

Offers Beyond the Negotiating Dyad: Including the Excluded in a Network Exchange Experiment*

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Abstract: Allocation offers in social exchange models and experiments are traditionally restricted to negotiating dyads. Hence, the full range of fairness preferences could not be analyzed in experimental designs. We experimentally study three-person networks, where subjects can make bilateral offers that allocate payoff shares to all network members. Our results show that subjects give indeed significant shares to third network members. The share depends either on the social value orientation of the subject with structural power or, given equal power, on the social value orientations of both agreeing subjects. We conclude that fairness preferences are important initial motivators in network exchange.

Highlights:

- We extend existing network exchange analysis assuming social value orientations.
- We conduct a network exchange experiment with a strong and equal power condition.
- We highlight the importance of an option to allocate to all network members.
- We show that social value orientations affect equality of exchange outcomes.

Keywords: fairness, network exchange, social value orientation, laboratory experiment

1. Introduction

Most social interactions can be seen as some form of social exchange, which is defined “as an exchange of activity, tangible or intangible, and more or less rewarding or costly, between at least two persons” (Homans 1961, p. 13). Prominent social exchange theories, such as the *Power-Dependence Theory* (Emerson, 1972a, 1972b) or the *Elementary Theory* (Willer & Anderson, 1981) and their refinements (see Neuhofer, Reindl, & Kittel, 2015), embed social exchange in a network structure. In a network, exchange takes place bilaterally between connected subjects. However, contrary to the typical setup in experimental studies, network exchange does not strictly imply that offers made within a dyad includes only the exchange partner as recipient of any benefit (or loss, for that matter). This study aims to add to the literature on social exchange by going beyond the dyad and permitting allocations which include more network members.

From the late 1960s onwards, motives other than self-centered utility maximization have been of great interest in social psychology (Balliet, Parks, & Joireman, 2009; Griesinger & Livingston, 1973; Messick & McClintock, 1968).¹ A meta-analysis of experimental studies on social value orientations (SVO) shows that 23.5 percent of subjects behave as individualists, 13.4 percent as competitors and 49.7 percent as prosocials (Au & Kwong, 2004).² Prosocial types voluntarily forgo their own payoff to benefit others without having any personal relation to these subjects. It is thus reasonable to assume that a significant number of people have an intrinsic motivation to give to others. Recent approaches in the social exchange literature include fairness considerations, affective regard towards exchange partners, and the value of reciprocity itself as motivations for exchange (see Cook, Cheshire, Rice, & Nakagawa, 2013). However, the assumption of narrow self-interest has resulted in a restriction in theoretical reasoning and experimental design, which only allows allocation within the negotiating dyad. Deviating from this assumption, Willer, Gladstone, & Berigan (2013, p. 126) argue that in a network context “prosocials are seen as concerned with equity, not just dyadically, but for all others in the group”.

We thus add the option to allocate shares of the resource to network members outside of the negotiating dyad. In other words, we extend the standard experimental design (Cook & Emerson, 1978; Cook, Emerson, Gillmore, & Yamagishi, 1983) by adding the option to send and receive offers which allocate profit points to network members who are neither sender nor receiver of this offer. By doing so, this study relates bargaining power in two simple network structures to fairness considerations. We expect that the social values held by powerful subjects contribute to the determination of exchange outcomes.

Our main results are as follows. If subjects have the chance to distribute points beyond the dyad, many do indeed allocate significant shares to the third network members. Strong power subjects identified as a prosocial type (Murphy, Ackermann, & Handgraaf, 2011) tend to use their power to equalize payoffs. In balanced power networks, the subjects reveal conditional fairness preferences, namely, the difference is only significant if both negotiation partners are prosocial. Furthermore, the shares received by the third subject decrease over time, especially after the first period.

The paper is structured in the following way: First, we review the literature on fairness concerns in network exchange experiments. In section 3 we move on to the Network Control Bargaining model (Braun & Gautschi, 2006) and derive the theoretical predictions and hypotheses by including fairness

¹ Over the last two decades, a research stream on social preferences also emerged in behavioral economics (Fehr & Gintis, 2007).

² Likewise, a meta-study of the dictator game for example finds that 63.9 percent of all participants give at least small amounts to others even though there is no strategic reason (Engel, 2011).

preferences as a determinant of the implemented bargaining power. In section 4, we describe the experimental design, and in section 5, we present the results. Finally, we discuss the findings and conclude.

2. Related Literature

The notion of fair exchange is deeply rooted in social exchange theory (Cook et al., 2013; Neuhofer et al., 2015). Nevertheless, scholars have almost ubiquitously assumed subjects to be self-interested and to maximize their own payoff. Among the most prominent concepts are the Power-Dependence Theory (Cook & Yamagishi, 1992; Emerson, 1972a, 1972b), Elementary Theory (Willer & Anderson, 1981; Willer & Emanuelson, 2008), the Core (Bienenstock & Bonacich, 1992, 1993), Expected Value Theory (Friedkin, 1992, 1995), and the Network Control Bargaining model (Braun & Gautschi, 2006). All these models explain the exchange payoff as a consequence of the structural embeddedness and ensuing power differences of subjects. It is now considered a stylized fact that the distribution of the resource benefits those with structural power (Cook & Gillmore, 1984; Markovsky, Willer, & Patton, 1988; Molm, Takahashi, & Peterson, 2000; John Skvoretz & Willer, 1991, 1993; Willer & Emanuelson, 2008) and even more so in repeated interactions (Emanuelson & Willer, 2009).

Yet, several experimental studies found that participants systematically deviate from the *homo oeconomicus*.³ Cook and Emerson (1978) showed in their initial experiment that justice concerns limited the use of structural power when participants were provided with information about the distribution of payoffs in the network. Studies dedicated to the role of fairness focus on the distribution of payoffs between two connected subjects embedded in a network (e.g. Molm, 2003; Molm, Schaefer, & Collett, 2009; Savage, Stets, Burke, & Sommer, 2016). Other scholars used a limited information setting in their experiments in order to avoid fairness considerations from influencing the distributive outcome of the social exchange process (e.g. Cook et al., 1983; Molm, Schaefer, & Collett, 2006). However, the restriction to split the payoff only between the exchange partners may be a crucial limitation to operationalize negotiated exchange, and the implementation of such an option may lead to different distributive outcomes.

To our knowledge, the experiment of Hegtvedt & Killian (1999) is the only one in the negotiated social exchange literature which includes the option to allocate a share of the resource to a third agent, who is not engaged in the negotiating dyad. In their experiment, the third agent was computerized and could not negotiate.⁴ The subjects first performed a real-effort task, and then engaged in dyadic negotiations about the division of their cumulative resource pool across all three members. The authors focus on the perception of fairness and found that the procedure positively affected subjects' emotions. They also found that the emergence of conflict negatively influenced perceptions of procedural fairness. Furthermore, subjects' own level of profit and the profit level of others influenced the perception of distributive fairness, but high performing subjects perceived their own relative profit and the relative profit of others to be more fair.

Fairness considerations may thus counteract the exercise of structural power. Whether seen as a social norm or an individual preference, they may induce disadvantaged subjects to demand more of a resource, or induce advantaged subjects to demand less from exchange than they should according

³ Around the turn of the millennium, numerous distributional (or social) preference models emerged in behavioral economics. For a comprehensive list of all major distributional preference types and a recent attempt to reconcile the different models see Kerschbamer (2015).

⁴ This fact was not communicated to the subjects, an element of the experimental design that would nowadays be considered a case of unnecessary deception.

to their structural relation. The first and only authors to model distributional preferences formally in negotiated exchange are, to our knowledge, Willer et al. (2013). They relax the assumption of narrow self-interest and instead introduce stylized social value orientation (SVO) types. In particular, the SVO framework assumes that specific types evaluate allocations between others and themselves differently; for example, they endeavor to maximize their own or even the difference in profits (proself) or maximize joint profits (prosocial).

3. Theory and Hypotheses

We build on the Network Control Bargaining model (Braun & Gautschi, 2006) to derive our hypotheses. Contrary to other sociological network exchange models, the Network Control Bargaining model (NCB) combines the generalized Nash bargaining solution from game theory with structural bargaining power. In the original NCB model, the authors assume that all subjects are narrow payoff maximizers. We additionally allow for heterogeneous fairness considerations as a determinant of the implemented bargaining power. This amendment extends the set of potential beneficiaries of the bargaining value.

In particular, we expect the subjects to consider two dimensions of the outcome: their own payoffs and distributive fairness. The internalization of the fairness norm and the relative weight given to fairness compared to their own payoff may differ between subjects and counteract payoff maximization. It is intuitive that a fair distribution is akin to an equal distribution (Miller, 1999) in this context, since the subjects enter the laboratory as equals and there are no incentives to raise equity or need-related concerns. Hence, a subject seeking fairness can be expected to prefer a more equal distribution over a less equal distribution. This interpretation is in line with the definition of social value orientations, where those subjects are called prosocial (Murphy et al., 2011).

To illustrate the effect of fairness preferences on outcomes we focus on negatively connected three-node networks (see fig. 1). Negative connections imply that each network member is restricted to exchange with not more than one other subject at a time. Thus, in negative three-node networks one subject is excluded from exchange. In the standard setting the exclusion from exchange goes along with the exclusion from any payoff. However, if the third network member receives no payoff share, the distribution between the subjects is unequal by design. This might be an unsatisfying outcome for a prosocial subject.

Simple three-person networks allow us to study two distinctly different power structures. On the one hand, we look at the *triangle*. In this network, all three subjects are connected and the structural power of each dyad is equal. On the other hand, we look at the *three-line* network. This is a strong-power network, in which one central subject is structurally advantaged by being connected to two peripheral subjects who are not connected to each other and compete for an agreement with the strong-power position. The NCB model makes clear predictions for both networks. In the following, we show how the predicted outcomes may vary in response to the inclusion of social values and develop the hypotheses.

[Figure 1 about here]

Bargaining power and social value orientations

In negotiated exchange subjects bargain in dyads over the distribution of a bargaining value, v . Suppose $B = (b_1, b_2, \dots, b_n)$ is a set of individual bargaining power in the network, where b_i is the

bargaining power of individual i . Further, there are three individuals i, j , and k , where $i \neq j \neq k$. A dyad comprises two connected individuals i and j , where $b_i \geq b_j \geq b_k$. If the network is negatively connected, one individual k is excluded from direct exchange. If the subjects in a dyad do not conclude an agreement on allocations, no one receives a payoff, and any agreement is Pareto-superior. The negotiated payoff of an individual i with individual j is denoted by x_{ij} , with $0 \leq x_{ij} \leq v$. The individuals in the dyad i and j negotiate over the payoff shares x_{ij} , x_{ji} and x_k as if they would solve the following optimization problem,

$$\max x_{ij}^{b_i} * x_{ji}^{b_j} * x_k^{b_k}, \text{ subject to } x_{ij} + x_{ji} + x_k = v. \quad (1)$$

A subject's bargaining power depends on two factors, structural power, s , and a bias dependent on social value orientations, η . Structural power depends on the degree of 'control' over relations with other subjects in the network, the exchange mode, mutual ties in the network, and the number of network members (Braun & Gautschi, 2006, p. 4-10). Structural power is, so to speak, an 'objective' determinant of bargaining power. Since any subject can only hold structural power in their direct relations with others, the structural bargaining power of subject k within the relation i and j is always zero, i.e. $s_k = 0$. By definition, power is exercised when one subject can impose her will on others (Weber, 1978). In line with Willer et al. (2013), we assume that social value orientations affect an subject's bargaining power.⁵ Willer et al. (2013, p. 119ff) argue that prosocial types exercise power over prosocial types even when structural power is equal. We interpret the social value orientation as a factor that biases outcomes toward a fair distribution. Structural power and social values jointly determine observed bargaining power of an subject i in the negotiating dyad,

$$b_{ij} = s_{ij} - \eta_{ij}. \quad (2)$$

This notation allows us to measure the difference between observed and structural bargaining power and we can test whether the negotiated bias is systematically related to the social value orientations. By definition, the structural power of individual k is zero in a relation where this subject cannot interfere. Yet, by being salient, and through the possibility of receiving some payoff, individual k may induce feelings of obligation. We interpret this as if the third individual had power over the two negotiating individuals,

$$b_k = \eta_k. \quad (3)$$

We assume that the observed bargaining power of the third individual k depends on the social value orientations of individual i and j , that is, the extent to which they are willing to take k 's payoff into account. The relative bargaining powers of the subjects determine the exchange payoff. The optimization problem in equation (1) yields the following payoff for individual i ,

$$x_{ij} = \frac{b_i}{b_i + b_j + b_k} v = p_{ij} v \quad \text{for } i \neq j \neq k, \quad (4)$$

where $p_{ij} := b_i / (b_i + b_j + b_k)$ defines i 's relative bargaining power in her relation with j . Likewise, the relative bargaining power of the third individual in the relation between i and j is defined by $p_k := b_k / (b_i + b_j + b_k)$. By definition, the three relative bargaining powers sum up to one, i.e. $p_{ij} + p_{ji} + p_k = 1$.

⁵ In the empirical analysis we will control for additional individual characteristics which could determine the exchange outcome, such as risk aversion (Nash, 1953).

Hypotheses

In general, any dyad $\{i, j\}$ can agree on a distribution as long as the subjects are connected. The NCB model makes use of Binmore's (1985, p. 273) formula for calculating structural power.⁶ Accordingly, in the triangle network all dyads have equal structural power, being $s_i = s_j \approx 1.18$ and $s_k = 0$. In the three-line network, dyads consist of a structurally powerful and a weak position, yielding the structural bargaining powers $s_i \approx 5.48$, $s_j \approx 1.14$, and $s_k = 0$, respectively.

In the original NCB model it is easy to show that the third subject receives no payoff if an subject's bargaining power only depends on structural power. If we set $\eta_k = 0$, then $b_k = 0$ and $x_k = \frac{0}{b_i + b_j + 0}v = 0$. In other words, the assumption of selfish payoff maximization suggests that the possibility of including a third subject in the allocation will not affect distributive outcomes, and thus the outcomes only depend on structural power. In this case, we can set the payoff share of the third subject to zero and the resource is distributed within the dyad, i.e. $x_{ij} + x_{ji} = v$. When we additionally set $\eta_i = \eta_j = 0$, we arrive at the bargaining solution of the original NCB model, where $x_i = x_j = 0.5v$ in the triangle network and $x_i \approx 0.83v$, $x_j \approx 0.17v$ in the three-line network. Logically, the higher the structural power of a subject, the higher her payoff share and the more unequal the overall payoff distribution.

We measure inequality as the range of payoffs in a network, i.e. $\max(x) - \min(x)$. The range captures interpersonal payoff differences,⁷ correlates highly with the standard deviation and variance of the payoffs, correlates perfectly with the inequality measure used in previous studies (Molm et al., 2000; Savage et al., 2016), and is easily accessible and interpretable. If the third subject receives no payoff by design, then $\min(x) = 0$. And since we know the payoff shares of all subjects, we know that the highest share in the three-line network is higher than the highest payoff share in the triangle network, since $0.83v > 0.5v$. It follows that the range must be larger in the three-line than in the triangle network, $0.83v - 0 > 0.5v - 0$. In this respect, we expect to replicate results of earlier negotiated network exchange experiments.

H1: *The average distribution of payoffs is more equal in the balanced network structure compared to the unbalanced one.*

Alternative assumptions about the determinants of relative bargaining power lead to different reference levels. The relative bargaining power predicted by the NCB model is denoted as p_i'' . Assuming, instead, that subjects' distributive preferences are also driven by fairness considerations implies that these individual characteristics interact with structural power. Here we make the critical assumption

$$s_i - s_j \geq \eta_i - \eta_j \quad (5)$$

that typically should hold. The reason is as follows. A strong subject who can potentially receive more from exchange through her structural advantage will not negotiate more intensively to further increase the payoff difference. By contrast, a strong subject exhibiting fairness preferences will make less use of structural power to further her own interests, such that the outcome is more equal. Similarly, a weak subject with fairness preferences is reluctant to agree on unequal outcomes. Thus, this reluctance works as if the subject's bargaining power increases relative to the other subject. In formal

⁶ $s_i = -1/\ln(\frac{m+n}{1+m+n}c_i)$, where m are the number of ties, n the number of s and c_i i 's network control.

⁷ $\max(x) - \min(x) = \frac{1}{2}(|x_i - x_j| + |x_i - x_k| + |x_j - x_k|)$, $x = (x_i, x_j, x_k)$

terms, according to assumption (5), it follows that if $s_i \geq s_j$, then $\eta_i \geq \eta_j$, and $b_i \geq b_j$. This means that the bias generated by social value orientations may equalize bargaining power but cannot turn it around. Therefore, if the structural determinates of the NCB model predict that one subject will receive a greater payoff than the other, social values cannot overturn the relative structural bargaining power of the two subjects. Likewise, social values will never increase the difference in relative structural power. In the equal power network, structural power implies equality and, hence, prosocial value orientations do not disturb the equilibrium in the standard setting. Since $s_i = s_j$, $\eta_i = \eta_j$ should hold according to assumption (5).

To compare the relative implemented bargaining power with and without fairness concerns, we introduce another reference level. The reference level p_i' denotes the relative implemented bargaining power assuming dyadic offer restrictions and $\eta_i \geq \eta_j$. From $\eta_i \geq \eta_j$ follows $0.5 \leq p_i' \leq p_i''$. This means that the difference in observed relative bargaining power is smaller than the structural advantage would suggest. Therefore, we expect that the differences in relative payoff shares are generally smaller than predicted if social value orientations are relevant. The question is by how much. If our argument is correct, then a strong power individual, i , who values fairness more than another strong power individual, i' , will make less use of structural power, given the same negotiation partner, i.e. $\eta_i \geq \eta_{i'}$ and therefore $p_i' < p_{i'}'$.⁸ In order to test this hypothesis, we measure individual SVO scores and use them as a proxy for fairness preferences. The lower the SVO score, the smaller the bias in structural power. Consequently, prosocial types are more likely to equalize payoffs if they have the structural power to do so.

So far, we have excluded the third subject from the analysis. If $\eta_k > 0$, the restriction $x_k = 0$ would bias the outcome. Therefore, in the last step we consider the implemented bargaining power when subjects have the option to allocate payoff shares to third network members. The assumption $\eta_k > 0$ means that $b_k \geq 0$ and, consequently, $x_k = p_k v \geq 0$. Hence, when the aggregated fairness preferences include individual k , she will receive a payoff share greater than zero. Furthermore, if $x_k > 0$, then the range will decrease, i.e. $x_i - 0 > x_i - x_k$. In other words, the opportunity to include a third subject reduces inequality between the three network members, compared to offers in the restricted condition.

H2: *If a negotiating dyad has the option to allocate a share of the resource to a third, dyads make use of this option and on average profits will be distributed more equally.*

Yet, as we disregard purely altruistic subject types, the observed bargaining power of subject k cannot exceed that of subjects i or j and thus $x_i \geq x_j \geq x_k \geq 0$.

The effect of individual fairness preferences on the payoff share of excluded subjects depends on relative structural power. The fairness preferences of structurally advantaged subjects are relatively more important than those of peripheral subjects since weak power subjects are not willing to decrease inequality with respect to the third subject if this means that their own inequality relative to the negotiation partner increases. This follows from $\eta_i \geq \eta_j$. Thus, in the three-line network the powerful subject is more likely to enforce her own preferences, whether she seeks to maximize her own payoff or to aim at a fair outcome. In the triangle network, however, we expect that the

⁸ In the analysis, we focus on individualistic and prosocial SVO types. It often makes no difference for the outcome whether a is competitive or individualistic (Fehr and Schmidt, 1999, p. 850f.). Hence, scholars frequently combine the individualistic and competitive SVO types to define a proself type (Willer et al., 2014). The other extreme, altruism, is rarely observed empirically (Murphy et al., 2011).

preferences of the subject with weaker fairness preferences is more important ($\eta_i = \eta_j$). Empirically, it has already been shown in other contexts that the most competitive subject is the best predictor of group decisions (Luhan, Kocher, & Sutter, 2009; Robert & Carnevale, 1997). Wildschut et al. (2003) argue that the social support of immediate self-interest, unavailable to individuals, undermines the fairness norms. An alternative explanation would be that subjects are only willing to include the third subject when the agreeing partner is also willing to do so. A subject alone is only able to reduce inequality toward a third subject by reallocating her own payoff shares, which might be considered unfair.

H3: *The higher the SVO score of the less prosocial subject in the agreeing dyad in a triangle network, the more equal the negotiated payoff distribution.*

H4: *The higher the SVO score of the strong subject in a three-line network, the more equal the negotiated payoff distribution.*

Yet, although we assume that fairness principles motivate human behavior, determining whether the third subject is included in bilateral agreements is not straightforward. Other rationalities may undermine prosocial behavior in this setting. Disregarding the third subject is still payoff maximizing, and the mere fact of negotiating may generate social distance between the members of the dyad and the third subject (Karakayali, 2009; Simmel, 1950). According to literature on the ‘discontinuity effect’ allocations to other subjects tend to be lower when groups decide instead of individuals (Kugler, Kausel, & Kocher, 2012). A fairness norm adhered to by some subjects can be undermined by identification with the dyad and the decay of responsibility.

4. Experimental Design

We study a 2 x 2 experimental design, in which we vary the distribution mode within subjects and the network structure between subjects. All subjects complete the SVO slider task (Murphy, Ackermann, & Handgraaf, 2011) prior to the experiment, but they do not receive information about their payoff from this task until the end of the experiment. The SVO slider measure is an incentivized task assessing an individual’s SVO score, based on decisions in various scenarios as the sender in a dictator game. The SVO scores are clustered into four main types, competitive, individualistic, prosocial, and altruistic, and serve as an estimate of individual fairness preferences. After the main part of the experiment, subjects complete a questionnaire including several socio-economic questions.⁹

Experimental Setup

Subjects are randomly allocated to groups of three and engage in exchange over ten periods. In each period, subjects negotiate the distribution of 24 profit points within the restrictions set by the network structure. Proposals can only be communicated within a dyad. The format of the proposals is restricted to numbers. Agreements have to be reached within three minutes. Within this period subjects are free to send as many offers and counteroffers as they choose. If no agreement is reached, all three network members receive zero points. In each period, network members are randomly re-matched and positioned in the network in order to avoid the development of direct reciprocity or insurance motives between subjects. At the end of the experiment two out of ten random rounds are paid, which should

⁹ The questionnaire also includes the BIG-5 30 item personality inventory (Costa & McCrae, 1992; Schupp & Gerlitz, 2008), but we do not further explore this information in the present paper.

also limit reciprocal behavior. Subjects are informed about the network, their position and the size of the resource to be distributed (see Molm ,2007, for the choice and variation of these factors). The instructions are formulated as neutrally as possible.¹⁰

In the *triangle* network, all positions have the same opportunities and the same ex ante probability of exclusion. In the *three-line* network, one of the two peripheral positions will be excluded from the exchange, and thus from any profit, while the central position cannot be excluded. The exchange mode determines whether excluded subjects can receive payoff shares from the exchange outcome. In the *exclusive treatment* (henceforth ET) subjects can make offers that only include the two negotiating subjects (i.e. the dyad). In the *inclusive treatment* (henceforth IT) offers can include a share for the third subject, who is not part of the bilateral negotiation and does not receive any information about the offers made. ET and IT are both played for five consecutive periods. In half of the sessions ET is implemented first and in the other half IT comes first. The network structure is fixed throughout the session.

We conducted four sessions with 27 subjects each at a laboratory in April 2016, resulting in a sample of 108 subjects.¹¹ In each session we assigned the subjects randomly to one of three independent groups of nine. Thus, we obtained twelve independent observations for each treatment. Within the groups of nine, subjects were randomly reassigned into three groups of three subjects in each of the ten rounds. Thus, in sum we obtained 180 data points each for the inclusive and the exclusive treatment. One experimental session lasted about 1.3 hours and the participants earned EUR 19.12 on average.

5. Results

First, we will compare the two networks in the exclusive treatment and analyze the effect of the social value orientation on the outcome. Second, we move on to the inclusive treatment, where we explore the shares for the third subject in more detail and examine the determinants of equal payoffs. Third, we contrast the exclusive and inclusive treatment, and finally, we include the time dimension of our experiment. Overall, the third subject receives on average more than 10 percent of the bargaining resource, which is about 30 percent of the share in the even three-way split. Figure 2 summarizes the results. Comparing ET to IT illustrates the shift toward the third, by the points within the edges of the triangle, with a focal point at the centroid, which indicates an equal distribution between all three subjects. Comparing the triangle to the three-line network, the shift of the data cloud towards node A illustrates the structural power of this node.

[Figure 2 about here]

In the ET the difference between the average range in the triangle (12.3) and the three-line network (13.2) is statistically significant (Mann-Whitney-U test, $p < 0.01$). This supports *H1*, stating that the average distribution of payoffs is more equal in a balanced than an unbalanced network structure in the ET. In the IT, however, the difference between the allocation ranges of the two networks is not significantly different from zero (9.2 vs. 9.1). Thus, the possibility of including the third subject in combination with fairness considerations tend to equalize the structural differences between the networks. Furthermore, in ET, the allocation range in the triangle is 12.3, while it is 9.3 in the IT. This

¹⁰ See the online supplementary material for the full instructions translated from German to English.

¹¹ We used z-Tree (Fischbacher, 2007) to program the experiment and ORSEE (Greiner, 2015) to recruit the participants.

means that the difference between the richest and the poorest network member is on average about one third larger when offers beyond the dyad are not allowed. The difference is statistically significant (Mann-Whitney U-test, $p < 0.01$), supporting hypothesis *H2* that average payoffs are more equally distributed in the inclusive treatment than in the exclusive treatment. Similarly, the average range for the three-line network in the ET is 13.2 points and in the IT it is 9.1 points. This difference is again statistically significant (Mann-Whitney U-test, $p < 0.01$), which also supports *H2*.

While the third always receives 0 points by design in the ET, the third receives on average 2.2 points in the IT. Whereas all standard models fail to predict accurately in the IT, we now turn to the proposition that adding fairness preferences to the utility function improves the explanatory power of the model. Table 1 summarizes the frequency of different divisions for each treatment.

[Table 1 about here]

Exclusive Treatment

In the exclusive treatment subjects could distribute the resource only within the dyad. In all ET networks, one dyad managed to agree on a distribution within the time limit of three minutes.¹² In the triangle network, subjects in the agreeing dyad receive on average 12 points – which logically follows from the fact that the positions are homomorphically equivalent and indistinguishable – with a standard error of 0.1. In the three-line network, the powerful and the weak subject receives on average 12.8 and 11.2 points, respectively. Given that one weak network member is always excluded, the overall average for the weak position is equal to 5.6 points. The powerful subject receives significantly more than 12 points (one-sided t-test, $p < 0.01$),¹³ which means that the structural advantage leads to a higher overall payoff. Yet, the advantage is much smaller than in comparable network experiments (e.g. Skvoretz & Willer, 1993; Thye, Lawler, & Yoon, 2011; Whitmeyer, 1999). Our findings are clearly inconsistent with the predictions of traditional network exchange models, independent of whether it is the NCB predicting a 20-4 split, elementary theory predicting a 23-1 split, or any other model (see Willer & Emanuelson, 2008).

Next, we analyze how SVOs and the distribution outcome are related in the ET, which might help explain why standard exchange models seem unable to predict outcomes in our experiment. According to the measure of social value orientations (Murphy & Ackermann, 2014) 43.5 per cent of the subjects can be categorized as prosocial types and 56.5 per cent as individualistic. In our sample, no participants are identified as competitive.

There is no significant difference between payoff shares of prosocials and proselfs in the triangle (11.9 vs 12.1 points). This makes sense since the bargaining power is equal and nobody prefers to be left out. In the three-line network a central, prosocial subject earns on average 12.3 points, which is in line with the defined preference to equalize payoffs. The central, proself subject earns on average 13.2 points, which is higher, as expected, but far from their theoretically preferred outcome. Still, the payoff difference between central prosocial and central proself types is statistically significant (Mann-Whitney-U test, $p = 0.04$). The results corroborate hypothesis *H4* that prosocial SVO types are more likely to equalize payoffs if they are in the powerful position. The difference between prosocial and

¹² We have to exclude one observation from the sample because two offers were accepted at two indistinguishable points in time, which led to an incorrect record in the output file, leaving us with a total of 179 observations.

¹³ The test is also significant if we aggregate the data on the six truly independent observations ($p < 0.01$).

proself weak power positions is not significant (11.4 versus 11.1 points), which again makes sense, as nobody prefers to be left out.

Altogether, it is surprising that structural power in the three-line network is not exploited more extensively. In some comparable experiments the same number of periods is sufficient to reach predicted equilibria (Skvoretz & Willer, 1993; Willer & Emanuelson, 2008). This may be due to the neutral framing of our experiment. We neither primed the participants to “assume a proself orientation” nor instructed them to “earn as many points as they can” (Willer et al., 2014, p.204; Willer & Emanuelson, 2008, p.182). Given this discrepancy in results, one explanation could be that in a standard network exchange experiment, equilibria converge more slowly with a neutral framing or depend on explicit instructions to behave in a self-regarding manner.

Inclusive Treatment

In the IT the resource can be allocated beyond the negotiating dyad. Overall, 178 out of 180 possible exchanges were realized and the subjects agreed in 61 cases (34 percent) on a distribution that distributes points to the third subject. In 38 cases (21 percent) the subjects agreed on an equal distribution.¹⁴

In the triangle each subject of the agreeing dyad receives on average 11.0 points (s.e. 0.1), leaving 2.0 points to the third subject (s.e. 0.4). The latter allocation is significantly larger than 0 points (one-sided t-test, $p < 0.01$). In the three-line network the powerful and weak subject receive on average 11.6 points (s.e. 0.3) and 9.9 points (s.e. 0.2), respectively. Even though this difference is small, it is statistically significant (Mann-Whitney U-test, $p < 0.1$). The third subject receives on average 2.6 points (s.e. 0.4), which is again significantly more than zero (one-sided t-test, $p < 0.01$).

As in the ET we examine differences between the SVO types. In the triangle network the average range is equal to 9.2. We can distinguish three cases: two proselfs agree on an exchange payoff (average range = 10.2), a proself and a prosocial type agree (average range = 9.4), or two prosocials agree (average range 6.6). The range difference for the first two cases is not statistically significant, whereas the difference between the first two and the latter is marginally so (one-sided Mann-Whitney U-test, $p = 0.07$; one-sided t-test, $p = 0.05$). Two prosocials allocate on average 3.7 points to the third, compared to 1.7 points in other dyads (differences: Mann-Whitney U-test, $p = 0.05$; t-test, $p = 0.08$). In line with the discontinuity effect, those results suggest that the social value orientations of both subjects in the dyad matter in an equal power network, suggesting that the altruism of subjects is conditional on the willingness of the negotiation partner to also allocate resources beyond their own dyad. Therefore, *H3*, which states that outcomes are more equal if more prosocial subjects are involved in the agreement, is corroborated.

The average range in the three-line network is 9.1. The difference compared to the triangle network is insignificant. Furthermore, the strong power subject has disproportionate influence on the distribution outcome. When a prosocial type holds the powerful position inequality (range 7.1) is significantly lower than when they do not (range 10.5; Mann-Whitney-U test, $p = 0.01$). Similar to the triangle network, the third subject receives significantly fewer points when the powerful subject is proself rather than prosocial (1.7 versus 3.9 points). However, if the powerful subject is prosocial the range is not significantly different, irrespective of whether the agreeing subject is prosocial or proself.

¹⁴ In the IT we have to exclude one observation for the same reason as in the ET. In the following we additionally exclude three observations from the analysis since one of the agreeing subjects received zero points in those cases. It is difficult to rationalize why a subject accepts an offer that yields no payoff share for them and we cannot exclude that the subject made an error. Note that by excluding those data points the third subject receives on average a smaller share of the resource and the tests are less likely to support the hypotheses.

Likewise, when the powerful subject is proself we find no statistically significant influence of the agreeing subject's SVO type subject. Yet, in both cases inequality increases when the agreeing subject is proself and not prosocial. Altogether the results support *H4*. The distribution of the resource is more equal if a prosocial subject is in the strong power position.

In sum, a substantial proportion of dyads make use of the possibility to allocate points beyond the dyad. Prosocial subjects are more likely to be among those subjects. When two prosocials in the equal-power triangle network agree on an allocation, or a prosocial subject is powerful in the strong power network and agrees on an allocation, they are more likely to equalize payoffs across all members of the network. On the other hand, proself subjects use their structural power to increase their own allocation, albeit less than predicted by standard network exchange theory. They earn on average 1.5 points more in the strong power position than prosocials, which is statistically significant (Mann-Whitney-U test, $p=0.01$).

Learning effects

It is noteworthy that, even though subjects in structurally advantaged positions earn more on average, the difference is rather small in magnitude. Especially, rational choice scholars stress the importance of learning in experimental settings (Camerer, 2003; Fudenberg, 2006). Powerful subjects may have not yet learned to use their structural advantage in the first periods of the experiment. Our findings could thus very well be the result of the limited number of repetitions.

Indeed we find that the payoffs for the third subjects decline significantly in later periods in both networks from four points in round one to only one point in round five (Mann-Whitney U-test, $p<0.01$). Correspondingly, as the subjects learn to use their structural advantage in the traditional three-line network and the payoffs have a small positive trend, payoffs increase in the IT for the two agreeing subjects. This suggests that negotiating subjects first learn to reduce the payoff share for third subjects beyond the dyad, then structurally advantaged subjects learn to use their power in the dyad.

In order to test whether the treatment effects are overshadowed by learning effects we run several tobit regression models. We use our inequality measure, the range of individual payoff shares, as a dependent variable. The independent variables are the treatments IT or ET, the SVO score, the Period and two interaction effects. The treatment variable *Inclusive treatment* is equal to one in the IT and equal to zero in the ET. The variable *SVO score* measures something different in the two networks. Generally, the SVO score depicts the individual angle of the measure, which ranges in our sample from -7.82 to +49.45 degrees. The coefficient in the regression output measures the effect on the range when the SVO score increases by 10 degrees. In the triangle network, SVO 1 measures the lower SVO score (hence the relatively more proself score of the two agreeing subjects) and SVO 2 measures the higher SVO score. In the three-line network, SVO 1 reports the corresponding value of the powerful subject and SVO 2 the one of the weak subject. Since the SVO score measures different aspects in the two networks, we estimated two independent regressions. To allow estimations of the different effects of SVO in ET and IT, we include an interaction effect. In the triangle, the crucial condition is the SVO angle of the less proself subject: An increase in the angle implies an increase in the overall level of prosociality of the dyad. In the three-line network, an increase in the prosocial attitude of the powerful subject is expected to decrease the range in IT.

We control for learning effects by including the *Period* as a linear effect.¹⁵ We allow this effect to vary over treatments by means of a further interaction term. We also estimate a second regression for

¹⁵ Alternatively, we controlled for the periods as separate dummy variables. All the main results are robust.

each network which includes controls for the risk attitude, laboratory experience, age, and gender, each for both subjects, and an order dummy which is equal to 1 when ET precedes IT.

[Table 2 about here]

The regression in Table 2 reveals that the treatment interacts in the expected way with social value orientations, even if we include periods and other variables as controls. Note, first, that the treatment effect as such indicates that the range is smaller in IT than in ET, although the effect approaches statistical significance only in the three-line network when controlling for the full set of controls. However, the range decreases on average by 1.2 to 1.8 points when the relevant SVO angle increases by 10 degrees in IT, that is, the lower SVO score in the triangle and the powerful subject in the three-line network.¹⁶ These results confirm the earlier findings. Unsurprisingly, the period has a significant and positive effect on inequality in both ET and IT in the three-line network, and also in the triangle in IT.¹⁷ But learning does not spoil the treatment and SVO effects.

6. Discussion and Conclusion

In this study, we have compared the traditional network exchange setting with a treatment that allows subjects in a negotiating dyad to allocate shares of the resource to third subjects in the network. Our main finding is that the effect of the change in the institutional rule depends on the other-regarding considerations of subjects. The possibility to include others in their agreement about the distribution of a collective endowment indeed leads to substantial shares being allocated to the third subjects. However, this effect is due to the influence of prosocial subjects: In the equal-power condition of the triangle, the less prosocial subject of the agreeing dyad is the best predictor of the allocation to the third subject. In the three-line network, the size of the allocation to the third subject depends on the prosociality of the powerful subject.

This result has to be qualified in several ways, however. First, overall, the exchange payoffs are more equal between the agreeing subjects than in previous studies (Willer et al., 2014, p.204). We conjecture that the lower inequality observed in this study compared to others is the result of the absence of an explicit encouragement in the instructions to behave prosocially. An alternative explanation may be that our results are a consequence of reshuffling the subjects in each period across positions, which may induce reciprocal motives. However, this reasoning is undermined by the fact that subjects were reshuffled not only across positions but also across groups and that only one period per treatment was paid out. Quite to the contrary, while reciprocity did not develop, subjects learned through observation and imitation (Bandura, 1962) how to increase own payoffs.

¹⁶ The slider measure assigns an angle between -7.82 and $+7.82$ to a subject who is a consistent individualist and an angle of 37.48 to a prosocial subject who is inequality averse. Hence, the difference between the two stylized types is about 30 degrees (three times the coefficient).

¹⁷ Regarding the controls (shown in the appendix, Table 3), we find no further factors that significantly affect the results in the triangle network. However, the situation is different in the two-line network. Here we find that women in a dyad agree on more equal allocations (-1.15^* points for women in the strong and -1.22^* points for women in the weak power position), whereas more experienced subjects agree on less equal allocations (for each additional experiment attended strong power subjects increase the range by 0.29^{***} points and weak power subjects by 0.14^*). Finally, we observe that the older the strong power subject is, the less equal the agreement (by -0.69^{**} points for an age increase by 5 years).

Second, allocations to the third subject as well as differences in treatment effects decline over time. In the inclusive treatment, we initially observe quite frequent three-way splits, but over sequential rounds the share allocated to the third subject declines. Moreover, the allocation is conditional on the social value orientation of the second subject of the negotiating dyad, especially if neither has a structural advantage. This pattern might be rooted in a behavioral regularity that we may call *conditional altruism*. The willingness of subjects to support weaker subjects depends crucially on the willingness of other subjects to do so as well. In that sense, our results echo the declining contributions found in experiments on public goods (Chaudhuri, 2011). Only a few proself subjects are required to start a vicious proself cycle to the disadvantage of excluded subjects. Though, the difference between conditional altruism and conditional cooperation is that the decisive subject does not benefit monetarily from bilateral cooperation, nor does altruism lead to more efficient outcomes.

Nevertheless, our experiment has shown that the assumption of selfish utility maximization underlying the design of previous studies is too restrictive. People do make offers beyond the negotiating dyad if others are willing to follow suit.

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Appendix

The Sample

Risk (Holt & Laury, 2002): One fifth switched exactly at the risk neutral point. The total distribution of risk is skewed slightly left, which indicates that the subjects are slightly more risk averse than risk-loving. 21 subjects made inconsistent choices, 15 switched more than once and 6 switched once but in the reverse order. We calculated the mean of the risk index, which is 0.45, and used it for those subjects instead.

61 per cent of the sample are women. The median age is 23 years. 62 per cent have little experience with laboratory experiments (0-2 visits), 31 per cent have medium experience (3-8 visits) and the remaining 6 per cent were frequent participants in experiments (more than 8 visits).

[Table 2 about here]

Tables

Table 1. Frequency of divisions

Division type between the dyad	Proportion of exchange outcomes			
	Exclusive Treatment		Inclusive Treatment	
	Triangle	Three-line	Triangle	Three-line
Even two-way split (12–12–0)	0.82	0.54	0.61	0.34
Even three-way split (8–8–8)	-	-	0.19	0.24
Uneven two-way split	0.18	0.46	0.10	0.29
Uneven three-way split	-	-	0.09	0.14
Two-way split	1.00	1.00	0.72	0.63
Three-way split	-	-	0.28	0.37

Table 2. Models of Inequality in Networks

	<i>Dependent variable: Range</i>			
	<i>Triangle network</i>		<i>Three-line network</i>	
Inclusive Treatment	-2.05 (1.47)	-2.15 (1.57)	-2.38 (1.83)	-3.88* (1.98)
SVO 1: high / strong power	0.22** (0.09)	0.38 (0.24)	-0.09 (0.13)	-0.04 (0.18)
SVO 2: low / weak power	0.00 (0.08)	-0.06 (0.19)	0.04 (0.15)	0.07 (0.22)
Period	-0.03 (0.05)	-0.02 (0.10)	0.33** (0.13)	0.40** (0.17)
Inclusive treatment x SVO 1	-0.46 (0.47)	-0.67 (0.54)	-1.56*** (0.53)	-1.24*** (0.47)
Inclusive treatment x SVO 2	-1.80*** (0.65)	-1.56** (0.70)	-0.72 (0.55)	-0.67 (0.51)
Inclusive treatment x Period	1.02*** (0.40)	1.04** (0.42)	1.26*** (0.48)	1.21*** (0.45)
Constant	11.74*** (0.18)	10.07*** (1.25)	12.64*** (0.43)	12.50*** (1.46)
Controls	No	Yes	No	Yes
Observations	174	174	179	179
Log Likelihood	-445.6	-443.2	-476.8	-462.4
Wald-statistic	39.51	41.43	55.27	97.72

Notes: Tobit models with robust standard errors, *p<0.1; **p<0.05; ***p<0.01

Table 3. Models of Inequality in Networks with Controls

	<i>Dependent variable: Range</i>			
	<i>Triangle network</i>		<i>Three-line network</i>	
Inclusive Treatment (IT)	-2.05 (1.47)	-2.15 (1.57)	-2.38 (1.83)	-3.88* (1.98)
SVO 1 (high / strong power)	0.22** (0.09)	0.38 (0.24)	-0.09 (0.13)	-0.04 (0.18)
SVO 2 (low / weak power)	0.00 (0.08)	-0.06 (0.19)	0.04 (0.15)	0.07 (0.22)
Period	-0.03 (0.05)	-0.02 (0.10)	0.33** (0.13)	0.40** (0.17)
IT x SVO 1	-0.46 (0.47)	-0.67 (0.54)	-1.56*** (0.53)	-1.24*** (0.47)
IT x SVO 2	-1.80*** (0.65)	-1.56** (0.70)	-0.72 (0.55)	-0.67 (0.51)
IT x Period	1.02*** (0.40)	1.04** (0.42)	1.26*** (0.48)	1.21*** (0.45)
Treatment order		0.10 (0.34)		-0.04 (0.49)
IT x Treatment order		0.30 (1.24)		1.22 (1.23)
Risk averse 1		-0.10 (0.16)		0.17 (0.23)
Risk averse 2		0.21 (0.17)		0.20 (0.18)
Female 1		0.11 (0.67)		-1.16* (0.63)
Female 2		0.79 (0.75)		-1.22* (0.63)
Age 1		0.07 (0.07)		-0.14*** (0.05)
Age 2		-0.11 (0.13)		0.01 (0.07)
Experience 1		-0.03 (0.06)		0.30*** (0.09)
Experience 2		0.03 (0.06)		0.14* (0.08)
Constant	11.74*** (0.18)	10.07*** (1.25)	12.64*** (0.43)	12.50*** (1.46)
Observations	174	174	179	179
Log Likelihood	-445.6	-443.2	-476.8	-462.4
Wald-statistic	39.51	41.43	55.27	97.72

*p<0.1; **p<0.05; ***p<0.01

Figures

Figure 1. Network structure and allocation offers

	Strictly bilateral offers	Inclusive offers
Triangle Network		
Three-line Network		

Figure 2. Final Agreements

