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Keywords: Social Value Orientation (SVO), social preferences, reciprocity, individual differences, preference dynamics

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Tuesday 6th August, 2013

Abstract

There is accumulating evidence that decision makers are sensitive to the distribution of resources among themselves and others, beyond what is expected from the predictions of narrow self-interest. These social preferences are typically conceptualized as being static and existing independently of information about the other people influenced by a DM's allocation choices. In this paper we consider the reactivity of a decision maker's social preferences in response to information about the intentions or past behavior of the person to be affected by the decision maker's allocation choices (i.e., how do social preferences change in relation to the other's type). This paper offers a conceptual framework for characterizing the link between distributive preferences and reciprocity, and reports on experiments in which these two constructs are disentangled and the relation between the two is characterized.

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1 Introduction

It has been shown in many different studies that decision makers (DMs) generally take into account other peoples' payoffs when making decisions in situations of interdependence, and thus typically do not behave according to the predictions of neoclassic economic theory. For instance, there is a large body of evidence showing that people voluntarily forgo some of their own gains for the benefit (or detriment) of others in experimental games, even if the situation is one-shot and anonymous (for reviews, see for instance Andreoni, Harbaugh, & Vesterlund, 2008; Camerer & Thaler, 1995; Camerer, 2003; Fehr & Fischbacher, 2003). Behavior deviating from simple own payoff maximization has been attributed in part to motivations referred to as social preferences (a.k.a. other-regarding preferences, social value orientation [SVO], altruism, or welfare tradeoff ratios). Primarily, social preferences have been understood in terms of simple distributive concerns, where a DM's utility is modeled as a joint function of his own outcome, and also of others' outcomes (see Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999; Grzelak, 1982; Loewenstein et al., 1989; Messick & Thorngate, 1967; Radzicki, 1976; Wyer, 1969). That is, a DM with social preferences derives non-zero utility

from benefitting or harming another person, even when information about this other person is absent, i.e., under complete anonymity and lack of information about any of this other person's characteristics, revealed intentions, or type (e.g., is the other person altruistic, prosocial, individualistic, or competitive).

The measurement and investigation of this *unconditional* type of social preferences has a long history in psychology, where this kind of motivation is referred to as Social Value Orientation (for reviews of SVO, see e.g. Au & Kwong, 2004; Bogaert, Boone, & Declerck, 2008; McClintock & Van Avermaet, 1982; Murphy & Ackermann, in press). A person's SVO can be understood as the general motivational goal a person has when allocating resources between herself and another person. Different types of SVOs are commonly considered and discussed in the literature. For instance, a person may be motivated to simply maximize the own payoff (individualism) as standard economic theory would predict, maximize the sum of all payoffs (prosociality), minimize the difference between payoffs (another kind of prosociality called inequality aversion), maximize the other's payoff indifferent to his own (altruism), or maximize his own relative gain (competitiveness), etc. These archetypes are useful when first considering social preferences, but SVO is a continuous construct and can be defined generally by the weights a DM attaches to their own outcomes and to other person's outcomes. These kinds of social preferences can be represented by a joint utility function, i.e., a utility function that involves separate terms corresponding to outcomes for the self, the other, and arithmetic

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combinations thereof.¹

Empirical work has shown the reliability of SVO as an individual difference (e.g. Au & Kwong, 2004; Murphy, Ackermann, & Handgraaf, 2011); the distribution of SVOs across individuals has been estimated, revealing substantial reliable differences across individuals and a bimodal pattern of preferences as well. Moreover SVO has been shown to be a valid predictor of choice behavior in strategic situations, such as social dilemmas (see Balliet, Parks, & Joireman, 2009; Murphy & Ackermann, 2013). However these examples use SVO as a static construct, not attending to the systematic reactivity of preferences and specifically how DMs' SVOs change in response to information about other people's SVOs.

There is support for the notion that DMs do sometimes condition their preferences and choices on characteristics of their interaction partners in experimental situations. Early research on this issue has shown that people exhibit dramatically different SVOs depending on whether the recipient in an own-other resource allocation task is described as a "friend", "unknown", or as an "antagonist" (Sawyer, 1966). These results suggest that DMs' distributive preferences, with respect to how resources are allocated between themselves and another person, are sensitive to revealed characteristics of the corresponding other person. Moreover, it has been shown that people may change their distributive preferences depending on the (potential) interaction partners' observed past behavior (e.g. Murphy & Ackermann, 2013; Sonnemans, van Dijk, & van Winden, 2006). That is, people may become less prosocial, or even hostile (for evidence on costly punishing behavior, see e.g. Fehr & Gächter, 2000a), after observing non-cooperative behavior by their interaction partner (this pattern is sometimes referred to as behavioral assimilation, a term coined by Kelley & Stahelski, 1970), or DMs may become (more) prosocial after observing a cooperative move from the interaction partner (e.g. Berg, Dickhaut, & McCabe, 1995; Diekmann, 2004). These two types of behavioral responses are often referred to as negative, and positive reciprocity, respectively (see Fehr & Gächter, 2000b). In addition to observed actions taken by the interaction partner, behavior can also be shaped by more complicated expectations of and beliefs about the interaction partner. For example, Schubert & Lamsdorff (2013) performed Ultimatum Game experiments in which Palestinians were confronted with offers from either Palestinian or Israeli proposers. The experimental results showed that Palestinian responders indeed responded differently to Israelis, as

shown by the significantly higher rejection rate as compared to the situation where they are matched with Palestinian proposers.

Results suggest that what people respond to when exhibiting positive or negative reciprocity is not merely the outcomes resulting from the interaction partners' behavior (i.e., its consequences), but the interaction partners' *intentions* as revealed by the interaction partners' behavior (see e.g. Cox, Friedman, & Gjerstad, 2007; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006; Falk, Fehr, & Fischbacher, 2008; Levine, 1998; Rabin, 1993; Stanca, Bruni, & Corazzini, 2009). It is important to notice that – at least in the context of experimental games – what has been termed the interaction partners' "intentions" is simply a synonym for the interaction partners' "unconditional social preferences", their SVO, or their type (e.g., altruistic, prosocial, individualistic, competitive). That is, the basic idea behind intention-based reciprocity models has been that DMs' SVOs may change depending on the interaction partners' assumed or observed SVO. In other words, people condition their social preferences upon what they believe the other person is like.

We follow this line of reasoning and apply a definition of reciprocity similar to the one provided by Cox (2004, p. 263) to address these changes in SVO. Concretely, we define reciprocity as *the change in a decision maker's distributive social preferences (i.e., SVO) in response to information about the interaction partner, compared to the decision maker's unconditional distributive social preferences* that are expressed when information about an interaction partner is absent. It is important to note that this definition of reciprocity is a difference score: it is the difference between unconditional (i.e., baseline) SVO and conditional SVO. Operationally then, a researcher would need to measure social preferences twice on the same DM in order to gauge the magnitude of reciprocity an individual exhibits. This reactivity, or the dynamics of social preferences, is what concerns us here in this paper.

In the present study, we investigate how information about an interaction partner's intentions – i.e., the interaction partner's SVO – changes people's distributive social preferences (the DMs' SVOs) in a non-strategic situation. This design allows us to disentangle strategic concerns (anticipated benefits or reprisals) and isolate the effect of changes in SVO.² Hence, we can measure reciprocity alone, without the potential confounding effects beliefs may have on a change in behavior.

There is already clear evidence that people exhibit reciprocity in one-shot situations³ by showing a willingness

¹The following is an example of a joint utility function that can account for social preferences:

$$U(\pi_s, \pi_o) = \pi_s + \alpha * \pi_o - \beta * |\pi_s - \pi_o|,$$

where π_s is the payoff for the self, π_o is the payoff for the other, and α and β are parameters (weights) attached to the respective terms.

²For a similar argument in the context of the sequential prisoner's dilemma, see Clark & Sefton (2001, p.55) and Dufwenberg & Kirchsteiger (2004).

³This form of reciprocity that is expressed in one-shot situations,

to forgo their own gains in order to respond prosocially to observed prosocial behavior in a sequential dictator game where no subsequent interaction will take place (Diekmann, 2004).

Diekmann also showed that the degree of kindness in reciprocating depended on the degree of kindness of the behavior being reciprocated, at the aggregate level. Our experimental design allows us to qualitatively replicate these findings and extend them in several important ways. First, rather than use a between-subjects design, we employed a within-subjects design and elicited complete reciprocity profiles of individuals across a set of different others. Second, subjects made a series of decisions in dictator games with varying tradeoff slopes (i.e., a mix of constant-sum and non-constant-sum dictator games with varying rates of marginal substitution), which allows a more fine-grained assessment of the willingness to pay for the benefit or detriment of the person whose previously observed behavior is being responded to. And third, our experimental design rules out the possibility that the previously observed behavior being responded to might be perceived as a mere strategic gambit. The subjects responding to previous dictator game decisions will be truthfully informed that the person who had made the dictator game decision was not informed that her decision would be revealed to the DM. This ensures that subjects are responding to –i.e., the object of reciprocation is– the interaction partner’s honest revealed social preferences. This means that the DM does not have to try to glean strategic considerations on behalf of the other, such as acting prosocially only for the sake of provoking positive reciprocity.

The second goal of this paper is to investigate the extent to which SVO is related to reciprocity. Studies have previously shown that people with different social value orientations follow different reasoning when engaged in experimental games. For example, Boone, Declerck, & Kiyonari (2010) found that cooperative behavior of subjects with an individualistic value orientation tends to depend on external incentives, while the cooperation of prosocial subjects tends to depend on trust. There exists a fair amount of evidence suggesting that people with prosocial distributive preferences are more likely to reciprocate a corresponding interaction partner’s prosocial choices compared to people with individualistic (i.e., goal to maximize own gain) or competitive (i.e., goal to maximize relative gain) distributive preferences (e.g. De Cremer & Van Lange, 2001; Kanagaretnam, Mestelman, Nainar, & Shehata, 2009; Van Lange, 1999; Van Lange & Semin-Goossens, 1998), although the latter two SVO

where no future interactions are taking place and thus beliefs are inconsequential is sometimes referred to as “altruistic reciprocity”, and is in accordance with our definition of reciprocity given above.

types have also been shown to reciprocate significantly under certain conditions as well (e.g. Parks & Rumble, 2001; Sheldon, 1999). There is also evidence from researchers applying questionnaire methods, which supports the conclusion of a positive relationship between SVO and reciprocity (Perugini & Gallucci, 2001; Perugini et al., 2003), although results are somewhat mixed in these studies.

In any case, the existent literature regarding the relation between SVO and reciprocity leaves room for improvement. First, the measures that have been used to assess SVO in these studies yield categorical data, i.e., data on the lowest scale level of measurement (Stevens, 1946), which results in low statistical power due to restricted variance. Concretely, subjects have typically been categorized as prosocial, individualistic, or competitive, or even dichotomized as prosocial vs. proself. This severely limits statistical power and may yield null results erroneously. Second, some of the cited studies asked subjects to make hypothetical choices rather than decisions with real consequences, which complicates the interpretation of results since a person’s reported intention of how to behave in a particular situation is not necessarily consistent with that person’s real behavior in the respective situation (see, e.g. Ajzen, Brown, & Carvajal, 2004; Sheeran, 2002). Third, and most importantly, no study so far has assessed reciprocity profiles at the individual level. That is to say that no study to our knowledge has assessed how individuals differing in SVO, responded differently to a set of distinct previously observed choices from different others. The present study addresses these three issues by *a*) measuring SVO on a continuous scale by means of the SVO Slider Measure (Murphy, Ackermann, & Handgraaf, 2011), *b*) implementing complete incentive compatibility, and *c*) requiring that each subject respond to a set of empirically observed previous decisions made by matched real interaction partners. Consequently, the data obtained by the study allows for a fine-grained and comprehensive assessment of reciprocity as an individual difference variable, and supports a more detailed analysis of its relation with SVO compared to previous studies.

2 Method

In order to address the research questions outlined above, we use an experimental setup that consists of two parts, A and B, where the results of experiment A serve as stimuli for experiment B. Concretely, experiment A allows us to conduct experiment B without using deception, such that subjects in both experiments A and B make real decisions with real monetary consequences, resulting in a fully incentive compatible experimental design. The procedure we employed is as follows.

Experiment A was conducted in terms of a paper-pencil experiment, where a total of 148 subjects from various disciplines made just a single decision, namely to choose one out of four options of how to distribute money between themselves and a mutually anonymous other person. These four distribution options are shown in Table 1. Each option dominates⁴ the other three options with respect to a particular motivational goal, namely the goal to maximize relative gain (option A dominates), the goal to maximize the own payoff (option B dominates), the goal to maximize the sum of payoffs (option C dominates), and the goal to maximize the other’s payoff (option D dominates). These four goals represent four prototypical SVOs: competitiveness, individualism, prosociality, and altruism, respectively. Hence, when a person chooses one of the four options, her "intention" or "type" is revealed and her primary social preference can be identified. The purpose of experiment A was to obtain choice results that would serve as stimuli for experiment B.

Data collection for experiment A was as follows. The experimenter was introduced to the subjects by a university instructor who then announced that a brief decision making task would be handed out. The experimenter then thanked the group for their willingness to participate in the experiment and told the subjects that participation is voluntary and participants would be compensated. Each subject was then handed the decision sheet with the item shown in Table 1 and an envelope. Furthermore, subjects were informed that decisions of the same kind would be made by other people in the future, and that they will be randomly matched in pairs with one of these future decision makers, such that final payoffs would be determined. Importantly, the subjects were not informed, however, that their decisions would be revealed to the future decision makers they could then be matched with. After all the subjects had made their decisions and put their marked decision sheet in their envelope, the experimenter collected the envelopes. Also an email list was distributed so that subjects could be contacted for payment once the future decision makers had made their choices. Out of the 148 subjects in experiment A, 4.1% chose option A indicating competitiveness, 16.9% chose option B indicating individualism (i.e., narrow self-interest or selfish), 73.6% chose option C indicating prosociality, and 5.4% chose option D indicating altruism.

After data collection from experiment A was completed, these data then served as stimuli for experiment B. Experiment B was then conducted as a laboratory experiment with a different sample of 148 subjects. The experimental procedure was as follows. Upon arrival to the research laboratory, subjects were welcomed by the ex-

⁴In the terminology of Messick & McClintock (1968), the item is a quadruple dominance decomposed game.

Table 1: Decision options in the pen and paper task

	A	B	C	D
Payoff for Self	85	100	85	50
Payoff for Other	15	50	85	100

perimenter and each participant drew shuffled cards with numbers. These numbers corresponded to the workstation numbers inside the laboratory. Subjects were then led into the laboratory where they first read the instructions regarding phase 1 of the experiment and thereafter were given the opportunity to ask questions. The instructions informed subjects that in phase 1 of the experiment they will be making a series of 15 decisions about how to allocate monetary resources between themselves and an unspecified anonymous other person who would remain unknown to them. After all subjects had read and indicated they understood the instructions, phase 1 of the experiment began. All subjects then completed the 15 items of the SVO Slider Measure (Murphy et al., 2011)⁵ in order to assess their individual SVO. Phase 1 therefore served as the baseline condition, where the subjects’ unconditional distributive preferences were assessed.

The SVO Slider Measure consists of 6 primary and 9 secondary items. The 6 primary items allow for the assessment of a person’s general SVO on a continuous scale in terms of an angle. An SVO angle of 0° indicates perfect selfishness, while positive scores indicate increases in positive concern about the payoff for another person (i.e., increasing prosociality), and negative scores indicate increases in the negative concern about the payoff for the another person (i.e., increasing competitiveness).⁶ The secondary items of the Slider Measure (items 7-15) allow for distinguishing inequality aversion from joint gain maximization among prosocial decision makers. For further details about the SVO Slider Measure, see Murphy et al. (2011) and Ackermann & Murphy (2012).

When all subjects had completed the baseline condition (i.e., phase 1) they were given information regarding phase 2 of the experiment (i.e., the reciprocity conditions) on their computer screens. Subjects were informed that in phase 2 they would be presented with the choices of four different people who had decided previously (i.e., in experiment A) how to allocate monetary resources

⁵The Slider Measure used was adapted from the z-Tree implementation provided by Crosetto, Weisel, & Winter (2012).

⁶In essence, the SVO angle is a trigonometric function of parameter α in the utility function $U(\pi_S, \pi_O) = \pi_S + \alpha\pi_O$, where π_S is the payoff for the self, and π_O is the payoff for the other person.

between themselves and an anonymous other person by choosing one out of the four options shown in Table 1. The subjects were then instructed to complete the 15 items of the Slider Measure with respect to *each* of these four specific and different people. Subjects were informed that they will be randomly matched with one of these four people and that the decisions made by the subject and the matched other person will be realized for payment.⁷ Subjects were further informed that the people they are responding to had only been informed that they would be matched with someone for the determination of final payoffs, but that they had not known that their decisions would be revealed to this other person they would be matched with. We informed subjects about this in order to make clear to them that the choices revealed to them are direct indicators of the other persons' intentions (or *type*), rather than potentially the result of strategic thinking or misrepresentation. Furthermore, before subjects began to complete the Slider Measure in phase 2 with each of the four others, the experimenter walked around the laboratory showing the subjects the stack of decision sheets from experiment A to assure them that they were going to respond to real decisions made previously by real people.

In this second phase of experiment B, each subject was presented with each of the four possible choices people from experiment A had made. Hence, the experiment is a within-subjects design where the subjects were sequentially responding to one person who had chosen option A (competitive condition), to one person who had chosen option B (individualistic condition), to one person who had chosen option C (prosocial condition), and to one person who had chosen option D (altruistic condition) in experiment A. The sequential order of the four conditions was randomized across subjects in order to control for order effects. In each of the four conditions, subjects were first presented with the four options shown in Table 1 and the corresponding choice made by the other person in experiment A (competitive, individualistic, prosocial, or altruistic), and were then asked to indicate in words what they think of this other person and the choice this other person made in an open ended text box.⁸ These written statements were elicited from subjects for two reasons. First, the statements allow for verifying whether the decision made by the "other"

⁷The relative frequencies of how many times each of the four different options had been chosen in experiment A were taken as the probabilities that a subject would be matched with a person who made a correspond choice for determining final payoffs.

⁸In addition, subjects had to indicate how much the other person had allocated to themselves and to the other, and could only proceed when the allocation was verified as correct. This additional comprehension check was implemented to mitigate any possible confusion between the amount allocated to themselves and the amount allocated to the other.

was interpreted in a sensible way by the subject. If, for example, a subject confronted with the altruistic choice indicated a statement such as "This person was obviously motivated to minimize the payoff the other person -in this case me- would receive", this would indicate that the subject misinterpreted the altruistic choice by confusing it with a competitive choice; these confused responses can be flagged and removed from subsequent analyses. Second, the elicited statements allow for a qualitative analysis of the cognitive and emotional reactions subjects express when confronted with other peoples' revealed social preferences. After the subjects indicated their opinion about the interaction partner and the interaction partner's decision, they were then asked to complete the 15 items of the SVO Slider Measure in response to this particular interaction partner whose distributive social preferences have been revealed (see Figure 11 in the Appendix for an exemplary screen-shot of this stage of the experiment). This procedure was the same under each of the four conditions all subjects went through during the experiment.⁹

Subjects then filled out the HEXACO questionnaire (Ashton et al., 2004) and answered some sociodemographic questions. The HEXACO measure of personality was chosen because it is claimed to allow for a more fine-grained analysis of prosocial behavior (Hilbig et al., 2013). We used the 60 item German HEXACO version (Moshagen et al., forthcoming). Subjects who had finished were asked to step outside the laboratory and wait until all subjects had finished answering the questions. Finally, the experimenter asked subjects to step into the laboratory one by one to privately collect their payment.

Experiment B was carried out over 12 experimental sessions with a total of 148 subjects conducted at a dedicated research laboratory at a University in Western Europe. The experiment was programmed using z-Tree (Fischbacher, 2007) and subjects were recruited using ORSEE (Greiner, 2004) which ensured that each subject only participated in the experiment once. In the experiment, subjects made decisions in terms of allocating points which were then exchanged at a conversion rate of 100 Points = 2.50 Euros. Subjects were paid according to their decisions and the decisions of a corresponding interaction partner via one randomly selected Slider Measure item from the baseline condition and also one randomly selected Slider Measure item from one randomly chosen reciprocity condition. This

⁹The procedure of presenting each subject with each possible decision made by people in experiment A is analogous to applying the strategy method developed by Selten (1967). As in other cases, this data collection method yields a rich dataset for analysis and modeling.

remuneration scheme was common knowledge and is incentive compatible. On average, subjects earned 11.10 Euros (min=8.50, max=12.80) including a show up fee of 3 Euros. The average duration of a session was about 60 minutes. For the payment regarding the pen and paper task from experiment A, the subjects' student id numbers were used to match subjects with the corresponding payment which they received after completion of the lab experiments (i.e., experiment B). On average the pen and paper task took 10 minutes to complete and subjects earned an average amount of 4.1 Euros (min=2.5, max=4.8).

In the following results section one can note that sample size varies slightly across different conditions and analyses. The reason for this is that we include subjects for a particular analysis only if they satisfy both of the following two conditions. First, a subject must show transitive choice patterns in the Slider Measure under the experimental conditions that are analyzed. Intransitive choice patterns in the Slider Measure are indicators of random responding (see Murphy et al., 2011) and were observed here only rarely (i.e. 2.7% in the baseline condition). Second, there must not be written statements collected under the reciprocity conditions indicating that a subject misinterpreted the choice made by the corresponding other person. If, for example, a subject had written a statement such as "The other person made a choice that maximized his own payoff" in the altruism condition, this subject would be excluded from all analyses involving the altruism condition. Because of these exclusion criteria the sample sizes are not constant across analyses. An overview on the respective sample sizes in the different conditions can be found in Table 2. Less stringent exclusion criteria were also considered and when implemented the pattern of results remained consistent with what is reported here. Raw data are publicly available for download.

3 Results

3.1 Primary results

A summary of the main results is shown in Figure 1. The distributions of SVO angles as produced in response to the choices made by the competitive, individualistic, prosocial, and altruistic "others" each differ significantly from the baseline SVO angle distribution as indicated by Kolmogorov-Smirnov (K-S) tests.¹⁰ This is clear

¹⁰The K-S statistics from the SVO reciprocity distributions in comparison to the baseline SVO distribution are $D = .31, p < .001$ for the competitiveness condition, $D = .20, p = .012$ for the individualism condition, $D = .24, p < .001$ for the prosociality condition, and $D = .27, p < .001$ for the altruism condition. Wilcoxon signed

Table 2: Descriptive statistics on SVO and change in SVO per condition

Condition	Mean SVO	N	Mean Δ SVO	N
Baseline	21.1	144		
Competitive	12.4	130	-9.4	127
Individualistic	17.7	141	-4.0	137
Prosocial	28.7	147	7.3	144
Altruistic	28.5	142	7.3	139

evidence that a sufficient number of subjects altered their SVO angles in response to the choices made by the corresponding "others" in particular directions. Furthermore, the comparisons¹¹ among the SVO reciprocity distributions indicate that they are all significantly different from each other as well, except for the comparison between SVO in response to prosociality and in response to altruism (Wilcoxon signed rank test $p = .89$; K-S test $D = .08, p = .67$). This means that subjects respond differently to competitiveness than to individualism, prosociality, and altruism, and differently to individualism than to prosociality and altruism, but respond to prosociality and altruism in generally the same way. To have an impression of what the reciprocal reactions mean on the aggregate level in monetary terms, we can compute an approximation of subject's willingness to pay for an increase of one monetary unit on the side of the interaction partner by taking the tangent of subject's SVO angles. In the baseline measurement, subjects are on average willing to pay .42 monetary units to increase the "other's" payoff by one unit. However, when the "other" is known to have made a competitive choice, the average willingness to pay drops by 40% to .25 monetary units. In response to an individualistic person, the average willingness to pay drops by 17% to .35. In contrast, when the "other" is known to be prosocial, the average willingness to pay for a one unit increase in the payoff for the "other" increases by 38% to .58 compared to the baseline willingness to pay.

The scatterplots in Figure 1 summarize the entirety of experiment B. They show how subjects' SVO angles from the baseline condition relate to their SVO angles as produced in response to each of the four other types. Observations on the diagonal line indicate no shift in SVO (i.e., no reciprocity), while observations above the diagonal indicate upward shifts (i.e., increase in SVO

rank tests corroborate these results, indicating that subjects' SVO angles changed in each reciprocity condition compared to the baseline condition.

¹¹Again, both K-S tests and Wilcoxon signed rank tests were used and indicated the same results.

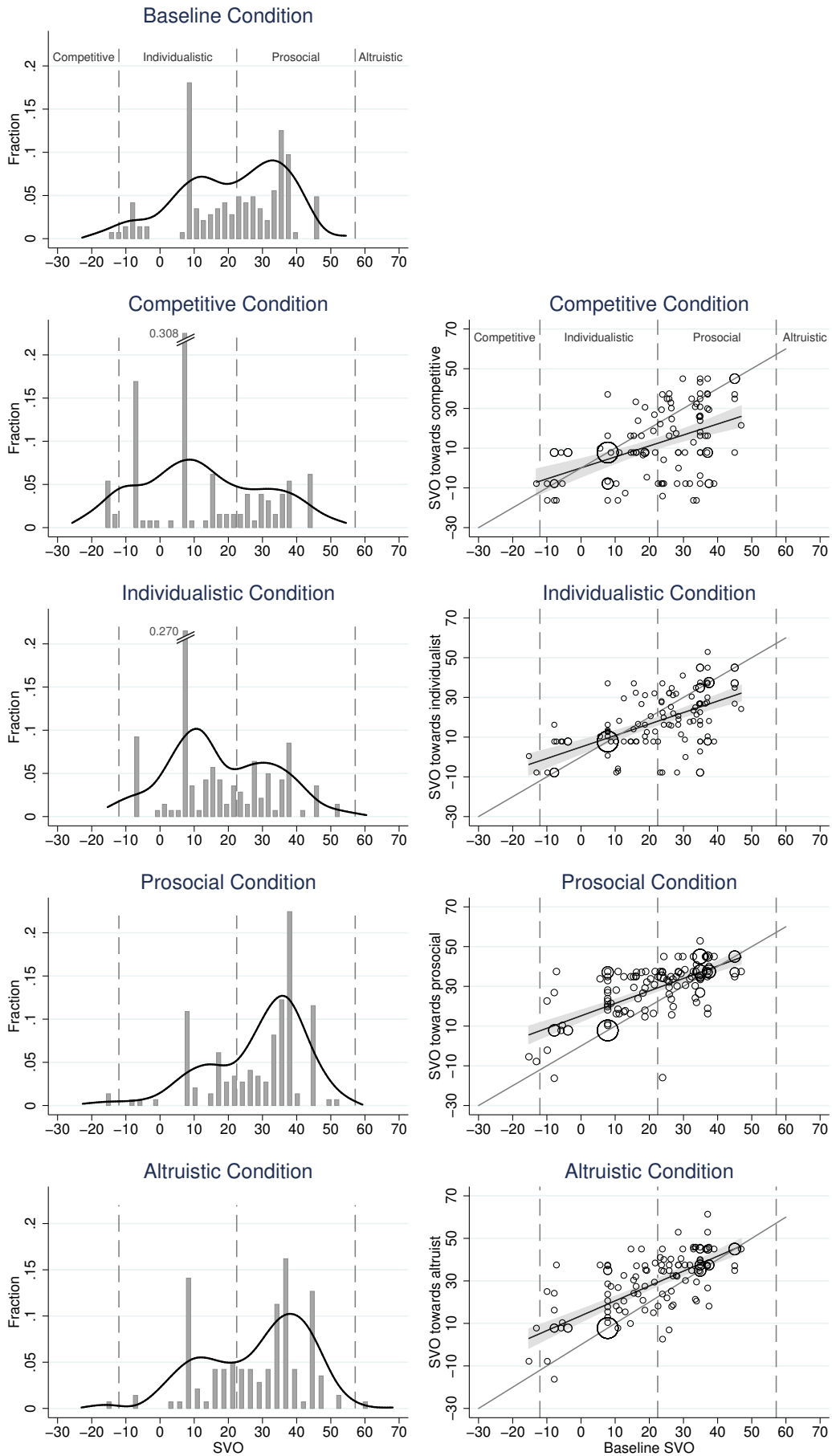


Figure 1: SVO and Reciprocity

Table 3: Percentage of subjects shifting in a particular direction per condition

Condition	Downward shift	No shift	Upward shift
Competitive	59.8	16.5	23.6
Individualistic	47.5	22.6	29.9
Prosocial	15.3	15.3	69.4
Altruistic	15.8	18.7	65.5

angle) and observations below the diagonal indicate downward shifts (i.e., decrease in SVO angle). Table 3 shows the percentage of subjects shifting and not shifting in a particular direction for each condition on the aggregate level. Mean shifts per condition are reported in Table 2. As can be seen in Figure 1, shifts in SVO on the individual level predominantly occur when the interaction partner’s SVO diverges from the own SVO. A competitive interaction partner evokes negative reciprocity predominantly among subjects who tend to be prosocial, while subjects who themselves tend to be competitive do not show much of a shift in their SVO angles. In contrast, a prosocial or even altruistic interaction partner evokes positive reciprocity predominantly among subjects who tend to be individualistic or competitive, while subjects who themselves tend to be prosocial do not show much of a shift, but rather just express their baseline prosociality towards the prosocial interaction partner. It is interesting to see that even subjects who tend to be competitive as indicated by negative baseline SVO angles can show considerable positive reciprocity in response to a prosocial or altruistic interaction partner.

However, there are large individual differences in the degree to which individuals are reciprocal. Figure 2 shows the distribution of average absolute shifts in SVO (i.e., Δ SVO) across the four conditions. About ten percent of subjects are not reciprocal at all because they do not have different SVOs in response to the revealed intentions of others as compared to their baseline SVO.¹² However, the vast majority of subjects did show at least some degree of reciprocity, and many of them show considerable degrees of reciprocity. One thing worth noting here, however, is that the degree of reciprocity when computed as the absolute average shift in SVO angle does not take into account that some subjects showed

¹²The actual share of subjects who do not show significant reciprocity is likely slightly underestimated due to measurement error. There may be subjects whose SVO angles changed slightly across conditions not because they reacted to the others in some way, but because they did not reproduce their choice pattern exactly between conditions. However, due to the Slider Measure’s very high reliability (Test-retest $r = .92$, see Murphy et al., 2011), measurement errors are expected to be fairly small.

negative reciprocity towards prosociality and/or altruism, some other subjects showed positive reciprocity towards individualism and/or competitiveness, and yet some other subjects showed consistent positive or negative reciprocity across all conditions. Although these patterns are difficult to rationalize, we are hesitant to exclude these cases from the analysis since we can not rule out that these patterns are consequences of the subject’s real preferences rather than just noise. Figure 10 shows examples of six different individual reciprocity profiles that may indicate different reciprocity preferences. Subject 14 is an example of a non-reciprocal individualistic subject who does not react in any way to the revealed intentions of “others”, while subject 45 is an example of a prosocial subject who shows negative reciprocity towards competitiveness and individualism, and positive reciprocity towards prosociality and altruism. Subject 113 is an example of an individualistic subject who does not react to competitiveness nor individualism, but shows positive reciprocity towards prosociality and altruism. Subject 111 is an example of a prosocial subject who does not react to prosociality nor altruism, but shows negative reciprocity towards competitiveness and individualism only. These examples make clear that there is substantial heterogeneity in the patterns of how subjects react to various others when information about them is revealed. Subjects 90 and 71 are examples of subjects who show a reciprocal reaction to others but do not differentiate between revealed intentions. As mentioned earlier, patterns of that kind are difficult to explain. Perhaps the simplest explanation for such patterns would be that these subjects are not reciprocal at all, but made a mistake in one or a few items in the Slider Measure under the baseline condition which they then corrected under the reciprocity conditions. Another explanation might be that these subjects really have different distributive social preferences when the other is a specified particular other person compared to an unspecified “someone” who will be randomly selected after the decisions have been made. However, we can not shed further light on the rationale behind patterns of that kind by means of the data available to us, but can only speculate about potential causes.

One question would be to consider if different types of DMs are more reactive than others. For example it could be conjectured that people with prosocial SVOs are more reactive than people with individualistic motivations. We tested for this relationship and Figure 3 shows a scatterplot of how SVO relates to the absolute degree of reciprocity (e.g., the overall degree of a person’s reactivity). The bivariate correlation between baseline SVO and degree of reciprocity (i.e., absolute shifts in SVO across the four conditions) is not significantly different from zero, indicating that there is no significant relation between SVO and reciprocity. The degree of reactivity in peo-

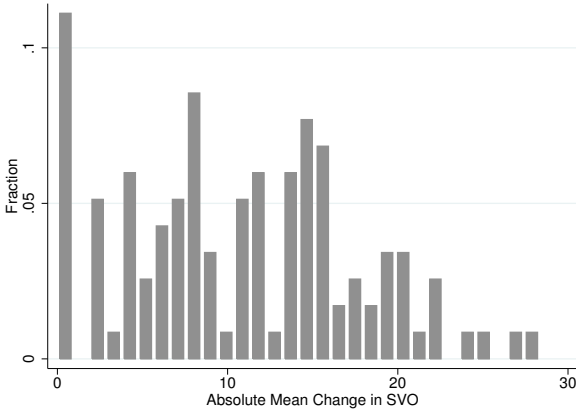


Figure 2: Aggregate absolute reciprocity ($n = 117$)

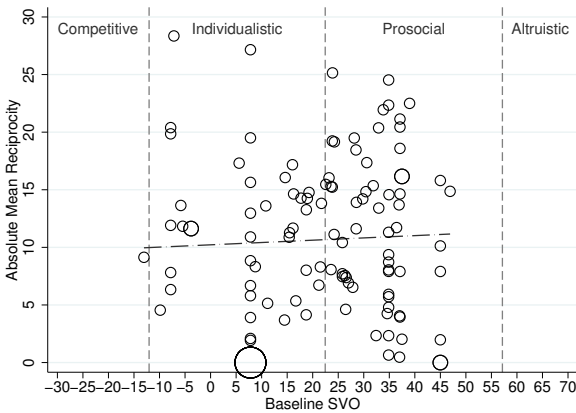


Figure 3: Relation between SVO and aggregate absolute reciprocity ($n = 117$)

ple’s social preferences is not conditioned on their baseline preferences.

3.2 Secondary results

3.2.1 SVO and its relation to positive and negative reciprocity

Figure 4 shows the absolute average positive and negative change of subjects’ SVO angles. The mean positive change in SVO angles over all four conditions captures the strength of subjects’ positive reciprocal reactions, while the absolute mean negative change indicates the strength of their negative reciprocal reactions. On average, subjects showed an average positive change in SVO of 5.3 degrees and an average negative change in SVO of 5.4 degrees.¹³ We observe that 26.5% of all subjects exhibit no positive reciprocity. This share is even higher for negative reciprocity (35.0%). Overall, we do not find a significant difference between the two distributions (K-S test, $p = .407$), indicating that the effects of positive and negative reciprocity are about the same on the aggregate.

Figure 5 shows a scatterplot indicating how positive and negative reciprocity are jointly distributed on the individual level. We observe some cases near the diagonal that exhibit a similar degree of positive and negative reciprocity. Cases below the diagonal show stronger negative than positive reciprocity including cases who exhibit negative reciprocity only. The opposite is true for cases above the diagonal where either less negative reciprocity as compared to positive reciprocity is observed or where negative reciprocity is completely absent. We can identify several factors that are partially responsible for the pattern shown in Figure 5. First of all, we have seen that individual reciprocity profiles are dependent on SVO in that subjects with higher SVO angles predominantly show negative reciprocal reactions towards competitive and individualistic interaction partners while showing no or only little positive reciprocity towards prosociality and altruism, while the opposite holds for subjects with lower SVO angles. Furthermore, we have seen that some subjects appear to show only positive or only negative reciprocity across all conditions. And finally, there are subjects -predominantly with intermediate baseline SVO angles- who show as much negative reciprocity towards competitiveness and individualism as they show positive reciprocity towards prosociality and altruism. As mentioned earlier, Figure 10 shows examples for each of these patterns. The combination of these

¹³The difference is not significant (Wilcoxon signed rank test, $p = .985$). It increases if we exclude cases that show no positive or negative reciprocity (7.2 and 8.3) but remains insignificant (Wilcoxon signed rank test, $p = .171$).

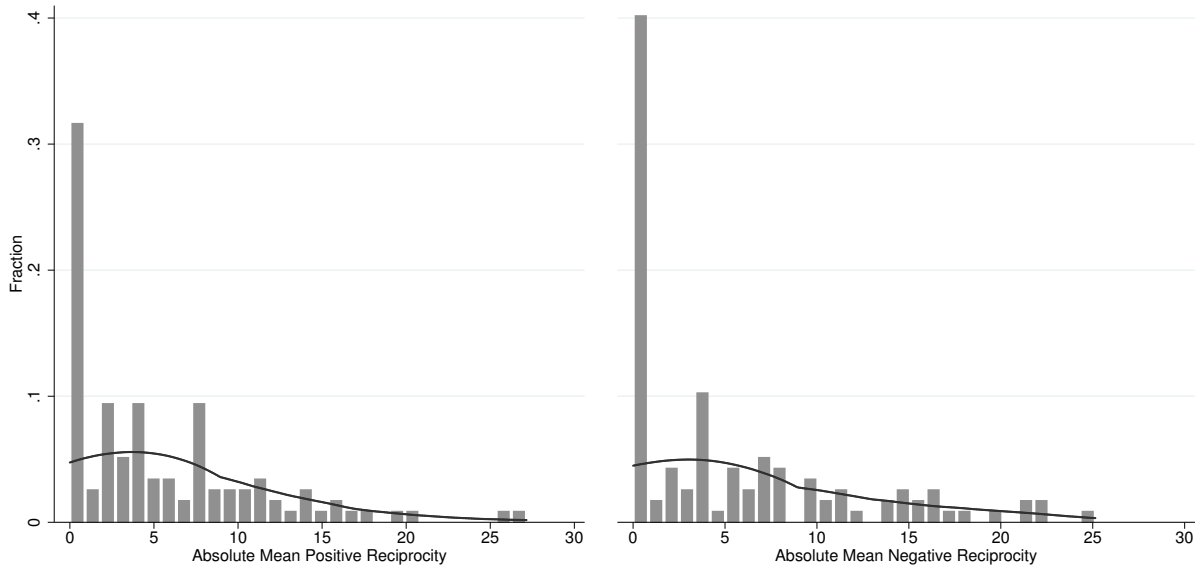


Figure 4: Aggregate positive and negative reciprocity (n = 117)

factors together, we argue, shape the triangle form of observations shown in Figure 5, and lead to a negative correlation of $r = -.367 (p < .001)$ between positive and negative reciprocity. This interpretation of the results is also supported by the observation of a positive correlation of $r = .479 (p < .001)$ between SVO (baseline) and negative reciprocity, and a negative correlation of $r = -.474 (p < .001)$ between SVO (baseline) and positive reciprocity as visualized in Figure 6. Since there are two separate effects in opposing directions for positive and negative reciprocity, this explains why we observe no correlation between baseline SVO and overall reciprocity (see Figure 3).

3.2.2 Hexaco

All factors of the Hexaco questionnaire show acceptable internal reliability.¹⁴ The correlation between the Honesty-Humility factor and baseline SVO is $r = .25 (p < .01)$, which is mainly due to the correlation between baseline SVO and the facet Greed-Avoidance: $r = .28 (p < .001)$. The direction and magnitude of this relation is in accordance with previous findings (e.g. Hilbig & Zettler, 2009; Hilbig, Zettler, Moshagen, & Heydasch, 2012). Also, this relation is the only one between baseline SVO and Hexaco scales that remains significant after

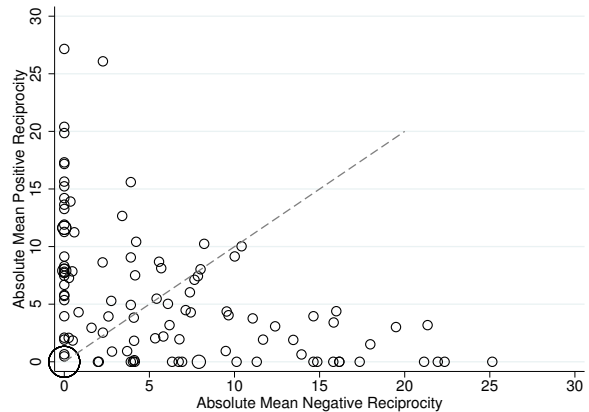


Figure 5: Relationship between positive and negative reciprocity (n = 117)

¹⁴Cronbach's alphas for the factors are as follows. Honesty-Humilty: .77; Emotionality: .84; Extraversion: .77; Agreeableness: .76; Conscientiousness: .81; Openness: .78.

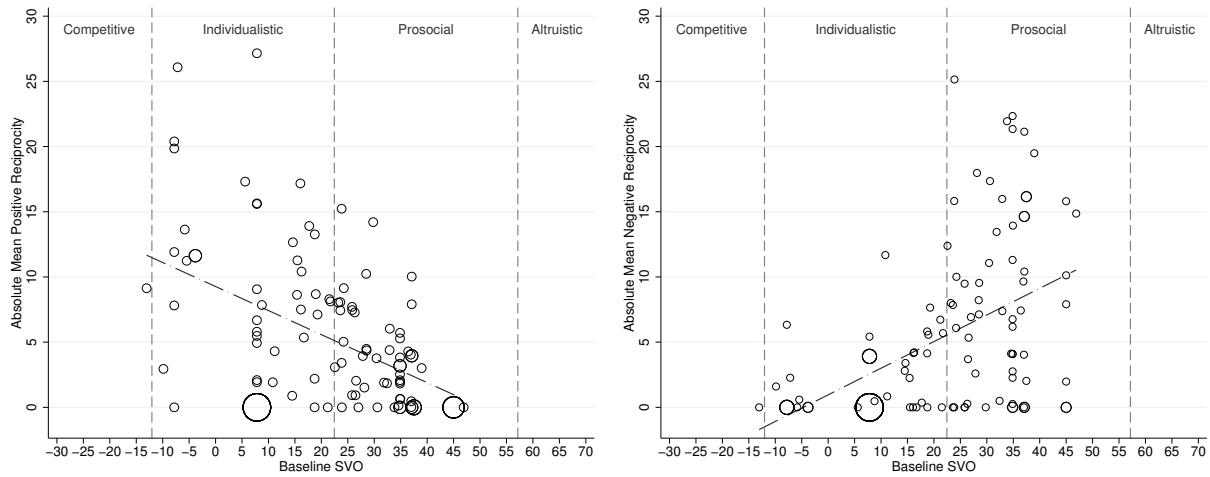


Figure 6: Positive and negative reciprocity and baseline SVO (n = 117)

Bonferroni correction.¹⁵

We continue the analysis of the relation between personality traits and reciprocity with OLS regressions as shown in Table 4 where we control for the subjects' baseline SVO.¹⁶ Also, we add an interaction term for Honesty-Humility and Agreeableness, since these two traits have been shown to influence cooperation in a wide range of situations (Hilbig et al., 2013).

We find no effect of any of the HEXACO scales on overall reciprocity. This changes, however, when we look at the effect of personality traits on positive and negative reciprocity separately (see Models 2 and 3 in Table 4). In the case of positive reciprocity we find a significant ($p < .05$) positive effect of the Honesty-Humility trait. People who score higher on this scale exhibit more positive reciprocity. Agreeableness, on the other hand, can be shown to have no effect on positive reciprocity. In the case of negative reciprocity, a significant ($p < .05$) negative effect of Honesty-Humility, Agreeableness and the interaction term between the two is observed. People with higher values on each of these two scales exhibit less negative reciprocity.

Honesty-Humility is described as a “tendency to be fair and genuine in dealing with others, in the sense of cooperating with others even when one might exploit them without suffering retaliation” (Ashton & Lee, 2007, p.156). So it makes sense that people who exhibit this trait show

less negative and positive reciprocity than those who do not. Agreeableness on the other hand only influences subjects' degrees of negative reciprocity. Since this personality trait captures “the tendency to be forgiving and tolerant of others, in the sense of cooperating with others even when one might be suffering exploitation by them” (Ashton & Lee, 2007, p.156), it makes sense that agreeable subjects show less negative reciprocity. In addition, since positive reciprocity was shown primarily when subjects were matched with prosocial and altruistic “others”, it is not surprising that we do not find a correlation between Agreeableness and positive reciprocity because there is nothing to forgive in these cases. These findings add further support to the argument of separating Honesty-Humility from other personality traits (Hilbig et al., 2013), since it appears to have separate effects on cooperative behavior in different situations. The pattern of results in this respect also suggests that tendencies towards positive and negative reciprocity may indeed be considered relatively independent motivational inclinations rather than collinear ones, which would be in support of recent findings (e.g. Eisenberger et al., 2004; Yamagishi et al., 2012; Egloff et al., 2013).

We explore the consequences of the interaction effect in Figure 7 where we set all predictors besides Honesty-Humility and Agreeableness to their mean value. We get the largest predicted negative reciprocity for low values on both Honesty-Humility and Agreeableness, since both of those coefficients show a negative effect and the resulting interaction effect increases the predicted value further. If only one of either values on Honesty-Humility or Agreeableness is increased, the predicted value of negative reciprocity is decreased. Only for high values of both

¹⁵Without Bonferroni correction, the relation between baseline SVO and the Hexaco scale “Openness” is significant as well with $r = .17$ ($p < .05$).

¹⁶The regressions show that the relation between baseline SVO and positive/negative reciprocity is robust even when controlling for the subjects' personality traits.

predictors the interaction yields a large enough positive effect to counteract the negative effect of the individual HEXACO scales resulting in a predicted increase in negative reciprocity. Thus we conclude that subjects who score high on only one of the two HEXACO scales, and low on the other, show little negative reciprocity, while subjects who either score high or low on both scales show more negative reciprocity. Future research may shed light on the psychological mechanisms underlying this effect.

Table 4: OLS Regression on Positive and Negative Reciprocity

	(1)	(2)	(3)
	Overall	Positive	Negative
	Reciprocity	Reciprocity	Reciprocity
Baseline SVO	0.014 (0.030)	-0.214** (-0.549)	0.227** (0.533)
Honesty-Hum.	-5.250 (-0.524)	6.829* (0.806)	-12.079* (-1.301)
Emotionality	0.232 (0.026)	-0.363 (-0.047)	0.595 (0.071)
Extraversion	-0.446 (-0.040)	-1.310 (-0.138)	0.865 (0.083)
Agreeablen.	-6.319 (-0.571)	4.723 (0.505)	-11.042* (-1.076)
Conscienti.	-1.594 (-0.145)	-1.117 (-0.121)	-0.477 (-0.047)
Openness	1.147 (0.113)	0.601 (0.070)	0.546 (0.058)
Honesty-Hum.	1.673 (0.804)	-1.603 (-0.910)	3.276* (1.697)
*Agreeablen.			
Constant	32.413 (.)	-3.119 (.)	35.533* (.)
Observations	117	117	117
R-squared	0.050	0.319	0.334

** $p < 0.01$, * $p < 0.05$.

Note: Beta coefficients in parentheses. Robust standard errors were used.

3.2.3 Inequality aversion

An alternative explanation for shifts in SVO angles may be that people do not change their baseline distributive social preferences, but simply always express the same distributive social preference, namely inequality aversion, when responding to advance payoff allocations. If a person wanted to minimize the difference between *fi-*

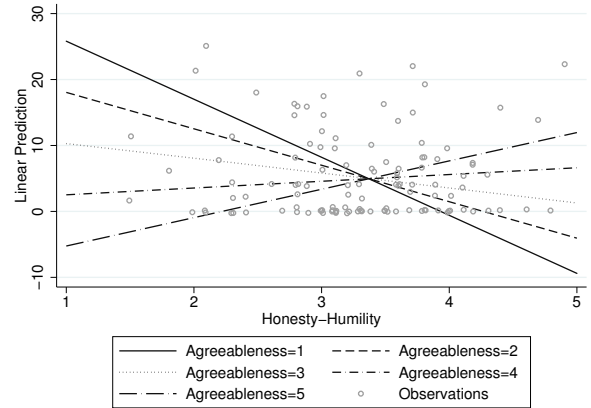


Figure 7: Positive reciprocity predictions for different values of Agreeableness and Honesty-Humility

nal payoffs for both decision makers, then this person would be expected to show a behavioral pattern that -by itself- is indistinguishable from perfect reciprocity. That is, such a person would respond competitively to a competitor, individualistically to an individualist, prosocially to a prosocial, and altruistically to an altruist, since these responses would guarantee that both decision makers receive equal payoffs in the end. We can test whether this alternative explanation holds. The secondary items of the Slider Measure allow for the assessment of the degree of inequality aversion (IA) among prosocial people. Concretely, for subjects whose SVO angles indicate prosociality, we can compute an IA index ranging from zero to one, where an index of zero indicates that a person is perfectly inequality averse (i.e., showing a choice pattern in the secondary items of the Slider Measure that is in perfect accordance with minimizing differences in payoffs), and an index of one indicates that the person is perfectly joint gain maximizing (i.e., showing a choice pattern in the secondary items of the Slider Measure that is in perfect accordance with maximizing the sum of payoffs).¹⁷ Among the 144 subjects who showed transitive choice patterns in the baseline SVO measurement, there are 70 prosocial subjects for which an IA index can be computed. Figure 8 shows the distribution of IA indices from these prosocial subjects under the baseline condition. Among the 70 prosocial subjects, 45 (i.e., 64.29% of the prosocial subjects, or 31.25% of all 144 subjects with transitive choice patterns) tend to be inequality averse as indicated by an IA-index of less than .5. Only 3 subjects are perfectly inequality averse as indicated by an IA-index of exactly zero. If the alternative explanation

¹⁷For details about the IA index, see Murphy et al. (2011) and Ackermann & Murphy (2012).

for the shifts in SVO angles holds, then we would expect that the vast majority of the subjects who tend to be inequality averse respond competitively to a competitive interaction partner. However, this is not what we find. Figure 9 shows the distribution of SVO angles from 38 inequality averse subjects¹⁸ when responding to the competitive interaction partner. In fact, only one out of these 38 inequality averters responded competitively to a competitor, thereby equalizing final payoffs. The modal response was individualistic with an SVO angle of -7.82° , which results from a perfectly individualistic choice pattern across all items where benefiting or harming the “other” is costly, and a competitive choice in the item where harming the “other” is free. Clearly, such a choice pattern does not serve the purpose of equalizing final payoffs, but punishing the other when it is free, and being concerned with one’s own payoff when punishment is costly. We therefore refute the alternative explanation of inequality aversion as the main driver of shifts in SVO angles.

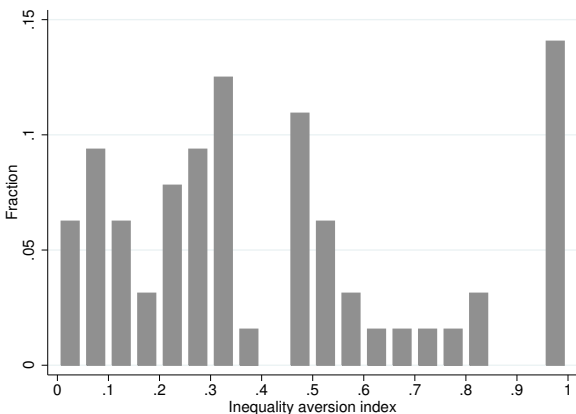


Figure 8: IA index of prosocial subjects from baseline condition ($n = 70$)

A further question regarding inequality aversion is whether this particular distributive social preference can be expressed in terms of a reciprocal reaction. Table 5 shows for each condition the percentage of subjects that can be categorized as prosocial (i.e., subjects with an SVO angle between 22.45° and 57.15°) subdivided into the two categories Joint Gain Maximization (Joint-Max, i.e., prosocial subjects with an IA index $\geq .5$) and Inequality Aversion (IneqAvers, i.e., prosocial subjects with an IA index $< .5$). The fourth row shows the me-

¹⁸We only include those 38 out of the 45 inequality averse subjects for this analysis who have transitive choice patterns in the Slider Measure in both the baseline and the competitive condition and showed no misperception of the competitive type.

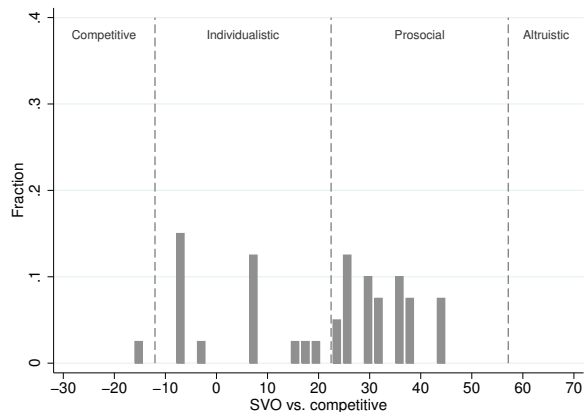


Figure 9: SVO angles of inequality averse subjects when responding to competitive interaction partner ($n = 38$)

dian IA index across all subjects who can be categorized as prosocial in the corresponding condition. In order to facilitate comparisons across conditions, only those $n = 117$ subjects are considered who show transitive choice patterns in the Slider Measure and no misperception of the “other’s” intentions across all conditions.¹⁹ Clearly, the percentage of subjects showing an inequality averse choice pattern in the Slider Measure varies substantially across conditions in expected ways. Regarding our question, the comparison between the percentage of inequality averse subjects in the baseline condition and the percentage of inequality averters in response to prosociality is most interesting. There are six percent more inequality averters among the subjects when they are responding to prosociality compared to the baseline condition. Table 6 informs about how this six percent increase in total is realized. While 9 subjects who showed inequality aversion in the baseline condition changed their distributive social preferences when responding to prosociality, 16 subjects who did not show concern about equality in the baseline condition responded to prosociality with an inequality averse choice pattern. Hence, there are 16 observations of inequality aversion as a response to prosociality. This is clear evidence that inequality aversion can be expressed in terms of a reciprocal reaction.

4 Discussion

We have defined reciprocity as a change in the distributive social preferences of an individual in response to information about an interaction partner’s characteristics.

¹⁹This is why the percentage of inequality averters in the table deviates slightly from the percentage mentioned earlier in this paper.

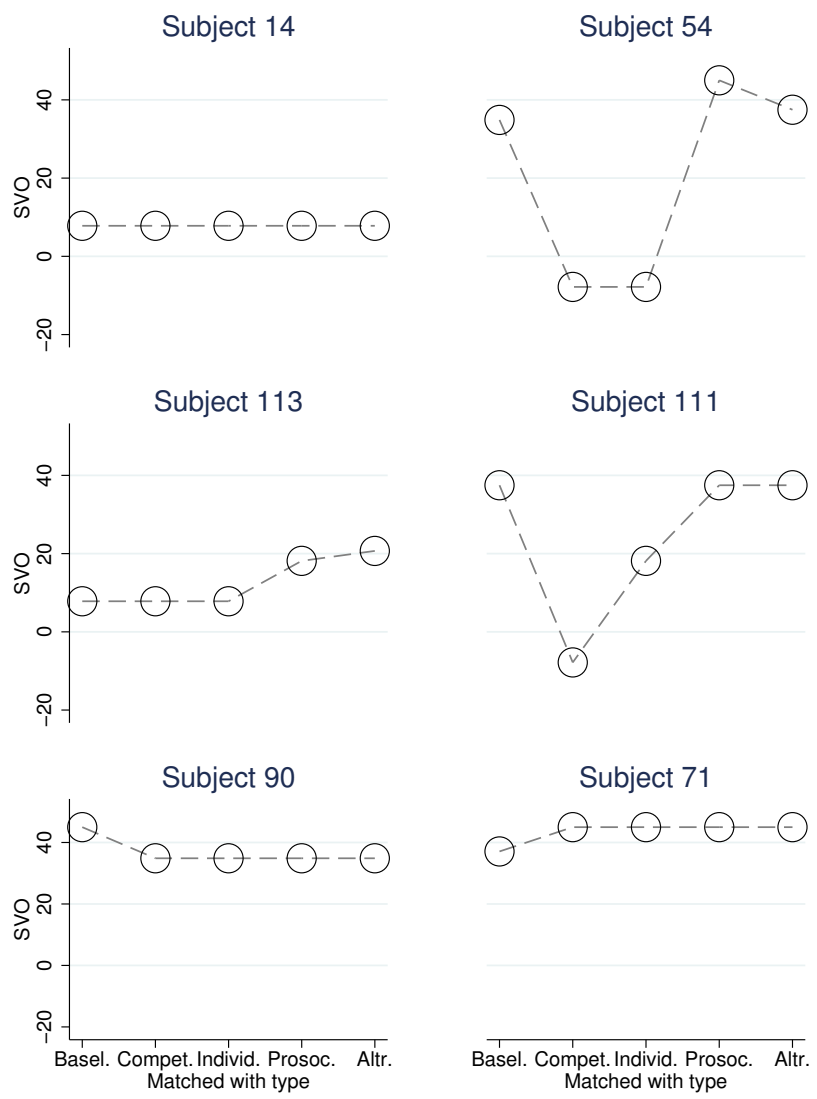


Figure 10: Examples of individual reciprocity profiles

Table 5: Proportion of inequality avers, joint max, and other subjects as well as median IA index per condition

		Conditions				
		Baseline	Compet	Indi	Proso	Altr
Proso	Else	50.4	76.9	69.2	39.3	41.9
	IneqAvers	30.8	13.7	16.2	36.8	27.4
	JointMax	18.8	9.4	14.5	23.9	30.8
IA median		.42	.33	.42	.35	.52

Note: Numbers in row one through row three are percentages of subjects categorized in the respective class per condition. The numbers in row four are the median values of the IA index from subjects categorized as prosocial. The IA index can range between 0 (i.e., perfect inequality aversion) and 1 (i.e., perfect joint gain maximizing). These proportions are based on $n = 117$ subjects.

Table 6: Type comparison between baseline and prosocial condition

		Prosocial condition		
		Else	IneqAvers	JointMax
Baseline	Else	41	11	7
	IneqAvers	4	27	5
	JointMax	1	5	16

Note: Numbers in the table are counts of subjects

Thus we have conceptualized reciprocity as an individual difference that can be measured and used as a dependent variable. We could show that the vast majority of people do change their distributive social preferences towards an interaction partner when the interaction partner's intentions are revealed, thereby showing reciprocity. Furthermore, we could show that there is considerable heterogeneity in the degree to which people are reciprocal and how degrees of reciprocity relate to SVO. These findings have significant implications regarding the study and modeling of preferences, beliefs, and behavior in experimental games that involve the revelation of information about interaction partners. It has been common practice in the economic sciences to infer distributive social preferences from responder behavior in experimental settings such as ultimatum games, for instance. It has been neglected, however, that the responder behavior may not reveal the responder's baseline distributive social preferences, but the responder's reciprocal reaction to revealed information about the proposer's characteristics, namely the proposer's behavior. In situations of that kind, it has often been assumed that the expression of one particular distributive social preference, inequality aversion, is responsible for the decision to accept an equal split and refute offers that deviate too much from it in ultimatum games, for instance. We have shown that there is another

explanation for the behavioral pattern often observed in these types of experimental games. Namely that distributive social preferences may change in response to information about the interaction partner, such that decision makers may assign a different weight – positive, zero, or negative – to the outcome for the interaction partner once information about the interaction partner is revealed compared to when no information is available. Consequently, both punishment and reward behavior can result from reciprocity as an individual difference and social preferences show a reactivity to information about the other.

Our results clearly support the validity of recently developed models of behavior in experimental games that take into account the significance of information about the intentions of interaction partners (e.g. Cox et al., 2007; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006; Falk et al., 2008; Levine, 1998; Rabin, 1993; Stanca et al., 2009). However, there is large heterogeneity in both peoples' baseline distributive social preferences and the degree to which people are reciprocal. Our results suggest that apart from people's beliefs, both individual differences in distributive social preferences and individual differences in the degree to which these preferences can change in response to information about the environment – predominantly about interaction partners – are key to understanding behavior in many situations of interdependence.

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5 Appendix

5.1 Pen and Paper Task Results

Table 7 shows the results of experiment A. In total, we observe 73.6% of answers corresponding to the prosocial choice (C), while 16.9% of our subjects chose the individualistic option (B). A comparison of the answers of students of social work with other students shows that the distributions differ significantly (Fishers exact test, $p < .01$) with social workers having a higher share of prosocials and altruists.

Table 7: Results of the pen and paper task

SVO Type	Field of Study					
	Other Field		Social Work		Total	
	#	%	#	%	#	%
Competitive	5	8.1	1	1.2	6	4.1
Individualistic	16	25.8	9	10.5	25	16.9
Prosocial	39	62.9	70	81.4	109	73.6
Altruistic	2	3.2	6	7.0	8	5.4
Total	62	100.0	86	100.0	148	100.0

Fishers exact test, $p=0.007$

Figure 11: Decision Screen for SVO slider with specific other

Before this experiment the real other person has already chosen the bold option out of the four options A, B, C and D shown below.

Please indicate for each of the following 15 questions which distribution of money you prefer most for yourself and this specific other person.

Die reale andere Person hat im Vorfeld des Experiments unter den vier gezeigten Optionen A, B, C, und D diejenige Geldverteilung zwischen sich selbst und Ihnen gewählt, welche fett hervorgehoben ist.

Geben Sie bitte für jede der folgenden 15 Fragen diejenige Geldverteilung an, welche Sie am meisten für sich und **diese konkrete andere Person** bevorzugen.

Ihre Entscheidungen werden jeweils sowohl für Sie, wie auch für diese konkrete andere Person, welche die unten gezeigte Entscheidung getroffen hat, Geld generieren.

The decisions you take will generate money for yourself and this specific other person, who made the decision shown below.

	A	B	C	D
Other allocated to you Jemand hat Ihnen zugeordnet	15	50	85	100
Other allocated to himself/herself Jemand hat sich selbst zugeordnet	85	100	85	50

You get										You get		
Sie erhalten	85	85	85	85	85	85	85	85	85	85	Sie erhalten	0
Dieser Jemand erhält	85	76	68	59	50	41	33	24	15	0	Dieser Jemand erhält	0

This other gets

This other gets

OK