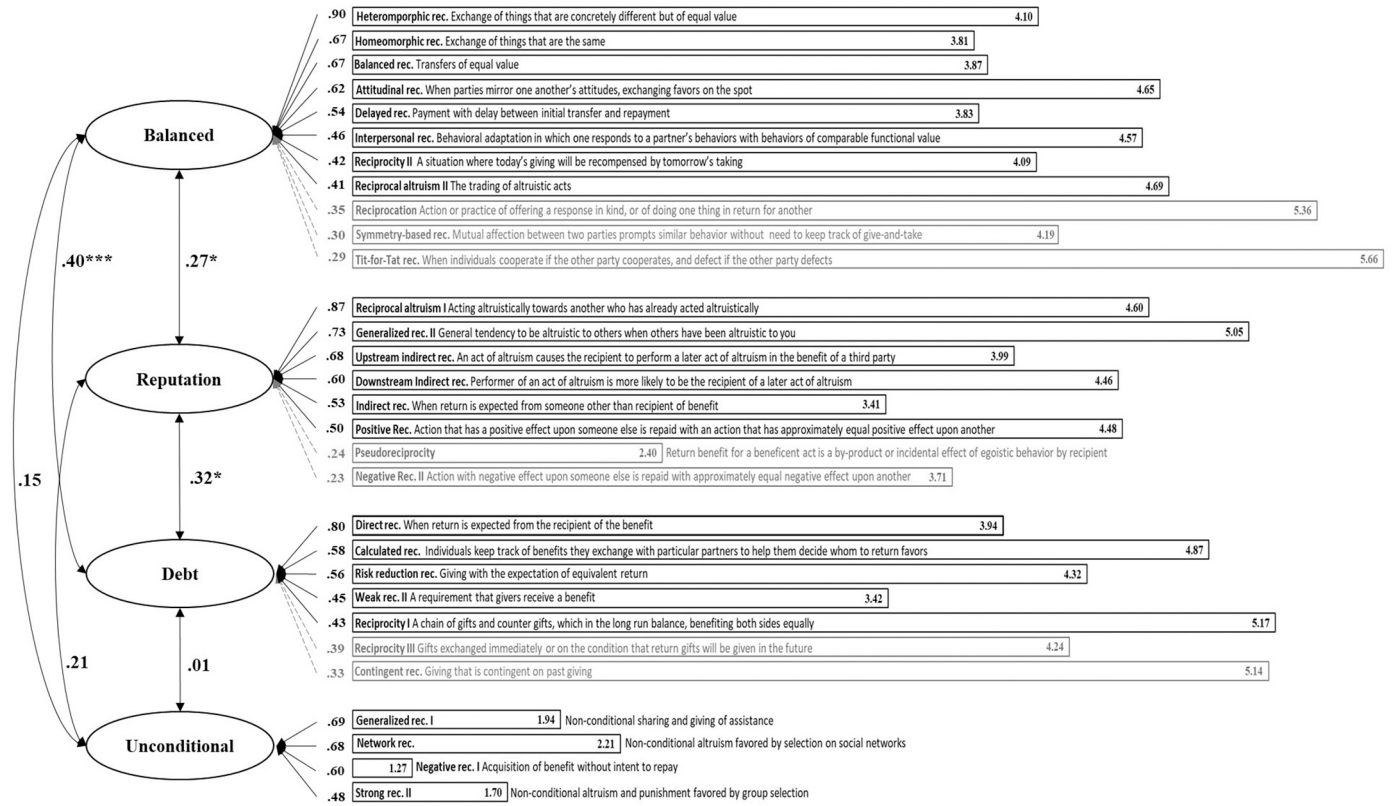


Fig. 1. Loadings from exploratory factor analysis of the scholarly definitions of the term reciprocity. Note. Bars show mean scores regarding whether participants agreed that the definition is reciprocity (1 = definitely not, 7 = definitely reciprocity). Single-arrow solid lines show factor loadings ≥ 0.40 , single-arrow dashed lines show factor loadings < 0.40 ; and double-arrow solid lines show inter-factor correlations (***) = $p < 0.001$, * = $p < 0.05$). Responses clustered along four dimensions: Balanced, Reputation-based, Debt-based, and Unconditional Transfers.

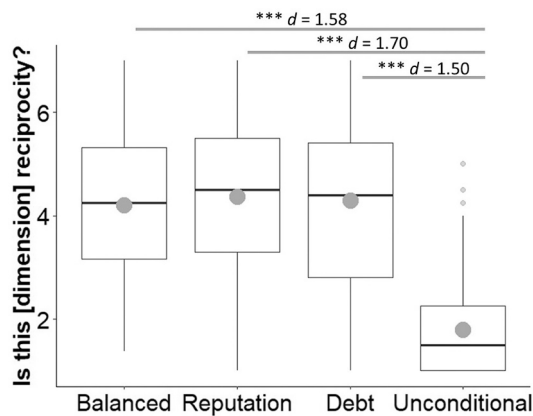


Fig. 2. Reciprocity ratings of extracted factors (scholarly definitions). Note. Participants rated Unconditional Transfers as less reciprocity than Balanced, Reputation-based, and Debt-based Transfers.

Retaliation was positively correlated with Unconditional Transfers ($r = 0.24$, $p = 0.04$), but not with Reputation-based Transfers ($r = 0.02$, $p = 0.86$), and Unconditional Transfers did not correlate with Reputation-based Transfers ($r = 0.19$, $p = 0.12$).

After removing participants who failed to report their academic expertise, a three-factor solution (Table S12) yielded more interpretable results than did a four-factor solution (Table S13). Although both the three-factor and the four-factor solutions yielded similar Balanced/Debt-based, Retaliation, and Unconditional Transfers factors, the four-factor solution did not result in the fourth factor reflecting Reputation-Based Transfers. Instead, these two items (i.e., 1. Chris gives Skyler some

bread. Then, Skyler gives Alex some bread; 2. Chris gives Skyler some bread and Alex sees the exchange taking place. Then, Alex gives Chris some bread) loaded onto Balanced/Debt-based transfers.

3.3.2. Reciprocity ratings based on extracted factors (social scenarios)

To explore whether researchers differed in the extent to which they considered the hypothetical scenarios to be reciprocity, we computed mean scores for the four factors extracted (Fig. 3). Researchers considered Balanced/Debt-based Transfers to be more reciprocity than all other scenarios, and Retaliation and Reputation-based Transfers scenarios to be more reciprocity than Unconditional Transfers, but researchers did not rate Retaliation and Reputation-based Transfers differently (Table S14; Fig. 4). A sensitivity analysis (paired-samples t , $n = 75$, $\alpha = 0.05$) shows we could detect effects as small as $d = 0.33$ with 80% power. Results were similar after removing participants who did not report their academic expertise (Table S15). Supplemental analyses show economists gave lower reciprocity ratings for Retaliation scenarios than biologists (SI S1.3.1; Table S16-S17).

3.3.3. Researcher agreement about the term reciprocity (social scenarios)

To further explore the extent to which researchers agreed the hypothetical scenarios were reciprocity, we ran Fleiss' Kappas (1–3 = Not reciprocity, 4 = Somewhat reciprocity, and 5–7 = Is reciprocity). Researchers agreed that the following scenarios were reciprocity: (1) Skyler is hungry and has no food. Chris gives Skyler some bread. On the next day, Chris is hungry and has no food. Skyler gives Chris some bread ($k = 0.78$, $CI_{95\%} [0.75, 0.81]$; after removing participants who did not report their expertise: $k = 0.80$, $CI_{95\%} [0.77, 0.83]$). (2) Skyler is hungry and has no food. Chris gives Skyler some bread once a week. One day, Chris is thirsty and has no water. Skyler gives Chris some water ($k = 0.76$, $CI_{95\%} [0.73, 0.79]$; after removing participants: $k = 0.78$, $CI_{95\%} [0.74, 0.81]$). In contrast,

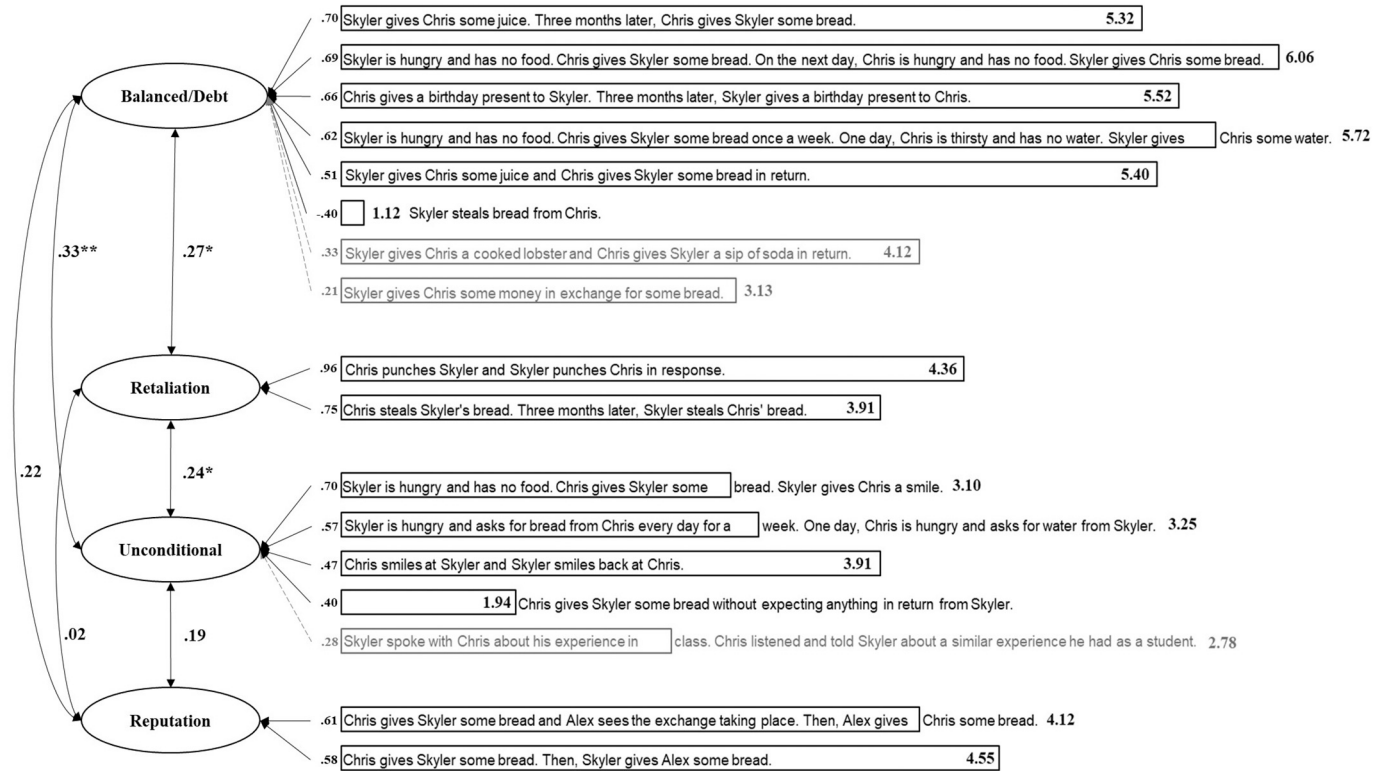


Fig. 3. Loadings from exploratory factor analysis of the hypothetical scenarios of reciprocity.
 Note. Bars represents mean scores regarding whether participants agreed that the scenario is reciprocity (1 = definitely not, 7 = definitely reciprocity). Single-arrow solid lines show factor loadings ≥ 0.40 , single-arrow dashed lines show factor loadings < 0.40 ; and double-arrow solid lines show inter-factor correlations (** = $p < 0.01$, * = $p < 0.05$). Responses clustered along four dimensions: Balanced/Debt-based, Retaliation, Unconditional, and Reputation-based Transfers.

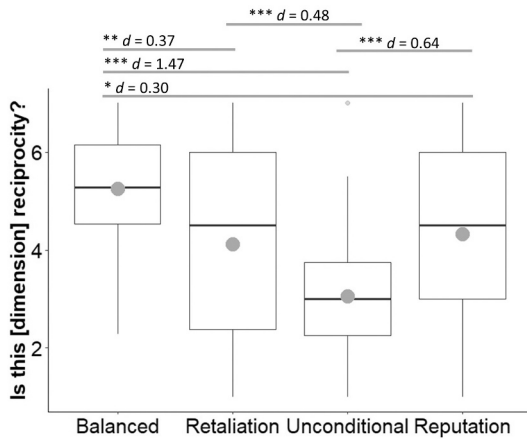


Fig. 4. Reciprocity ratings of extracted factors (social scenarios).
 Note. Participants rated Balanced/Debt-based scenarios to be more reciprocity (1 = definitely not reciprocity, 7 = definitely reciprocity) than Retaliation, Unconditional, and Reputation-based scenarios. Participants also rated Retaliation and Reputation-based scenarios to be more reciprocity than Unconditional Transfers scenarios.

researchers agreed that *Skyler steals bread from Chris* was not reciprocity ($k = 0.97$, $CI_{95\%} [0.94, 1.00]$; after removing participants: $k = 0.97$, $CI_{95\%} [0.93, 1.00]$). All other scenarios did not reach an acceptable level of agreement (k 's < 0.65 ; after removing participants: k 's < 0.66) (Table S18).²

3.4. Differences and similarities between definitions and social scenarios

We ran EFAs with both the scholarly definitions and social scenarios. A six-factor solution accounting for 48% of the variance yielded the most interpretable results ($\chi^2(814) = 869.77$, $p < 0.08$, $TLI = 0.90$, $RMSR = 0.06$, $RMSEA = 0.03$, $CI_{90\%} [0.00, 0.05]$). This solution resulted in factors similar to those extracted from the previous analyses: Balanced/Market-based, Reputation-based, Unconditional, Balanced/Relationship-based, Retaliation, and Debt-based Transfers (Table S19).

The main difference between the previous and the current analysis is that the scholarly definitions and social scenarios that loaded on the Balanced Transfers factors made up two separate factors. The first factor included mostly scholarly definitions (e.g., Heteromorphic reciprocity: *Exchange of things that are concretely different but of equal value*), and one social scenario. The second factor included only social scenarios (e.g., *Skyler gives Chris some juice. Three months later, Chris gives Skyler some bread*). Comparing these two factors, we saw that researchers believed that Balanced/Market-based Transfers ($M = 3.99$, $SD = 1.52$) were less reciprocity than Balanced/Relationship-based Transfers ($M = 5.07$, SD

² A robustness check where we coded responses to 1–2 = not reciprocity, 3–5 = somewhat reciprocity, 6–7 = is reciprocity yielded more conservative results. Only *Skyler steals bread from Chris* reached an acceptable level of agreement that it should not be considered reciprocity ($k = 0.95$, $CI_{95\%} [0.91, 0.99]$). All other scenarios did not reach agreement (k 's < 0.60).

= 1.09, $t(68) = -6.59$, $p < 0.001$, $M_{diff} = -1.08$, $CI_{95\%}[-1.41, -0.75]$, $d = -0.79$).

When we looked at researchers' open-ended responses to the items that made up these two factors, the difference appears to stem from two things: the nature of the relationship between agents, and the value placed on the items being transferred. Researchers used words such as "trade," "deal," "credit," and "market transaction" to describe Balanced/Market-based Transfers, suggesting that researchers saw these transfers as stemming from market-like transactions. This is corroborated by the fact that the scenario *Skyler gives Chris some money in exchange for some bread* loaded on this first factor. Although researchers also used words such as "economic exchange" to describe Balanced/Relationship-based Transfers, other researchers said that whether a scenario should be considered reciprocity depends on the "communal relationship and what's happened in the interim."

3.5. "What is reciprocity?"

In the last section of the survey, we asked experts to respond to the question *what is reciprocity?*. Participants consented to have their names and comments included in a publication of this work.

3.5.1. Definitions

Some respondents provided definitions of reciprocity. We excerpted these definitions, some of which we edited for length (full responses available in SI S2).

Bovet, Dalila: "when the gift of some food, or another favor, increases the probability for the donor to receive the same thing, or something else, from the receiver".

Carter, Gerald: "when an organism makes cooperative investments that are in some way contingent on the experience (or memory) of cooperative returns from the recipient".

Fehr, Ernst: "Reciprocal strategies in repeated games [...]. A social norm [...]. [A preference] to respond to kind acts with kind acts and to unkind acts with unkind acts."

Gaechter, Simon: "a pattern of behavior that responds to a beneficial act one has received with an act that is beneficial for the person (or group of people) whose beneficial act one has enjoyed in the first place."

Kenny, Dave: "a partner effect in the sequential [Actor-Partner Interdependence Model]."

Lister, Andrew: "a non-instrumental tendency to respond in kind."

3.5.2. Themes

3.5.2.1. Is reciprocity conditional? Experts mentioned several themes including the idea that reciprocity is characterized by "conditionality" (Noguera, Fischbacher, Fehr, Mesterton-Gibbons, Carter, Lister). Two researchers wrote that "If it's non-conditional, then it's not reciprocity." However, other researchers emphasized different types of conditions. Out of all of the open-ended responses (i.e., 548 observations provided by 48 participants), 39 responses (7.1% of all observations) provided by 13 (15.3%) participants dealt with the issue of conditionality. The most common conditions included that a transfer: (1) is *not* reciprocity if there is a formal contract/agreement or if it involves purchased goods ($n_{participants} = 4$); (2) is reciprocity depending on the relationship (e.g., if the recipient is kin; $n_{participants} = 4$); (3) is reciprocity *only* if agents get a return ($n_{participants} = 3$); (4) is reciprocity if it is positive/has value ($n_{participants} = 2$); (5) is reciprocity if it is dyadic ($n_{participants} = 2$); and (6) is reciprocity if the agents are engaging in strategic behavior or are keeping score ($n_{participants} = 2$). However, (7) one researcher wrote that "keeping track is not reciprocity;" and (8) another researcher argued that a transfer is not reciprocity if agents "are giving to show off, in that case it is signaling."

3.5.2.2. Is reciprocity intentional? Another theme was that the concept

of reciprocity should include not just behavior but also preferences for engaging in reciprocal behaviors (Fehr and Fischbacher), and one respondent said that "intent" was critical to concepts of reciprocity as applied to humans (Chalub). Echoing Fehr and Chalub, Schino wrote that in reciprocity "one tries to influence the other by incentivizing or punishing," and two other researchers provided six open-ended responses of the scholarly definitions indicating that the concept of reciprocity depends on the intentions (e.g., "if [the] intent is to reward other person's altruism"), and preferences of the agents (e.g., "expectation that other will have reciprocal preferences").

3.5.2.3. Is reciprocity best defined according to the psychology of the giver or the transfer's impact on the receiver? Another theme that emerged is the question of whether the hallmarks of reciprocity are to be found in the psychology of the giver or in the impact that a transfer has on receivers. One respondent noted that "Reciprocity is [...] a proximate (i.e., mechanistic) concept implying decision rules evolved through certain cost/benefit relationships" (Taborsky). In parallel to Taborsky, one researcher wrote "...I would ask WHY is the person being altruistic to others (the conscious proximate reason). The answer might be because of [an] obligation to give back (reciprocity) or for some other reason (not reciprocity)".

In contrast to Taborsky, Noë suggested that the focus of definitions of reciprocity should be on the actual transfer [and fitness impact] of benefits from one individual to another and "the actions of agents [like] 'X invests in Y'". Echoing Noë, another researcher wrote that "[reciprocity] must be judged only from the outcome (not the intention)."

3.5.3. Concerns

Participants also voiced concerns about the use and definitions of reciprocity terms. Pointing to the issue of mixing up proximate with ultimate-level explanations, Gaechter noted that "even people with no prosocial motivations whatsoever can behave reciprocally if it furthers their (long-run) strategic incentives..." According to him, this leads to situations where "reciprocity can be confounded with purely egoistic, transactional incentives."

Others voiced that existing definitions are not adequate. One respondent noted that "the formulation [of existing definitions of reciprocity] is rather sloppy" (Fischbacher). Echoing Fischbacher, 10 (11.7%) researchers provided 11 open-ended responses (2% of observations) for the scholarly definitions voicing similar concerns. The most common (i.e., 7) of the responses dealt with the use of the word "altruism" within definitions of reciprocity, with researchers indicating that transfers that involve a back-and-forth of transfers or expectations of repayment should not be considered altruistic.

Another researcher who voiced concerns about the adequacy of existing definitions noted that "indirect reciprocity means different things to different people" (Mesterton-Gibbons). Indeed, 20 (23.5%) researchers provided 52 open-ended responses (9.5% of observations) spanning seven different scholarly definitions where they used the words "indirect reciprocity" to describe a scholarly definition. Not only did different researchers use "indirect reciprocity" to describe different scholarly definitions, but 11 of these researchers used the words "indirect reciprocity" on more than one occasion to describe different scholarly definitions.

4. Discussion

4.1. What is reciprocity?

4.1.1. Reciprocity is (perceived to be) characterized by balance, debt, and reputation

We explored the extent to which researchers deem various types of cooperation to be reciprocity, including thirty definitions taken from the scholarly literature and seventeen hypothetical social scenarios.

Employing exploratory factor analyses, we discovered that the various types of reciprocity could be distilled into four types of transfers: (1) Balanced Transfers, which include transfers that are of equal or equivalent value, including both instances in which items are transferred in-the-moment, or with some delay; (2) Reputation-based Transfers, which include types of transfers where individuals give to others who have given in the past and receive from others if they have given in the past. These included transfers between dyads, a third person, or from other individuals within the network. 3) Debt-based Transfers, which include types of transfers where individuals keep track of, and expect repayment for, what they give to others, including transfers that occur between dyads, or among members of a network. 4) Unconditional Transfers, which include types of transfers that do not revolve around concepts of debt or account keeping and that may occur between dyads or among members of a network.

Experts displayed a certain level of consensus, agreeing that the term reciprocity was both useful and necessary. Researchers from various fields also provided similar reciprocity ratings for Balanced, Reputation-based, and Debt-based Transfers, suggesting some cross-disciplinary agreement on the extent to which these transfers are considered reciprocity. However, economists rated Balanced and Reputation-based Transfers lower in reciprocity than other fields (see SI S1.2.1). Moreover, the overall mean scores for these factors were around the scale's midpoint, indicating that none of these dimensions were strongly considered to be reciprocity.

4.1.2. Reciprocity is (perceived to be) characterized by informal transfers

We observed similar patterns for the hypothetical social scenarios, with researchers across academic fields rating the Balanced/Debt-based, Retaliation, and Reputation-based Transfer scenarios on the mid-point of the scale, showing some level of consensus regarding the degree to which these transfers are considered reciprocity (but see SI S1.3.1, economists rated Retaliation lower than Biologists). Moreover, unlike the scholarly definitions, researchers rated Balanced/Debt-based Transfer scenarios to be more reciprocity than Retaliation and Reputation-based Transfer scenarios.

Further analyses indicated that researchers believe that balanced transfers that occur outside of formal transactions (e.g., contracts, institutions, markets), are considered more reciprocity than those that occur within formal transactions. This was supported by four observations. First, the Balanced/Relationship-based scenarios received the highest rating of all factors. Second, researchers rated the Balanced/Relationship-based scenarios to be more reciprocity than the Balanced/Market-based Transfers ($d = 0.79$). Third, four researchers (4.7%) provided open-ended responses in which they explicitly stated that a transfer is *not* reciprocity if it occurs within a formal agreement (e.g., “[is reciprocity] On [the] condition that there is no official agreement or obligation”). And, fourth, a majority of researchers (89–90%) agreed that two of the Balanced/Relationship-based scenarios were reciprocity (e.g., *Skylar is hungry and has no food. Chris gives Skylar some bread. On the next day, Chris is hungry and has no food. Skylar gives Chris some bread.*)

4.1.3. Reciprocity is not (perceived to be) unconditional

The clearest consensus derived from this study is that experts believe reciprocity is conditional. This conclusion was supported by three observations. First, the Unconditional Transfers factors received the lowest rating of reciprocity compared to all other factors. The definitions that loaded on Unconditional Transfers and that should not be considered reciprocity according to experts in this survey were Generalized reciprocity I, Network reciprocity, Negative Reciprocity I, and Strong reciprocity II.

Second, most researchers (90–96%) agreed that Negative Reciprocity I (*acquisition of benefit without intent to repay*), and Strong Reciprocity II (*non-conditional altruism and punishment favored by group selection*) were *not* reciprocity. And, third, 13 (15.3%) researchers explicitly stated that a transfer is reciprocity only if it is accompanied by some type of

condition (7.1% of open-ended responses), such as the condition that transfers involve a return to the giver. An additional six researchers (7%) wrote that reciprocity includes some kind of conditionality in their responses to the question *What is reciprocity?*

4.2. What do researchers disagree about the most regarding the term reciprocity?

We searched within the open-ended responses of the scholarly definitions and social scenarios with the lowest rates of agreement (SI S1.4; Table S18), and through all responses to the question *What is reciprocity?* (SI S2) to see how common these disagreements are. In addition to researchers using the same definition to describe multiple scholarly definitions (e.g., “indirect reciprocity”), we identified six potential grounds for disagreement: (1) Intentionality: researchers (5.9%, including Fehr, Chalub, Schino) indicated that transfers were reciprocity if agents had the intention to reward a giver or incentivize a receiver to give back. (2) Value of the transfer: researchers (8.2%, including Fischbacher, Fehr, Noguera, Mesterton-Gibbons, Schino, Carter, Gaechter) stated that reciprocity involved negatively and positively valued transfers. However, two researchers (2.3%) stated that only transfers with positive utility are reciprocity.

(3) Account keeping: researchers (12.9%, including Noguera, Mesterton-Gibbons, Carter, Gaechter, Fehr, Noë) stated that reciprocity involved expectations of return, keeping score, and strategic behavior. However, one researcher stated that a transfer was not reciprocity if it involved “keeping track,” and Lister stated that reciprocity is “non-instrumental.” (4) Formal transactions: researchers (4.7%) indicated that a transfer was reciprocity if it did not involve a formal/market transaction. (5) Type of relationship: researchers (5.9%) stated that a transfer was reciprocity depending on the relationship between/among agents. Two researchers, including Mesterton-Gibbons, stated that transfers that occurred within close relationships were not reciprocity, while another stated that a transfer was reciprocity if the recipient was kin. (6) Costliness: researchers (3.5%, including Taborsky, Mesterton-Gibbons) stated that reciprocity involved a cost. However, another researcher stated that reciprocity does not involve “costs or negative actions.”

4.3. Is it necessary to use new terms to describe the ‘types of reciprocity’?

4.3.1. “Why I prefer defining verbs rather than nouns” (Noë)

We suggest that a new terminology of ‘balanced transfers,’ ‘reputation-based transfers,’ ‘debt-based transfers,’ and ‘unconditional transfers’ should be considered for talking about categories, or dimensions, of reciprocity. We suggest that using the term ‘transfer’ offers greater clarity than terms such as reciprocity or cooperation. Here, we echo Noë in “defining verbs rather than nouns,” and in the “need [for] definitions of the visible outcomes of these [reciprocal] strategies: the actions of agents.” Although the term reciprocity has a long history, our results clearly indicate that this term often means different things to different researchers. A transfer focuses on the action of agents. And, unlike reciprocity, the term transfer does not imply that the action is mutual or conditional (e.g., expectations of return). On this point, the terms loading on the ‘unconditional transfers’ dimension (e.g., Generalized Reciprocity I) were consistently rated as not ‘reciprocity,’ making the term ‘transfers’ more appropriate.

Moreover, unlike the term cooperation, which implies mutually beneficial actions, a transfer is agnostic towards the effect on the recipient. As Noë argues: “...An investment [or transfer] can be defined ... independent of the way in which it is embedded in the temporary structure of actions: before, during or after an action by the receiver of the investment, but also in the absence of any action of the receiver. Correctly defined, it remains one and the same action independent of context and thus a genuine target of selection.”

4.3.2. Reducing the number of dimensions used to define a transfer

We also echo Pat Barclay, one of our kind reviewers, in recognizing that individuals may engage in transfers that are simultaneously balanced, delayed, indirect, and calculated (or many other possible combinations). In the case of the framework we suggest here, the main reason to consider these new terms is that no commonly used existing terms capture the variation within the factors that emerged from factor analysis of the expert responses. In adopting these terms, we can provide specific qualifiers to a transfer while at the same time reducing the possible number of dimensions that describe a transfer based on whether, or the extent to which, they are balanced, debt-based, reputation-based, or unconditional.

We also recognize that these four dimensions do not specify the effect of the action on the recipient. Whether a transfer provides a benefit to or imposes a cost on its recipient must still be identified by researchers. On this point, three researchers (3.5%) indicated that a transfer was only reciprocity if it had a positive value/did not involve negative actions, while another indicated that both negative and positive actions were reciprocity, making the term ‘transfer’ more appropriate than reciprocity.

Pat Barclay also pointed out that some definitions we included in our study focus on the proximate mechanisms involved (e.g., motivations and decision rules, as in calculated reciprocity), while others are more about the ultimate level of explanation because they include information about the selection pressures thought to have favored the behavior. For example, the term “risk reduction reciprocity” includes within it an assertion about the selection pressures that would have favored the behavior in question among our ancestors. While the terms we are proposing (balanced, debt-based, reputation-based, and unconditional transfers) do include information about the proximate mechanisms thought to underlie a particular transfer (e.g., to create a debt or to improve the donor’s reputation), they do not by themselves imply any particular set of selection pressures that might have been responsible for their evolution. For example, the types of transfers that occur among hunter-gatherers in systems of central place provisioning (Berbesque, Wood, Crittenden, Mabulla, & Marlowe, 2016; Cashdan, 1989; Isaac, 1983; Marlowe, 2005) were likely to have been favored by selection due to their value in pooling risk (Bird et al., 2002; Cronk et al., 2019; Cronk & Aktipis, 2021), and might be motivated at the proximate level by concerns about a recipient’s need or concerns about the donor’s reputation.

Some readers might wonder why we did not use the language of direct, indirect, and generalized reciprocity. Two experts (Fischbacher and Taborsky) described direct, indirect, and generalized reciprocity as the three types of reciprocity. Indeed, Direct reciprocity loads onto debt-based transfers (0.80), Indirect reciprocity (0.53) and Generalized reciprocity II (0.73) load onto reputation-based transfers, and Generalized reciprocity I loads onto unconditional transfers (0.69). This suggests that these dimensions of reciprocity do map reasonably well onto this framework. However, in our factor analysis, many other types of transfers are also loaded with each of these broader factors, including types of transfers that are not captured by direct, indirect, and generalized reciprocity definitions.

4.4. Limitations and future directions

An important limitation was the limited sample diversity, with respondents mainly being male and from Western societies. Other dimensions of diversity were not assessed, potentially narrowing the scope of our findings. Additionally, our search for participants only included papers with “cooperation” or “reciprocity” in the title. Consequently, we may have missed experts researching similar topics using alternative terms, such as “reciprocal altruism.”

While our sample size was reasonable overall, samples within academic disciplines were small. In addition, open-ended responses to the scholarly definitions were labeled as optional. This led to only receiving

21.5% open-ended responses (out of a total possible of 2550 responses) from 56.5% of participants. This makes it hard to look at consensus among researchers within disciplines, and across disciplines. Thus, with the exception of unconditional transfers not being considered reciprocity, findings regarding consensus among experts (or lack thereof) should be treated as suggestive, rather than conclusive.

Despite these limitations, we were able to identify six potential grounds for disagreement regarding whether a transfer is considered reciprocity: the intention/preferences of agents engaging in transfers, the effect a transfer has on the recipient, expectations of return/account keeping, the type of relationship between agents (e.g., market-based, communal), and the costliness of a transfer. Researchers may consider investigating these dimensions to reduce disagreements regarding whether these dimensions are characteristic of the term reciprocity.

Our results also suggest that economists believe that balanced transfers are less reciprocity than psychologists and biologists. Economists also believe unconditional transfers are less reciprocity than psychologists, and that debt-based transfers are less reciprocity than biologists (SI S1.2.1). While these results are suggestive given the small number of researchers represented in each field, greater interdisciplinary collaboration may allow researchers to solve existing disagreements regarding these dimensions of the term reciprocity.

Another limitation concerns the potential impact of the scenarios included in our survey on the derived underlying structure. A broader range of cooperative interactions (e.g., partner choice, mutualism, spiteful cooperation) could have led to a different underlying structure. This limitation also affects our ability to establish discriminant validity between reciprocal and non-reciprocal interactions. One exception was a conversation-based scenario (i.e., *Skyler spoke with Chris about his experience in class. Chris listened and told Skyler about a similar experience he had as a student*). This scenario did not load onto any reciprocity factors, implying that interactions without resource transfers are not considered reciprocity.

Future research could survey experts about other cooperative acts such as positive assortment, partner choice, mutualism, kin selection, fitness interdependence, spiteful cooperation, need-based transfers, and cultural evolution. Such studies would allow researchers to establish discriminant validity between interactions that are reciprocity, and those that are not, and may help researchers reach greater consensus regarding the dimensions that constitute various cooperative strategies and supporting proximate mechanisms.

5. Conclusion

Cooperation can take many shapes and forms, from coordinated action such as alarm calling, to gift giving in mate seeking and coalition formation, caring for the young, communal food sharing, reputation-based giving, punishment, intergroup conflict, and market exchanges. Given the complexity and diversity of cooperation in which humans and other species engage, it is no surprise that 34 definitions of the term reciprocity have been offered thus far.

Overall, results indicate that researchers agree more about what reciprocity is *not* than what it is: i.e. it is not unconditional giving. We offer a potential framework here that is based on experts’ ratings of reciprocity terms. As the scholarly community moves forward, it may be valuable to refrain from describing special cases, or dimensions, of cooperation as some kind of reciprocity, and instead adopt terms such as balanced, reputation-based, debt-based, and unconditional transfers. This could facilitate communication among scientists and, ultimately, may lead to new discoveries about the nature of cooperation among humans and other animals.

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Declaration of Competing Interest

none.

Data availability

data is available here: <https://osf.io/53pzj/>.

This manuscript is available as a preprint: psyarxiv.com/cz3ue/.

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Appendix A. Supplementary data

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