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Daniela Di Cagno, Werner Güth, Marcello Puca,
Patrizia Sbriglia

Group Influence in Sharing Experiments

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Daniela Di Cagno[†], Werner Güth[‡], Marcello Puca[§], Patrizia Sbriglia[**]

ABSTRACT

We experimentally study how group identity and social influence affect proposers and recipients in Ultimatum and Impunity Games. To induce group identity and social effects, we assign individuals to different color groups and inform them about the median choice of their own group. When testing the relevance of this social signal for intentions and decisions we distinguish uni- and bi-dimensional behavior, the latter to let individuals select on which rule of conduct of the others to condition own behavior. When disagreement and conflicting views are possible, coordinating with group behavior may be less important and individuals may prefer self-serving. The bi-dimensional design apparently allows for more variety: tracking both group medians, only one or none.

Social influence significantly affects behavior in Ultimatum but has much weaker impact in Impunity experiments. Social information seems to act in two ways: as a *coordination* device and as a *learning* device. However, the marginal impact of the signal and the direction of its influence is strongly role dependent.

J.E.L. Classification: C90, C91.

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[†] Luiss University. Email: ddicagno@luiss.it

[‡] Luiss University; Max Plank Insitute. Email: Güth@luiss.it

[§] University of Bergamo; Università della Svizzera italiana. Email: marcello.puca@unibg.it

[**] University of Campania – Luigi Vanvitelli (corresponding author). Email: patrizia.sbriglia@unicampania.it; tel.: +39(0)823274022; fax: +30(0)823274042.

1. Introduction

According to competitive equilibria of market economies, agents react to the equilibrium price vector. Human cooperation and coordination, however, does not rely only on reactions to prices but also on social influences (Cason and Mui (1998), Charness and Sutter (2012), Falk et al. (2013), Delfino et al. (2016), Gioia (2017)). We imitate others or let them advise us, especially when they belong to the same social group. What has always seemed obvious to social psychologists and sociologists (Tajfel (1982), Snyder and Swann (1978), Hedstrom (2005)) is now also a central topic in behavioral economics: our behavior, beliefs and opinions are influenced by other members of our social community to which we feel attached.

How social influence affects behavior, however, is less clear and not so much an active research topic. Do we use information on others to coordinate behavior and rely on opinion dynamics in our group to conform to what the group accepts as the norm of conduct or do we strategically exploit social information to achieve higher payoffs? Different experiments so far have provided largely conflicting answers to this question.

Some scholars argue that social cohesion increases individual willingness to trust others or induces coordination (Berg *et al.* (1995), Falk *et al.* (2013)). Therefore, in groups a common norm of conduct often emerges which limits self-interest and is also applied by group members who, otherwise, would have acted differently. In other research work, social effects produce more selfishness, indicating that individuals either "learn" what is in their interest by observing the choices of others or more probably– when acting in a group – by making choices that follow standard game-theoretic predictions (Charness and Sutter (2012)).[1] In private interactions, however, individuals usually are not affected by competitiveness and may be more emotionally affected and influenced by idiosyncratic biases, cognitive limitations as well as by social concerns.

Whether social exchange leads to competition or coordination, its social social influence is implicitly based on the assumption that individual preferences want to appear as homogeneous and consistent (see Festinger and Hutte (1954), Brandstätter et al. (2006)). Or, alternatively, that internalizing stable and consistent inclinations are a pre-requisite for common (homogeneous) behavior to emerge.

In real-world group interactions, like family affairs, political groups or market interactions, assessing social influence is very complex. We may use social information to promote individual success (*e.g.* like the daughter of a successful entrepreneur enrolling in a business school aiming to manage the family business

[1] It is, for example, a general claim that identifying groups by markets, *e.g.* by their seller and sellers, triggers more opportunism (see for example V. Smith (1962)).

after graduation); or, in contests to win against a competitor or a member of the same group (*e.g.* a candidate running for primary elections competing with other party members). As conflicts can be excessively costly, it is important to explore how group influence and social information exchange can reduce the likelihood of conflict.

Coordination or learning devices often depend on the way individuals use social information, and the relative position of a group member. For example, political parties located in different countries, despite sharing common ideological views and cultural values, may have opposite performance and success due to their internal group structure (*e.g.* whether it is hierarchical or not). Moreover, unlike in the overwhelming literature on social influence, group members may prefer different rules of conduct. In this case, coordination may seem impossible, and individuals may fall back on self-serving opportunism.

We try to systematically study the effects of social influence or group effects in sharing experiments. Specifically, we use Ultimatum Games (UG) and Impunity Games (IG) (see Güth and Kocher (2014) for a recent survey) as our experimental workhorses to test the effect of social influence in a context of full (UG) versus no (IG) sanctioning power (Bolton and Zwick (1995)). Group identity is induced via a minimal group paradigm (Tajfel (1970)).[2] One experimental condition imposes consistency across roles (uni-dimensional case) whereas in the other individuals may or may not be consistent (bi-dimensional case).[3] Stable and consistent group norms of conduct suggest that group members behave consistently and are therefore well coordinated, regardless of their role in the interaction. On the contrary, unstable and inconsistent preferences may be role dependent.

The experimental protocols involve three different stages (group formation, then private and later public decision-making). In stages two and three, individuals express own intentions before making actual choices. In the public stage subjects are informed about the median intended choices formed in their group on the previous stage. Using the strategy vector method allows each subject to decide in both roles.

Both, the ultimatum and the impunity game, allow first movers to exploit the strategic advantage of proposer power.[4] There exists, however, overwhelming experimental evidence showing that individuals

[2]Tajfel experiment was aimed at testing in-group favoritism and prejudice in a sample of 64 school boys in UK. Tajfel hypothesis was that people simplify social relationship creating categories, in which they distinguish between *us* and *them*.

[3]For example, in an Ultimatum Game, inconsistency allows proposers to make offers which they would turn down as recipients. Section 2 explains the designs in detail.

[4] See section 2.

seldom behave according to the subgame perfect equilibrium strategy,[5] and often share even when second movers have no sanctioning power as in Impunity Games (Bolton and Zwick (1995), Bolton and Ockenfels (2000), Yamagishi *et al*. (2009)).

One explanation of rather fair play is the "social" value of fairness. According to Bicchieri (2005) and Bicchieri and Xiao (2009), fairness is an accepted norm or rule of conduct in many social contexts. Hintze and Hertwig, (2016) further suggest that social preference models, which take generosity and fairness into account, are likely to capture ecologically rational heuristics which let people behave optimally given their evolutionary habitat or context.[6] In such contexts, evolutionarily stable behavior is well or optimally adapted and is no longer "irrational". Our focus is to experimentally test whether this finding is also valid in case of strategic conflicts and possibly inconsistent and role-dependent views, for example, of what is "fair".

We find social effects to be stronger when preferences are unstable and coordination on fair outcomes to be more likely in the uni-dimensional condition, imposing individual consistency. Also, the direction of social effects differs between the uni-dimensional case (individuals propose and expect fair agreements in the private phase and rarely change their mind after learning the median group choice) and in the bi-dimensional case: subjects behave similarly in the private phase but, in UG substantially increase offers (resp. reduce acceptance thresholds) whereas they decrease offers and acceptance thresholds in IG after observing the group median. Thus, we altogether confirm mutual influence as harmonizing behavior but not across all conditions.

The paper is organized as follows. Section 2 introduces the experimental design and the research questions we want to answer. Based on this framework, we briefly review the relevant literature in section 3, specifically relating our study to other experimental studies of social influence which employ similar experimental paradigms and neglect the abundant field evidence on social influence in consumer, buyer and seller behavior, as well as on opinion dynamics. Section 4 describes the data and analyzes the mean effects before the summary regression analysis in section 5. Section 6 concludes.

2. Experimental design

Two participants, one in allocator/proposer role X and one in recipient/responder role Y, can share a positive monetary reward, the "pie" π. Role X offers to Y an integer amount y with $0 < y < \pi$. Role Y can

[5] Or, an even weaker requirement, to (once repeated) elimination of weakly dominated strategies.

[6] Güth and Pezanis (2015) prove how evolutionary selection of conjectural belief about others' behavior can imply equilibrium bidding in bidding contests.

accept or reject the offer y by stating an acceptance threshold $\underline{y}$, with $0 < \underline{y} < \pi$, meaning that only offers $y \geq \underline{y}$ are acceptable. Rejection, *i.e.* non-acceptance, means in ultimatum games (UG) that both X and Y earn 0 while, in impunity games (IG), X earns $\pi - y$ and Y receives y. Denoting $\delta(y) = 1$ (resp. $\delta(y) = 0$) as Y's decision to accept (resp. reject) y, the payoffs are $\delta(y)(\pi - y)$ for X and $\delta(y)y$ for Y in UG and $\pi - y$ for X and $\delta(y)y$ for Y in IG.

The experiment implements IG as non-private impunity, meaning that X is informed whether Y has accepted and collected the offer y (Yamagishi *et al.* (2009)). Solution behavior of IG in weakly dominant strategies entails $y^* = 1$, the smallest positive amount, and $\underline{y}^* = 1$. In UG once repeated elimination of weakly dominated strategies also yields $y^* = \underline{y}^* = 1$, *i.e.* in both games optimal behavior is uni-dimensional. Since we experimentally employ the strategy vector method – every participant chooses both an offer y in role X and an acceptance threshold $\underline{y}$ in role Y – optimality allows to restrict both choices such that $\pi - y + \underline{y} = \pi$ as in the uni-dimensional case. The bi-dimensional case obviously allows for $\pi - y + \underline{y} < \pi$ (resp. $\pi - y + \underline{y} > \pi$) meaning to tolerate (resp. refuse) more (resp. less) ambitious choices of one's counterpart.[7]

It is behaviorally interesting how subjects adjust strategy vector choices, which would be bi-dimensional when unrestricted, when uni-dimensionality is imposed. Not being this our topic, however, we assess "uni-" versus "bi-dimensional" decisions between subjects only. The main reason for this comparison is the hypothesis that social influence is stronger when triggered by uni-dimensional information about others's behavior.[8] In the bi-dimensional condition it is possible to individually select in which dimension to follow what we predict to weaken group influence.

Let us now describe how group members can affect individual behavior, *i.e.* the own strategy vector choice $(y, \underline{y})$ in the bi-dimensional and $(y, \pi - y)$ in the one-dimensional case. In the experiment, groups of four participants are formed randomly and minimally identified by color (black, white, orange, yellow, blue and green). Group influence is not based on group members actual choices but only on their stated behavioral intentions, more specifically, on the group's "median offer", $\hat{y}^0$, and "median acceptance threshold", $\underline{\hat{y}}^0$. For each group of four, we computed the two median intended offers (resp. thresholds) and

[7] Güth *et al.*, 1982, already provide evidence for both as well as for self-imposed uni-dimensionality.

[8] Even in the bi-dimensional choice elicitation, a participant can behave uni-dimensionally.

referred to their average as "median" offer (resp. threshold).[9] To enhance group identity and group influence, we first let all four participants state their intentions, then informed each of them about the "median" intentions of their group before finally asking them to decide about $(y, \underline{y})$, or $(y, \pi - y)$ not knowing with whom of the three others they would be paired with in playing the game. Finally, game playing proceeds as follows:

- random pair formation; followed by
- random role assignment;
- using the role specific choices of each pair members to determine the outcome, the offer y of the one in the X role, the acceptance threshold $\underline{y}$ of the one in the Y role, and the individual payoffs;
- before providing outcome and individual payoff information to both pair members.

The description above applies to the main (second) phase when playing successively first UG and then IG or vice-versa. Unlike in the second phase, participants play the game without knowing the median intentions $(\hat{y}^0, \underline{\hat{y}}^0)$, respectively $(\hat{y}^0, \pi - \hat{y}^0)$. The first phase, therefore, establishes already group embeddedness but, as information on payoffs is not revealed yet, does not allow participants to learn something about the actual choice of the randomly selected group member. From a behavioral perspective, the actual strategy vector choices in the second phase, referred to as "social play", can be affected:

(i) by one's own first phase strategy vector choice, denoted as $(\tilde{y}^0, \underline{\tilde{y}}^0)$ or $(\tilde{y}^0, \pi - \tilde{y}^0)$ and referred to as "private play";

(ii) by one's own stated second phase intentions $(y^0, \underline{y}^0)$ or $(y^0, \pi - y^0)$;

(iii) by median second phase intentions $(\hat{y}^0, \underline{\hat{y}}^0)$ or $(\hat{y}^0, \pi - \hat{y}^0)$.

The effects of (i) and (ii) could result from wanting to behave consistently, *i.e.* by not at all or only slightly adjusting one's final vector choice $(y, \underline{y})$ or $(y, \pi - y)$ in the second phase. This would capture external stability or immunity to social influence (related for example, to one of the factors when reducing the multi-dimensionality of personality questionnaires. For instance, Brandstätter et al. (2006)). Such consistency and immunity to later social influence could be due to an ego-defensive attitude, a behavioral self-image together with avoidance of cognitive dissonance (see Festinger and Hutte (1954)).

[9] For example, if the four intended offers are such that $y_1^0 \leq y_2^0 \leq y_3^0 \leq y_4^0$, we compute the median as $(y_2^0 + y_3^0)/2$.

Group influence would be indicated by an effect of (iii). However, deviations from one's own intentions only count as group influence when they tend towards the median intentions in the bi-dimensional case, at least in one dimension.

[Insert Figure 1 here]

Figure 1 visualizes the experimental protocol, which is the same for all conditions (game type, private and social play, unidimensional or bi-dimensional strategy vector elicitation). Only the dimensionality of strategy vector elicitation and the sequence of game types was varied between subjects in the 2x2 factorial way in Table 1.

[Insert Table 1 here]

3. Related Literature

Several factors are bound to influence the strength and direction of social influence on individual behavior. One first factor pertains to the type of social context and the shared (identity) values. We are interested in social influence *per se* and not in the strongest way of triggering it, for example, by group competition which enhances in-group favoring and out-discrimination or even outgroup hate (see, for instance Bornstein and Yaniv (1998), Bornstein (2003), Mummendey et al. (2001) and Waldzus and Mummendey (2004)). By not pitching our experimentally formed groups against outgroups we seemingly focus on a worst-case scenario for confirming social influence effects. Furthermore, in our design participants can only condition – if at all – on the intention of others and not how they behave,[10] like in Berg *et al.* (1995) reporting on two experiments on trusting behavior and confirming social effects of information about the choices of individual participants in the same session, even when not interacting with them. However, when informing about trusting behavior of participants in different sessions (social history) the effect was much weaker. So, it seems that individuals are more interested in the behavior of "neighbors", possibly because they are viewed as role models or perceived as part of a social context to which they feel more obliged. Thus, it is crucial to recognize and understand why the same role is not attributed to subjects from different social contexts. Falk *et al.* (2013), for instance, report the results of experiments whose subjects were randomly placed in two different groups to play a coordination game or a public good game and found that most subjects made group-specific decisions. This, however, confronts participants with two different co-

[10] One can justify this for situations where group members discuss their intentions when convening but act privately, *e.g.* at home or at their individual workplace or, between countries, in the context of political agreements.

player groups and suggests that one wants to align with co-players, even when the behavior of the two coplayer sets differs.

Several field experiments provide robust evidence that social effects are strong when social groups share common identity values, possibly triggered by similar historical or cultural background or work environment. Gneezy *et al.* (2016) study cooperation and trust in two communities of fishermen, located in two different areas of the same country.[11] The two groups organize work differently: in one case, fishermen are forced to work in groups whilst in the adjacent society (located on a lake) fishing is an inherently individual activity. Not surprisingly, individuals in the first community trust and cooperate more and have greater ability to coordinate collective actions than the lake fishermen (see, however, the extensive survey by Ostrom and Vollan (2010) of case studies which question that this is a regularity).[12]

Effects of social identity are also confirmed by laboratory experiments which induce group identity artificially. In Chen *et al.* (2012), participants are more generous if paired with individuals of their group than they are when paired with an outgroup member. Likewise, participants are more likely to reward an ingroup match for good behavior, and less likely to punish an ingroup match for misbehaving. As mentioned above, however, this confirms not social influence *per se* but more team or group competition effects.

A crucial element affecting the direction of social effects is the type and content of information, available to group members. According to Bicchieri (2005), a common norm of behavior may emerge in a social group when shared by most of its members. Thus, information on the behavior and beliefs of others is needed.[13] For a pricing duopoly, Dufwenberg and Gneezy (2000) report results of two treatments whose two duopolists decide on the price of a homogenous good. Decisions were simultaneous and the game was repeated for a known number of periods with random re-matching across rounds. Once information release was restricted to the choices of one's partners, once all periodic decisions of all randomly matched pairs (full information treatment) in the same session was reported. The difference between both treatments is striking: in the full information treatment, players coordinated their actions stating higher prices, converging to the collusive price in the long run. The former treatment yielded lower prices in the short and long run.

[11] For a similar study, see Carpenter *et al.* (2011).

[12] Voluntary cooperation often fails due to free riding and cheating which trigger conflicts and possibly failures to maintain the common pool resource.

[13] See also Bruttel (2009) for a discussion on the role played by full or partial information disclosure in shaping the effects of social influence.

Finally, an important factor possibly affecting social influence is directly related to the individual characteristics and rents. Since living in a social group and sharing identity values implies a process of mutual imitation and conditioning, recent research could confirm relevance of individual cognitive capabilities and personality traits for the emergence and strength of social influence.[14] In the real world, social groups share the same economic and historical background and external opportunities but may nevertheless experience different outcomes and results due to cognitive constraints, individual heterogeneity and idiosyncratic opportunities.

4. Descriptive data analysis and mean effects

[Insert Table 2 here]

We recruited 128 participants from a pool of undergraduate students from the faculties of Economics (39.06%), Engineering, Physics or Math (14.84%), Law or Political Science (12.5%) or other majors (33.59%) at the University of Siena (Italy) using *hroot* (Bock *et al.* (2014)). No subject participated in more than one session. Between subject treatments T1 and T3, like T2 and T4, followed the same experimental protocol, based on $\pi = 21$, but the order of UG and IG games was reversed. The software is based on z-Tree (Fischbacher, 2007). The experimenter read the instructions aloud and answered questions privately before starting the experiment.[15] Because each participant submitted a strategy vector for both games and pairs were matched only after private and social play, we obtained $2{\times}2{\times}4$ independent strategy vectors per group, each with 4 participants. Since there are 32 groups, our dataset contained $32{\times}2{\times}2{\times}4 = 512$ strategy vectors which we analyzed globally and treatment-wise.

[Insert Figure 2 here]

We begin with descriptive statistics and graphical illustrations. Table 2 reports summary statistics for intended and actual offers (y^0, y) and thresholds $(\underline{y}^0, \underline{y})$. Columns (1) and (2) (resp. (3) and (4)) report averages for uni-dimensional (resp. bi-dimensional) action sets. We compared the average effect of playing with bi-dimensional action sets with a heteroskedasticity robust t-test, reporting strongly significant effects in column (6). Individuals tended to significantly adjust their offer and acceptance threshold downwards in the

[14] See Carpenter *et al.*(2005, 2006); Delfino *et al.* (2016).

[15] A translated version of the instructions is available in the Appendix.

bi-dimensional treatments.[16] Differences between private and social play, on the other hand, were not statistically significant at the aggregate level. This is also visually obvious in Figure 2, illustrating the average actual proposals y and thresholds $\underline{y}$ by uni- or bi- dimensionality and by private versus social plays.

Result 1: *For all game and group interaction types, participants significantly adjusted offers and acceptance thresholds downwards when playing in the bi-dimensional treatment.*

Whereas a lower offer (acceptance threshold) questions (enhances) the chances of reaching an agreement it is ambiguous whether the frequency of acceptance, $\delta(y) = 1$, is higher or lower in the bi-dimensional choice elicitation. As all individual strategy vectors are independent, one can simulate all possible matches for the same game and interaction type to assess which effect dominates acceptance frequency, the lower offer or the lower acceptance threshold.

The insignificance of group influence and the apparently limited behavioral alignment may be surprising. This partly results from inducing group identity only by the minimal group paradigm. In our view, the main reason is that groups did not confront an outgroup, *i.e.* that we did not trigger group competition. Social influence in the form of group members trying to behave similarly is likely to be stronger when facing an outgroup. What we wanted to avoid due to our interest in social influence as such and not in team or group competition (see Bornstein (2003) and Mummendey et al. (2001, 2004)).

[Insert Table 3 here]

Table 3 reports summary statistics for individual differences between: (i) actual and intended offer ($y - y^0$) and acceptance threshold ($\underline{y} - \underline{y}^0$); (ii) actual and intended median offer ($y - \hat{y}^0$) and acceptance threshold ($\underline{y} - \hat{\underline{y}}^0$); and (iii) actual and median offer ($y - \hat{y}$) and acceptance threshold ($\underline{y} - \hat{\underline{y}}$). Statistics are presented by private (resp. social) plays in columns (1)-(2) (resp. (3)-(4)) and by game type, with the UG (resp. IG) plays in the top (resp. bottom) row. Column (6) reports p-values of the heteroskedasticity robust t-test between private and social play. Both in UG and IG, participants significantly modified their intended offers: in UG they tended to *increase* their actual offers when playing in the social game phase, whereas in IG they tended to *decrease* actual offers. Other differences did not show statistically significant changes

[16]For brevity, we do not report distinct summary statistics for UG and IG. All differences between bi-dimensional and unidimensional elicitation, however, are also robust with respect to the game type.

when moving from private to social play. p-values of the heteroskedasticity robust t-test between private and social plays are reported in Figure 2, on top of the dark gray bars.

Result 2: *Actual offers differed significantly from own intentions with the average difference changing from negative to positive in UG when comparing private and social play. For IG, the already negative difference was increased. Beyond this, social play had no significant effect.*

The game-dependency of average offer adjustment, $y - y^0$, illustrates an interesting interaction between "second thoughts" and "sanctioning power". Here "second thoughts" means that when switching from more emotion-triggered intentions to more deliberated actual choices, individuals become more opportunistic or self-serving.[17] This directly explains the IG effects. In UG, however, proposer opportunism runs the risk of losing everything meaning that often "second thoughts" trigger more generous offers when anticipating altruistic sanctioning.

[Insert Figure 3 here]

Figure 3 compares differences between intended and actual offers (top panel) and thresholds (bottom panel), in private and social plays, for each game type (UG and IG) and each dimensionality (bi- and uni-dimensional). Again p-values of the heteroskedasticity robust t-test between private and social plays are reported on top of the dark gray bars.

Individuals significantly adjusted their intended UG (resp. IG) offer upwards (resp. downwards) whereas in both, UG and IG, they adjusted their actual acceptance thresholds downwards, but with lower statistical significance. The altruistic sanctioning aspect of UG is most clearly obvious in social play when played bi-dimensionally: compared to intentions, offers were enhanced and acceptance thresholds were reduced (*i.e.* in both roles subjects tried to avoid conflict) aiming at a "fair(er)" split of pie π. The opposite effect for IG suggests strategic thinking rather than fairness concerns. All statistically significant differences apply only to bi-dimensional choice elicitation.

[Insert Figure 4 and Figure 5 here]

This result is visually confirmed by Figure 4 (resp. Figure 5) presenting scatterplots between (on the vertical axis) actual and (on the horizontal axis) intended offers (resp. thresholds) with UG (resp. IG) plays on

[17] For the more general distinction of fast emotional reactions (system 1) and later more deliberated ones (system 2), see Engel and Singer (2008).

the top (resp. bottom) panel and the bi-dimensional (resp. uni-dimensional) treatment on the left (resp. right) panel. As when comparing average treatment effect, most of the upwards (resp. downwards) adjustments are observed when individuals observe the group median in UG (resp. IG) phase.

Result 3: *Social interaction induces individuals to adjust actual offers as well as intended offers upwards (resp. downwards) in UG (resp. IG) only in case of bi-dimensional strategy vector elicitation.*

5. Regression Analysis

To confirm these results econometrically we use linear regression analyses, controlling for the various conditions of the experiment.[18] We first analyzed the average effects of social interaction, uni-dimensional elicitation and game type before assessing the effect of these conditions on individual offers and thresholds.

[Insert Table 4 here]

Social Interactions

Table 4 reports multivariate OLS regressions with offer (models (1)-(2)) and acceptance thresholds (models (3)-(4)) as dependent variables. All models control for sequence of game types, play phase and sociodemographic characteristics of individual participants.

When considering the full dataset (models (1) and (3)), there is no significant effect of social interaction *per se* – captured by the dummy variable *Social*. But a strong and significantly positive effect on individual offers, y, is detected when individuals observe their group median and played UG, *i.e.* when *Social* interacts with *UG*. This result is also reinforced by the positive – and statistically strongly significant – *UG* coefficient of model (2), which considers social plays only.

For acceptance thresholds, there is a strong and statistically significant negative effect of social interaction, measured by the *Social* coefficient in model (3). Moreover, with social interaction, individuals tend to significantly increase their acceptance threshold in the uni-dimensional case, as confirmed by the *Uni-dimensional* coefficient in model (4). Individual acceptance thresholds are also positively correlated with median intended offers: subjects tend to adjust acceptance thresholds upwards when observing higher median offers. The significant effects of own intention for y and $\underline{y}$, *i.e.* of y^0 and $\underline{y}^0$, respectively, are obvious and suggest using $y - y^0$ and $\underline{y} - \underline{y}^0$ as dependent variables.

[18] All results are also robust to right-censored Tobit regressions, which we do not report here for brevity. Regression tables are available upon request.

[Insert Table 5 here]

Individual deviations

Table 5 reports multivariate OLS regressions with differences between actual and intended offers (resp. thresholds), columns (1)-(3) (resp. (4)-(6)), as dependent variables. Models (1) and (3) report regression results using the full dataset. Models (2) and (5) (resp. (3) and (6)) report regression results using only the bi-dimensional (resp. uni-dimensional) treatment.

While the *Social* coefficient is not statistically significant when considering the full dataset, the *Social*UG* coefficient of model (1) is again positive and statistically strongly significant for individual offers. This finding confirms the average treatment effect that in UG individuals only adjust their offers upwards when they observe their group median. While the positive effect of social interaction combined with UG is confirmed and reinforced in the bi-dimensional condition, individuals do not react in the same way in the uni-dimensional treatment: the coefficient on *Social*UG* of model (3) is not statistically significant. Whereas, in the bi-dimensional treatment individuals, afraid of disagreeing and, therefore, adjusting their offers upwards, they understood the ambiguity of an offer increase in the uni-dimensional case, where higher offers automatically trigger acceptance of lower acceptance thresholds.

When considering the difference between actual and intended acceptance thresholds, individuals overall reacted negatively to social influence, as confirmed by the negative *Social* coefficient – although statistically less significant – in models (4) and (5). We refer to this phenomenon the "second thought effect": it occurs when a subject opportunistically switches from a more emotional to a more deliberative decision, after re-considering a previously established intention.

6. Conclusions

The great achievements of mankind are due to labor division and cooperation: partly by exchange, e.g. trading on markets, partly by coordinated production in large industrial enterprises (see Coase (1937) for a discussion of when which form of labor division applies). But we do not only interact socially at the workplace but also in our private life, in clubs, political parties, by engaging in social movements etc. As illustrated by our experimental setup, this does not necessarily require an outgroup. Workers of one firm do not necessarily consider another firm's workers in the same or a different market like an outgroup with which they compete. Our interest was in social influence *per* se, *i.e.* without such intergroup competition. Although

several groups were formed in each session, there were no informational or behavioral spillovers between them.

This seems a kind of worst-case scenario to confirm social effects between group members. This is further enhanced since our setup only allows conditioning on intentions but not on actual behavior of others, and by also using games like the ultimatum game, for which strategic sanctioning is crucial, and possibly crowding out individual attempts to align own behavior with that of the other group members. Finally, group identity was only minimally induced (Tajfel, 1970) to avoid confounding social influence with structural interdependencies.

Nevertheless, we confirm significant social influence, depending on the experimental conditions implemented partly within (all groups play both game types) and partly between subjects (the order of both games which both games and the dimensionality of strategy vector elicitation (see Table 1)). The strategy vector method has been employed in the tradition of single-population models in evolutionary biology, *i.e.* by assuming that each participant can end up as proposer as well as responder. Assigning constant roles would have split up each group in two heterogeneous subgroups, the X- and the Y-group, and has therefore been avoided.

Our results justify our treatment design: except for sequence of the two games which we did not expect to exert any significant effect (see the regressions in Table 4 and Table 5). There is a clear effect of bi-dimensional strategy vector elicitation: it encourages more opportunistic behavior compared to the uni-dimension elicitation which requires consistency of offering and responding. Furthermore, social influence depends on the game type. In UG subjects behaved more strategically to avoid conflict[19] whereas in IG opportunism is enhanced by social influence. In addition, across the board own intentions were often re-considered and had to pass the cognitive reflection filter of "second thoughts".

Social influence, as captured by one admittedly stylized setup, is less special than it may seem at first sight. Intentional agreements, for example to limit global warming specify what its member countries should do although compliance is often questionable not verifiable. So, one learns about intentions of other countries and reacts to them and not to partly contradicting reports about their actual performance. Another example, in politics, could be party programs before an election, e.g. when one party promises a tax cut which causes other parties to do the same, even though rational expectations render it doubtful that, once elected, tax cuts will be implemented.

[19] When observing the median intention of the group one receives information which may help to render conflict less likely.

In the corporate world intentions can be observed in takeover bidding with the potentially acquiring companies stating how many employees of the target company they will maintain. Here, one firm promising very little downsizing often triggers reduced downsizing offers by its competitors and only for the acquiring firm one can compare its intention with actual downsizing. In the private sphere, our interaction setup resembles the behavior of men trying to win the attention of a woman. They often behave in ways that they would not contemplate normally, often by competing with one another and adapting their courting strategy (offer) to those of their rival suitors. This presupposes that they are, or at least feel, committed to their proposals (offers) and that women believe them to be reliable. Altogether this demonstrates that often we are not affected by what others choose, but by what they intend to do, as captured and analyzed by our experimental design.

7. References

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8. Appendix 1

Tables

Table 1. 2x2-factorial between subject treatments.

	Sequence of game types	
Strategy Vector Elicitation	UG → IG	IG → UG
Uni-dimensional	T1	T3
Bi-dimensional	T2	T4

Table 2. Summary statistics for intended (resp. actual) offer and acceptance threshold ($y^0, \underline{y}^0$) (resp. $y, \underline{y}$). The top panel reports statistics across all treatments, while the middle (resp. bottom) panel reports statistics for private (resp. social) plays. We report the number of observations in parentheses. Columns (1)-(2) (resp. (3)-(4)) report statistics for unidimensional (resp. bi-dimensional) strategy elicitation. P-values for the heteroskedasticity robust t-test between unidimensional and bi-dimensional plays are reported in column (5).

	Uni-dimensional		Bi-dimensional		
	(1)	(2)	(3)	(4)	(5)
All ($N = 256$)	Mean	SD	Mean	SD	t-test
y^0	11.98	3.319	10.50	3.530	0.0000
$\underline{y}^0$	9.023	3.319	7.395	3.880	0.0000
y	11.83	3.097	10.48	3.645	0.0000
$\underline{y}$	9.168	3.097	7.270	3.642	0.0000
Private ($N = 128$)	Mean	SD	Mean	SD	t-test
y^0	12.17	3.210	10.27	3.399	0.0000
$\underline{y}^0$	8.828	3.210	7.344	3.711	0.0004
y	12.05	3.095	10.30	3.454	0.0000
$\underline{y}$	8.945	3.095	7.383	3.693	0.0001
Social ($N = 128$)	Mean	SD	Mean	SD	t-test
y^0	11.78	3.427	10.73	3.656	0.0090
$\underline{y}^0$	9.219	3.427	7.445	4.056	0.0001
y	11.61	3.095	10.66	3.832	0.0154
$\underline{y}$	9.391	3.095	7.156	3.601	0.0000

Table 3. Summary statistics for individual differences between: i) actual and intended offer ($y - y^0$) and acceptance threshold ($\underline{y} - \underline{y}^0$); ii) actual and intended median offer ($y - \hat{y}^0$) and acceptance threshold ($\underline{y} - \underline{\hat{y}}^0$); and iii) actual and median offer ($y - \hat{y}$) and acceptance threshold ($\underline{y} - \underline{\hat{y}}$). Columns (1)-(2) (resp. (3)-(4)) report statistics by private (resp. social) plays. The top (resp. bottom) panel reports statistics of the UG (resp. IG) game phase. We report the number of observations in parentheses. Column (6) reports p-values of the heteroskedasticity robust t-test between private and social plays.

	Private		Social		
	(1)	(2)	(3)	(4)	(5)
UG ($N = 128$)	Mean	SD	Mean	SD	t-test
$y - y^0$	-0.0781	0.728	0.172	1.459	**0.0422**
$y - \hat{y}^0$	0.117	2.881	0.117	2.891	0.5000
$y - \hat{y}$	0.445	2.994	0.461	2.845	0.4829
$\underline{y} - \underline{y}^0$	0.102	0.751	-0.0703	1.533	0.1280
$\underline{y} - \underline{\hat{y}}^0$	-0.141	3.198	0.0625	3.129	0.3040
$\underline{y} - \underline{\hat{y}}$	-0.125	3.398	-0.0156	3.126	0.3944
IG ($N = 128$)	Mean	SD	Mean	SD	t-test
$y - y^0$	-0.00781	0.943	-0.406	2.161	**0.0288**
$y - \hat{y}^0$	-0.0781	2.947	-0.422	3.366	0.1928
$y - \hat{y}$	-0.594	3.026	-0.688	3.388	0.4078
$\underline{y} - \underline{\hat{y}}^0$	0.0547	0.983	-0.0469	2.300	0.3232
$\underline{y} - \underline{\hat{y}}$	-0.0625	3.140	0.156	3.340	0.2949
$\underline{y} - \underline{\hat{y}}$	0.266	3.293	0.375	3.396	0.3969

Table 4. This table report results from multivariate OLS regressions with offer (models (1)-(2)) and acceptance thresholds (models (3)-(4)) as dependent variables. All models control for the sequence of game types, play phase and sociodemographic characteristics of the participants. Error terms are clustered at the group-session level. ***, ** and * represent 1%, 5% and 10% significance levels, respectively.

Dep. Variable	y		$\underline{y}$	
Model	(1)	(2)	(3)	(4)
	All	Social	All	Social
Social	-0.341		-0.672**	
	(0.255)		(0.283)	
Uni-dimensional	-0.0637	-0.0865	0.181	0.716***
	(0.218)	(0.305)	(0.144)	(0.257)
Social*Uni-dimensional	0.256		0.695	
	(0.419)		(0.456)	
UG	0.0159	0.624**	-0.0439	-0.141
	(0.0932)	(0.250)	(0.114)	(0.253)
Social*UG	0.909***		0.214	
	(0.273)		(0.350)	
Uni-dimensional*UG	-0.0267		-0.0414	
	(0.192)		(0.213)	
Social*Uni-dimensional*UG	-0.614		-0.520	
	(0.501)		(0.533)	
y^0	0.881***	0.818***		
	(0.0321)	(0.0571)		
$\hat{y}^0$	0.0767	0.0998	0.0627**	0.0683
	(0.0582)	(0.0896)	(0.0290)	(0.0524)
$\underline{\hat{y}}^0$	0.0177	0.0111	0.0267	0.0401
	(0.0541)	(0.0763)	(0.0435)	(0.0643)
$\underline{y}^0$			0.847***	0.762***
			(0.0249)	(0.0445)
Constant	0.483	0.897	0.0840	-0.453
	(0.561)	(0.993)	(0.282)	(0.797)
Observations	512	256	512	256
R-squared	0.841	0.754	0.843	0.766

Table 5. This table shows multivariate OLS regressions with differences between actual and intended offers (resp. thresholds) on columns (1)-(3) (resp. (4)-(6)) as dependent variables. Models (1) and (3) report regression results using the whole dataset. Models (2) and (5) (resp. (3) and (6)) report regression results using only the bi-dimensional (resp. unidimensional) treatment. All models control for the sequence of games types, play phase and sociodemographic characteristics of the participants. Error terms are clustered at the group-session level. ***, ** and * represent 1%, 5% and 10% significance levels, respectively.

Dep. Variable	$y - y^0$			$\underline{y} - \underline{y}^0$		
Model	(1)	(2)	(3)	(4)	(5)	(6)
	All	Bi-dimensional	Uni-dimensional	All	Bi-dimensional	Uni-dimensional
Social	-0.405	-0.661**	0.117	-0.679**	-0.573*	-0.117
	(0.273)	(0.247)	(0.331)	(0.301)	(0.273)	(0.331)
Uni-dimensional	-0.0873			0.133		
	(0.214)			(0.162)		
Social*Uni-dimensional	0.369			0.663		
	(0.421)			(0.463)		
UG	-0.0240	-0.104	0.0542	-0.0379	-0.0366	-0.0542
	(0.0858)	(0.0893)	(0.195)	(0.112)	(0.117)	(0.195)
Social*UG	0.977***	1.040***	0.315	0.203	0.205	-0.315
	(0.284)	(0.293)	(0.404)	(0.341)	(0.351)	(0.404)
Uni-dimensional*UG	-0.0202			0.00128		
	(0.197)			(0.219)		
Social*Uni-dimensional*UG	-0.675			-0.516		
	(0.512)			(0.534)		
$\hat{y}^0$	-0.0392	0.0482	-0.192*	0.0602*	0.0598**	0.192*
	(0.0487)	(0.0326)	(0.107)	(0.0301)	(0.0257)	(0.107)
$\underline{\hat{y}}^0$	0.0102	-0.102**		-0.107**	-0.120**	
	(0.0541)	(0.0382)		(0.0463)	(0.0417)	
Constant	-2.029**	-3.785***	0.518	-2.013**	-3.826***	-0.802
	(0.941)	(1.143)	(2.389)	(0.894)	(0.947)	(1.570)
Observations	512	256	256	512	256	256
R-squared	0.100	0.141	0.161	0.098	0.161	0.161

Figures

Figure 1. Timeline of the experiments for each game, UG and IG and uni- or bi-dimensional strategy vector elicitation.

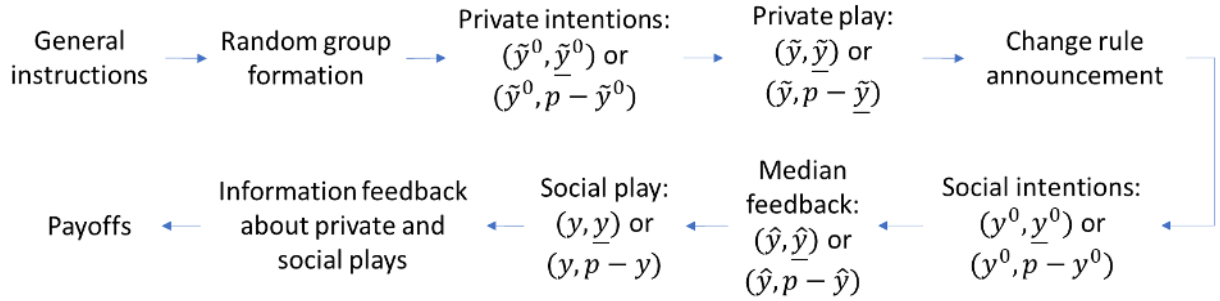


Figure 2. Average actual proposals y (top row) and acceptance thresholds $\underline{y}$ (bottom row) by strategy vector elicitation dimensionality, and private vs. social plays. P-values of the heteroskedasticity robust t-test between private and social plays are reported on top of the dark gray bars.

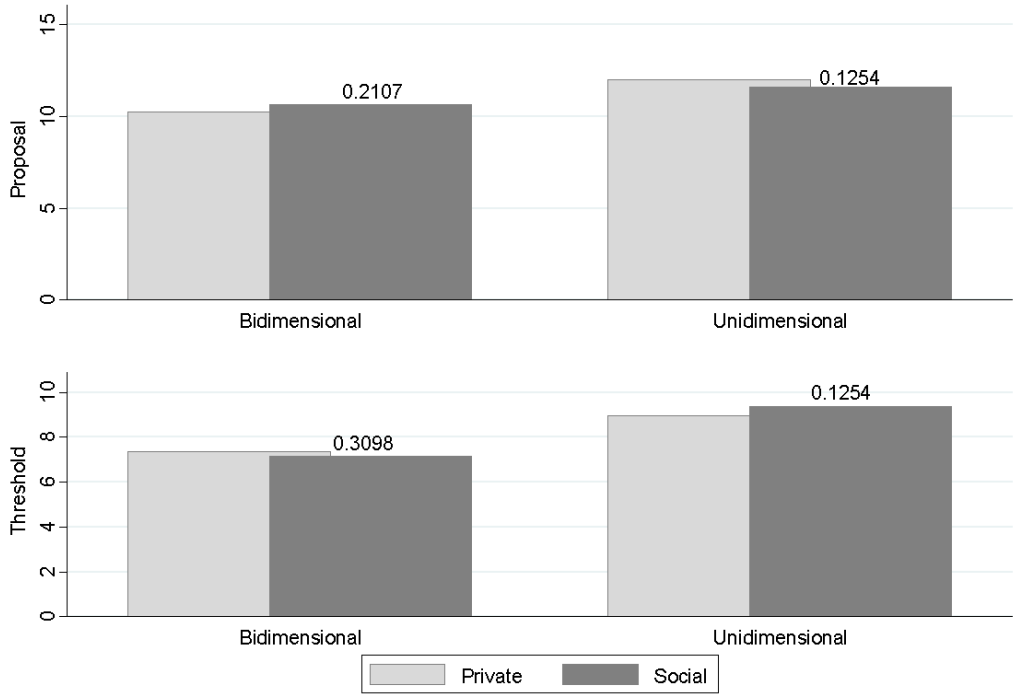


Figure 3. Average differences between actual and intended offers ($y - y^0$) (resp. threshold ($\underline{y} - \underline{y}^0$)) in private and social plays. The left (resp. right) panel presents averages from the UG (resp. IG) phase. P-values of the heteroskedasticity robust t-test between private and social plays are reported on top of the dark gray bars.

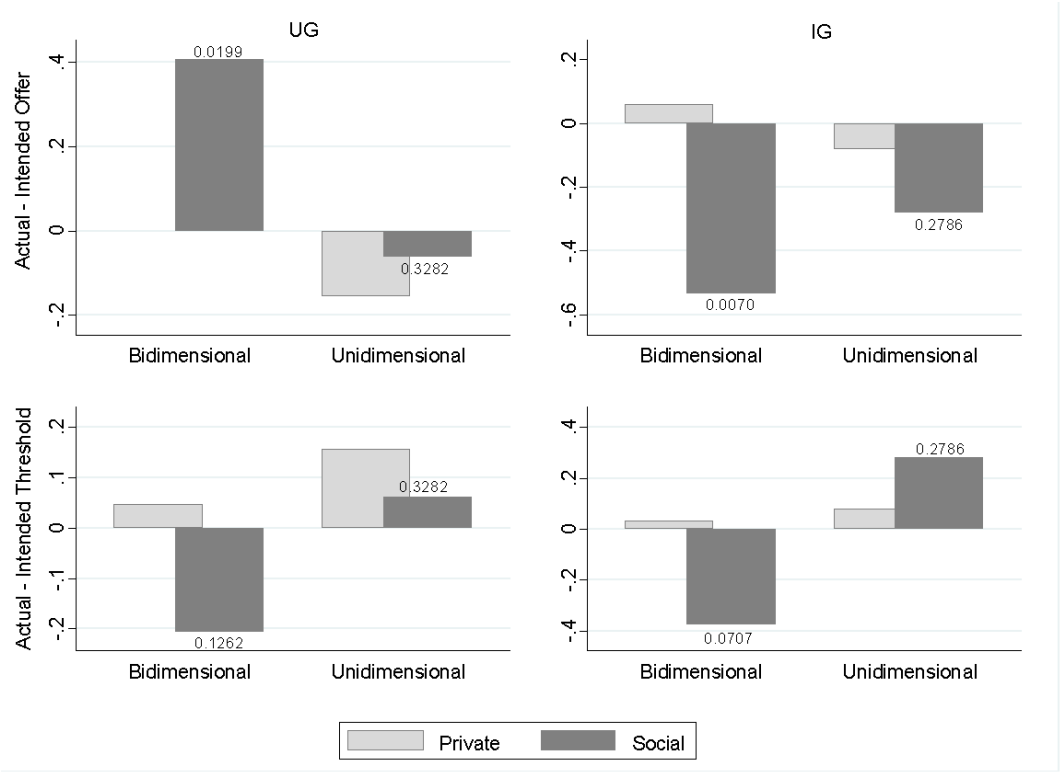


Figure 4. Scatterplots between actual (y) and intended offer (y^0), with the private (resp. social) phase on the left (resp. right) panels. Top (resp. bottom) panels are for the UG (resp. IG). Left (resp. right) columns are for the bi-dimensional (resp. unidimensional) vector elicitation treatments

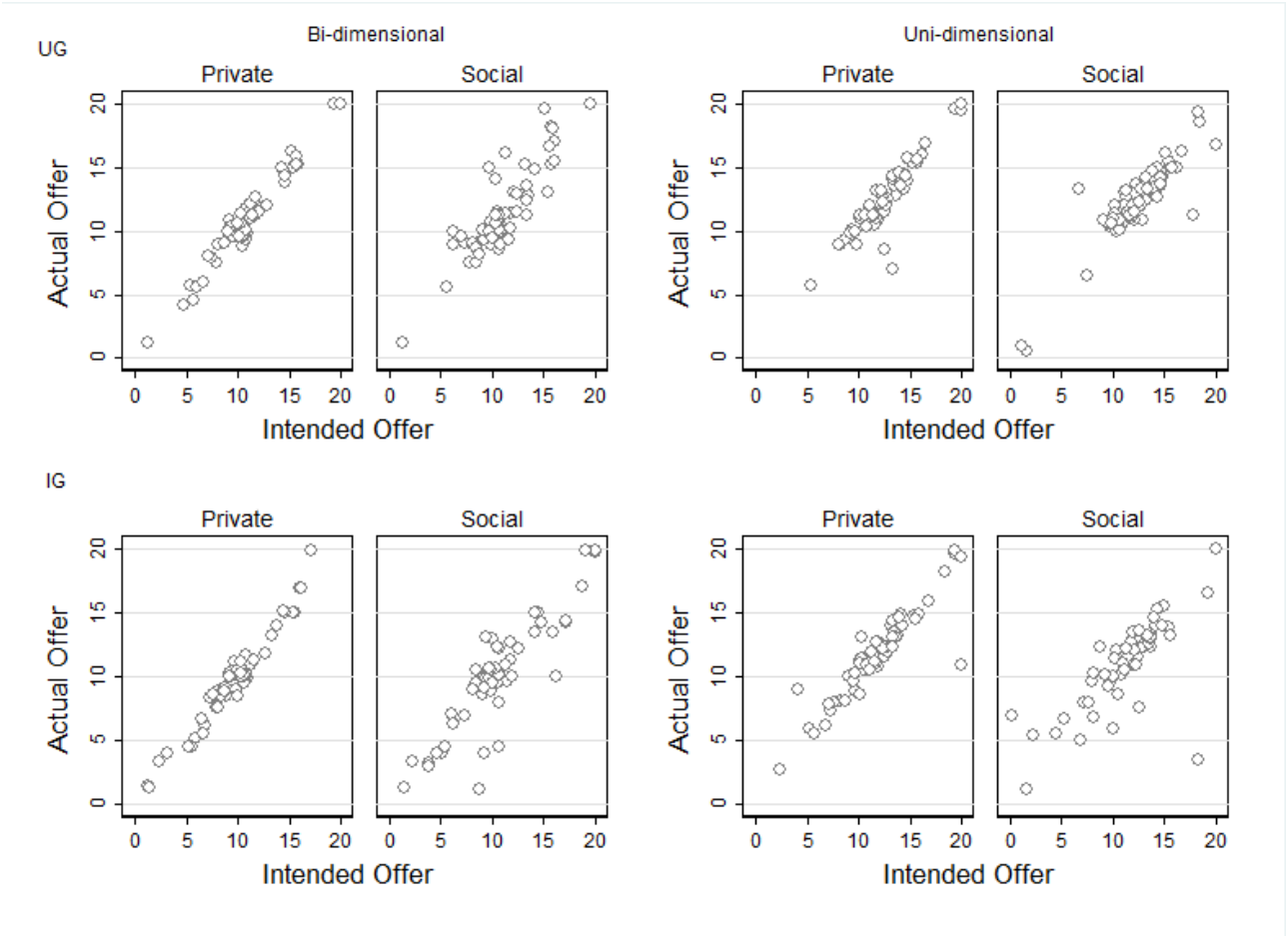
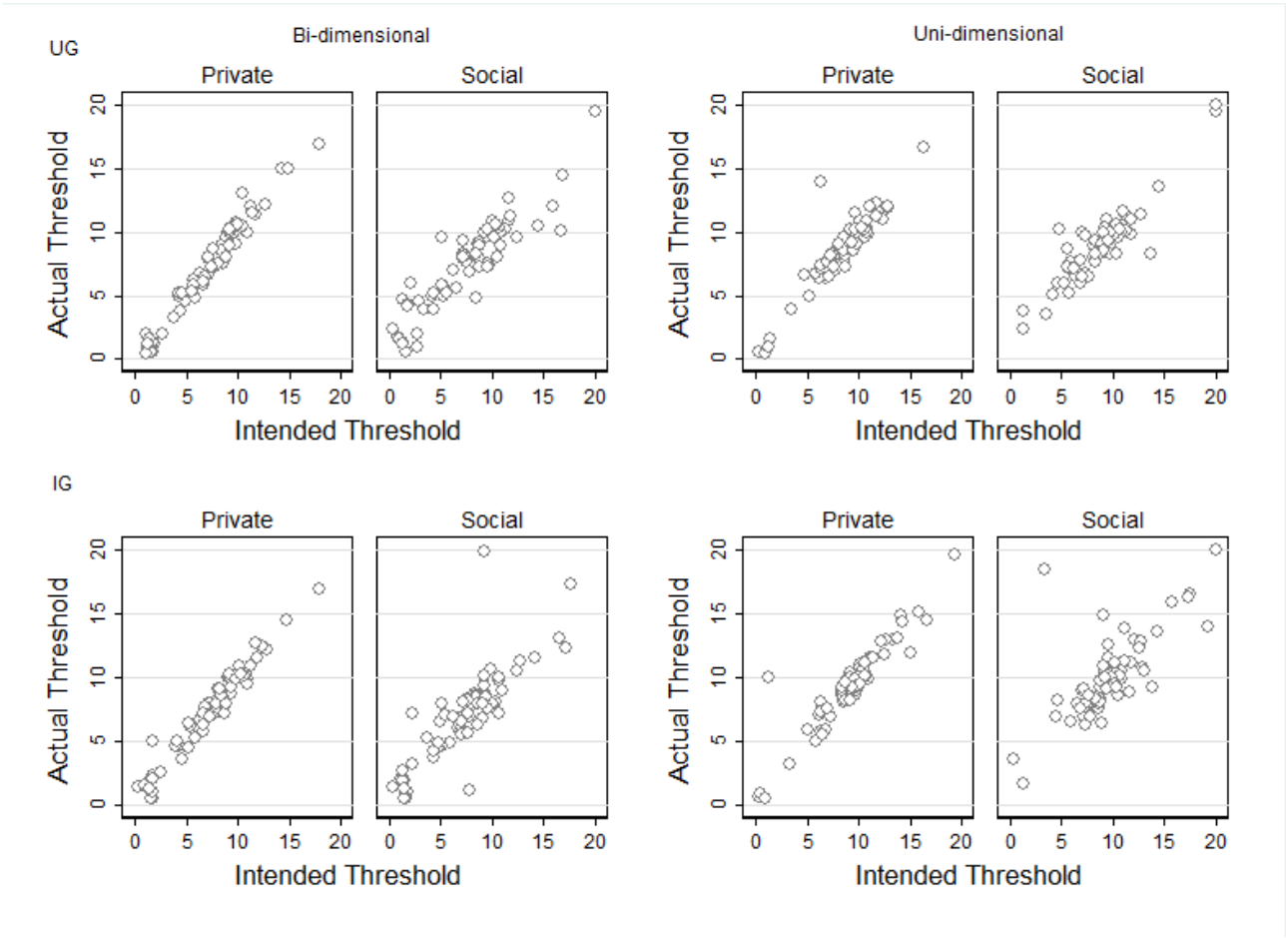


Figure 5. Scatterplots between actual ($\underline{y}$) and intended threshold ($\underline{y}^0$), with the private (resp. social) phase on the left (resp. right) panels. Top (resp. bottom) panels are for the UG (resp. IG). Left (resp. right) columns are for the bi-dimensional (resp. unidimensional) vector elicitation treatments.



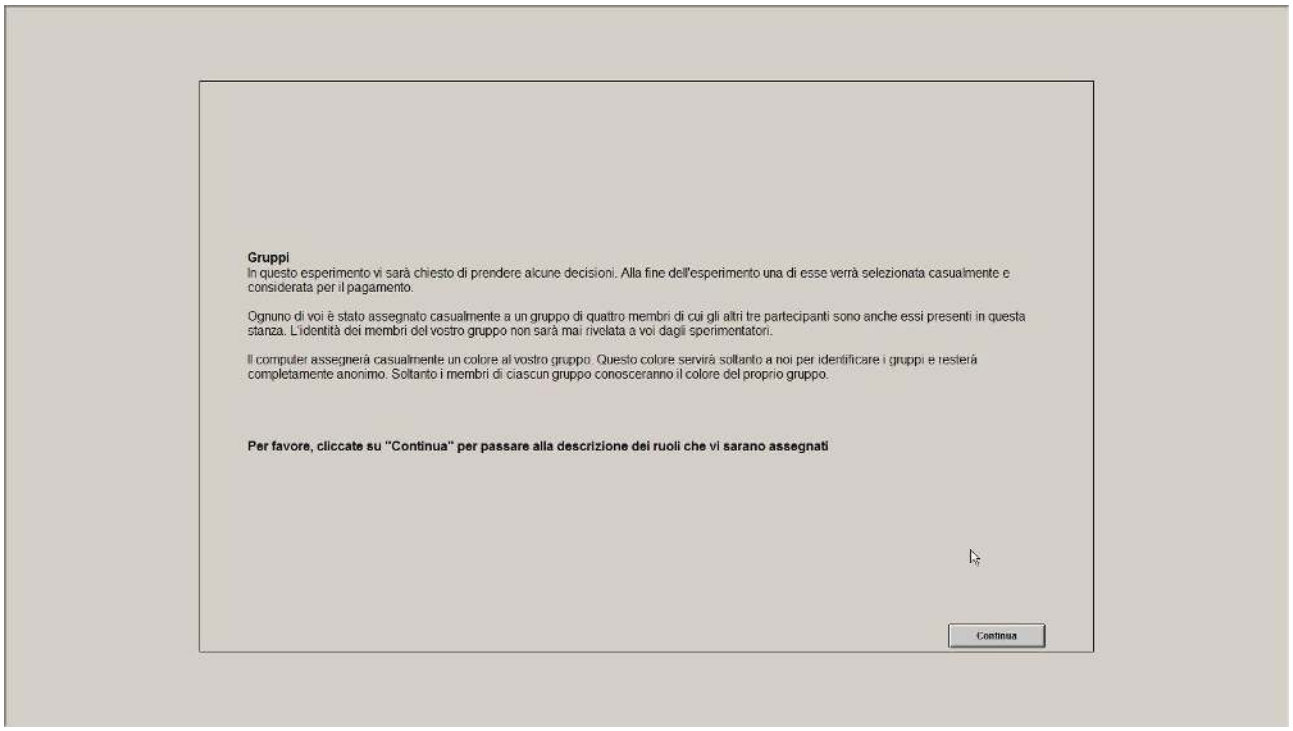
APPENDIX 2

Experiment Instructions (Uni-dimensional treatment)

Welcome to today's experiment! Please follow the instructions as we guide you through the experiment you will be taking part in. Please do not touch the mouse or the keyboard unless you are instructed to do so. I will read through this script to explain the nature of today's experiment and how to work with the software you will be using. I will be reading this script to ensure that all sessions of this experiment receive the same information, should you have any questions please raise your hand and an experimenter will come to you and answer your question privately. We ask that everyone please refrain from talking or looking at the monitors of the other participants during the experiment.

The purpose of this experiment is to study how individuals take decision in specific situations. You will receive 5 euros as a show up fee and you may earn more during the experiment. All payments will be anonymous and you will be paid in cash at the end of the experiment.

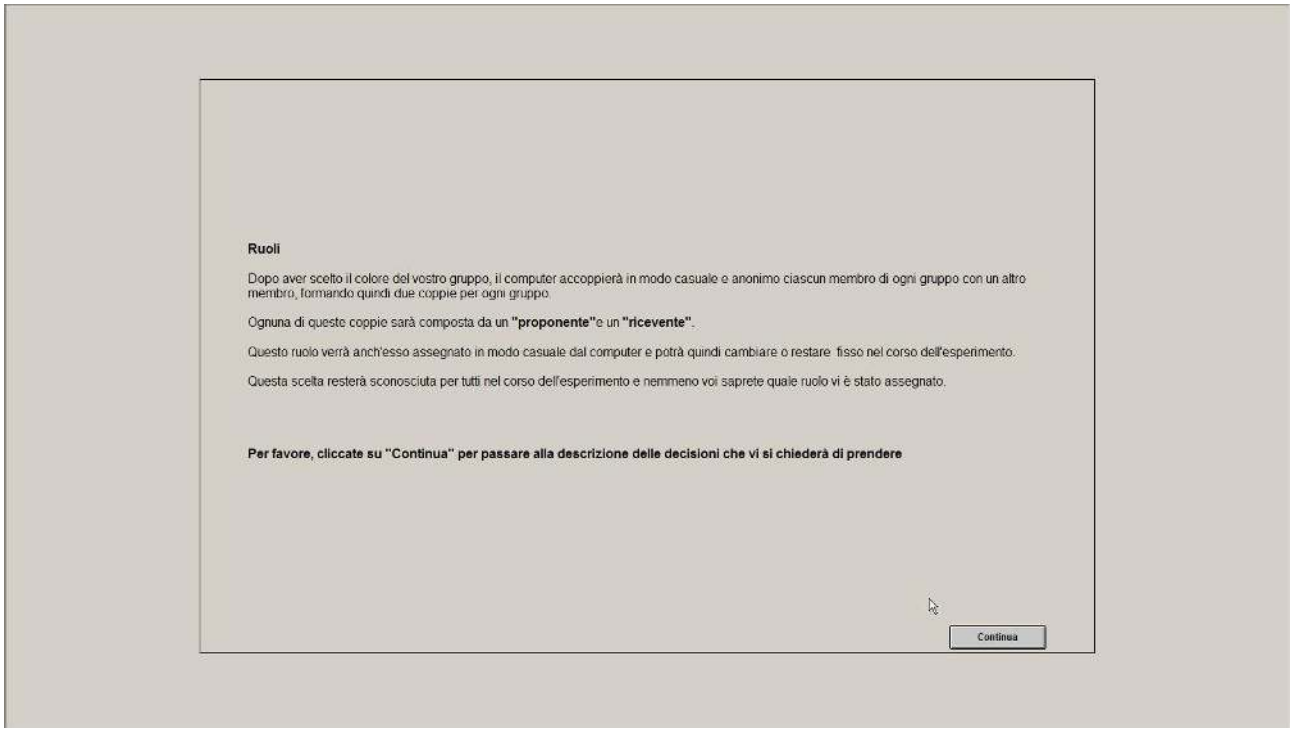
Please click "Continue" now to view the instructions of the experiment.



Groups. In this experiment, you will be asked to take some decisions. At the end of the experiment one of these decisions will be selected at random and considered for your final payment.

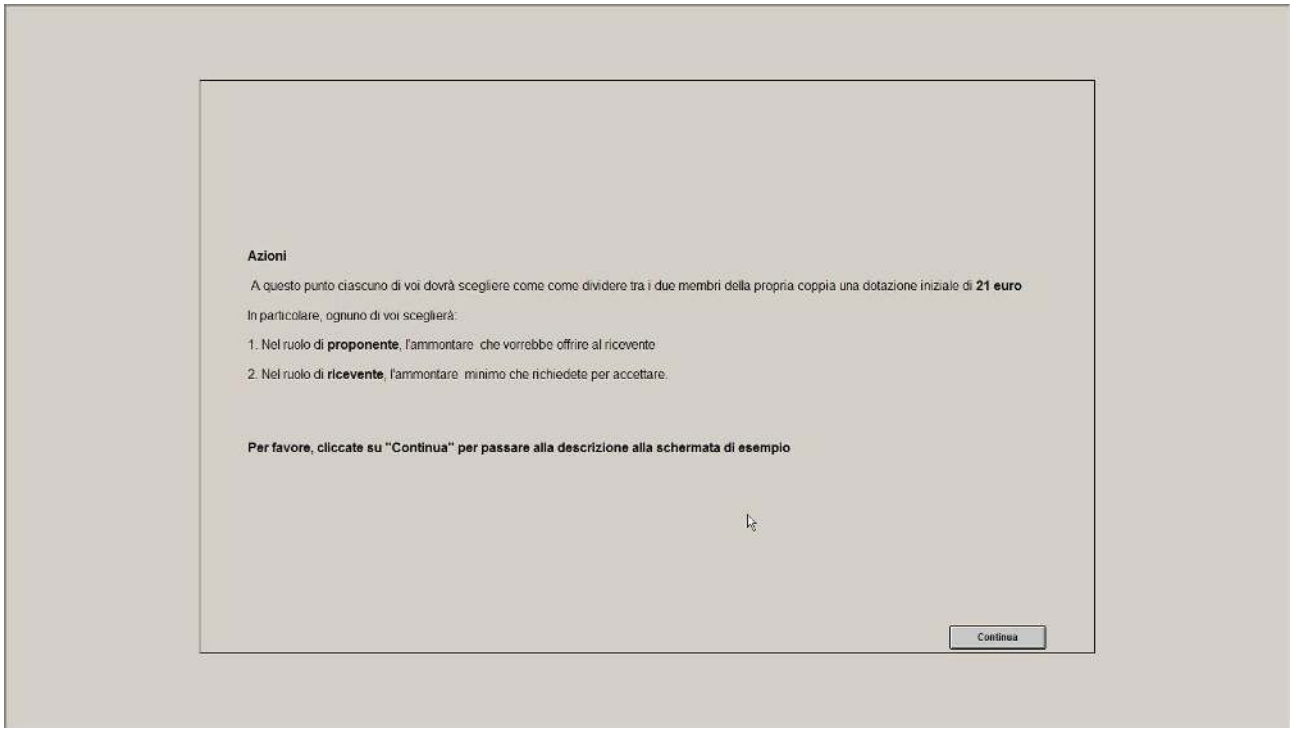
Each of you has been randomly assigned to a group of four members with other participants in this room. The identity of the other members of your group will never be revealed by the experimenters. The software will randomly assign a color to your group. We will use this color only to identify your group and will also be kept secret. Only the members of each group will know the color of their own group.

Please click “Continue” to view the role descriptions you will be assigned to.



Roles. Having formed the groups, the software will randomly and anonymously pair each of you with another member of your group, thus forming two couples in each group. Each of these couples will have a “proposer” and a “recipient”. This role will be randomly assigned by the software and may, or may not, change during the experiment. This choice, however, will be hidden during the experiment, so you will not know in which role you will be playing.

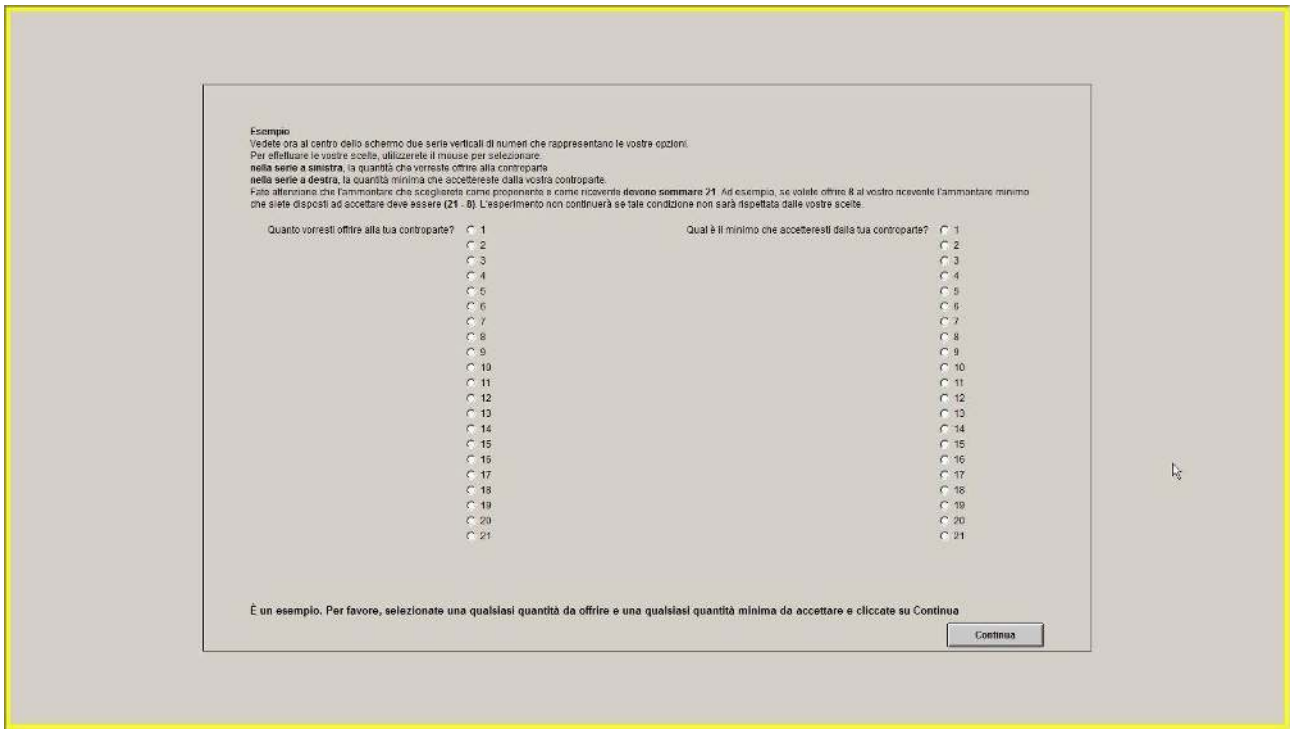
Please now click “Continue” to move to the description of the actions you will be taking.



Actions. Now each of you must choose how to split a pot of 21 euros between you and your partner. Specifically, you will be required to:

1. in the proposer role, choose the amount you are willing to offer the recipient
2. in the recipient role, the minimum amount you are willing to ask the proposer for

Please click “Continue” to move to the description of the example choice.

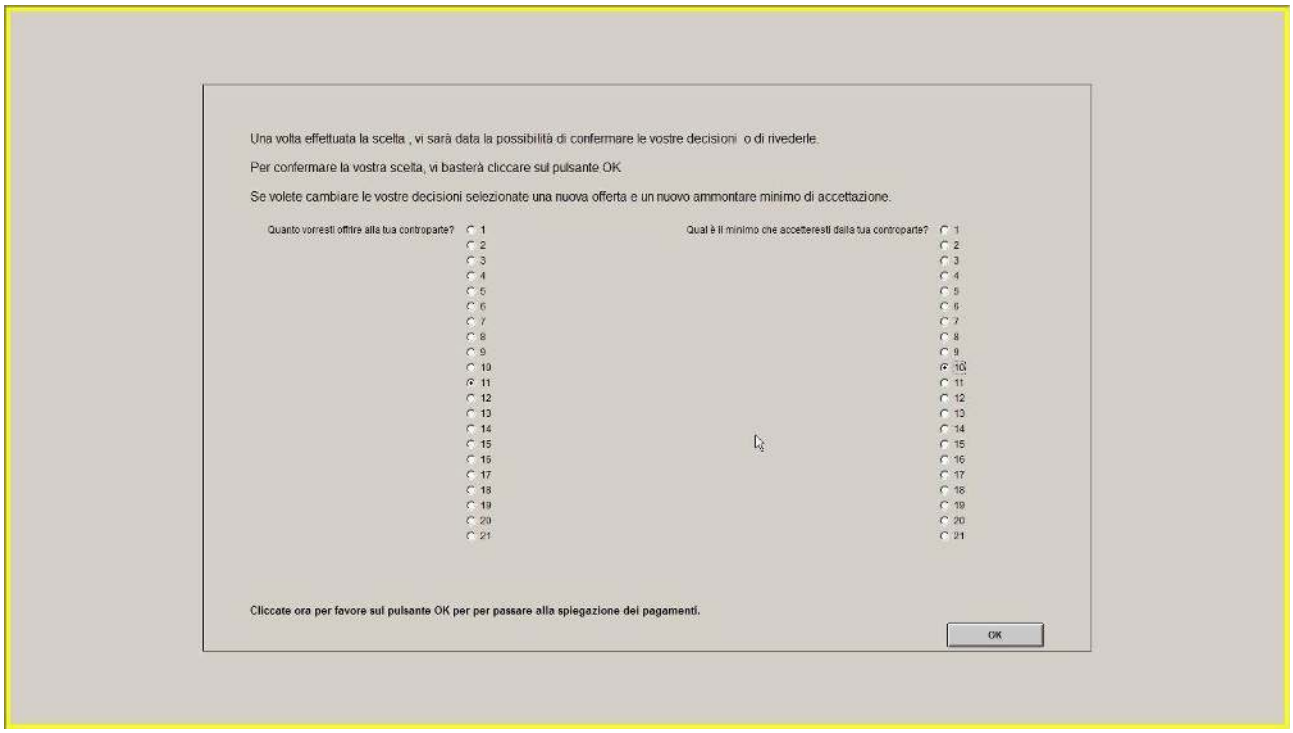


Input. In the middle of the screen, two vertical series of numbers represent the possible choices you can take. To make your choice, use the mouse to select:

1. on the left column, the amount you are willing to give to your partner,
2. on the right column, the amount you are willing to accept from your partner.

Be careful: the amount you will be choosing as a proposer and recipient must add up to 21. For example, if you wish to offer your opponent 8, the minimum amount you can accept must be 21-8=13. The experiment will not continue until this condition will be met.

Please now select an amount you are willing to offer and the minimum you are willing to accept. Please note that this is an example. Please choose any quantity you like, as this choice will not affect your final and actual payoff, and then click “Continue”.



After you make your choice, we will give you the opportunity to confirm or change your decision. To confirm a decision, you will just need to click on the "OK" button. If, however, you decide to change your offer or minimum acceptance threshold, click on another number and then confirm it by clicking "OK".

Please click on "OK" now for an explanation of payments.

Payoffs. Your final payoff will depend

1. On the role assigned by the software;

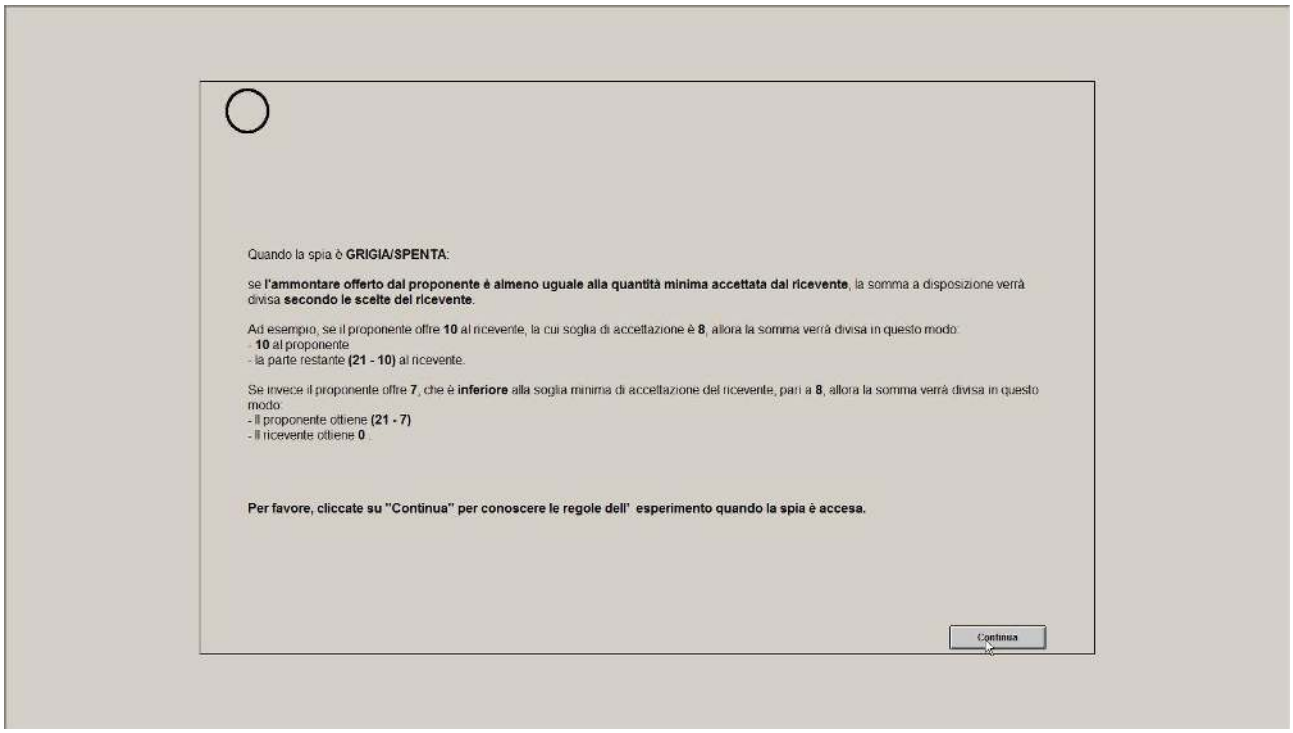
2. On the decisions made by your partner;
3. On the color of a button you will see at the top left of your screen

This button will tell you in which phase of the experiment you are playing. The button can be

a. Turned off (gray)
b. Turned on (red)

Remember: you will be assigned to a group of four participants and you will be paired with another member whose identity will never be revealed. In each phase of the experiment new pairs will be formed. This means that you may be paired to another member of your group or with the same member.

Please click “Continue” to move to the explanation of the rules when the button is turned off.



When the button is turned off/gray, if the quantity offered by the proposer is greater or equal to the minimum quantity accepted by the recipient, the amount will be split according to the recipient’s decisions.

For example, if the proposer is willing to offer the recipient 10, whose acceptance threshold is 8, the pie will be split as follows:

- 10 will go to the recipient
- 21 – 10 will go to the proposer

If however the proposer offers 7, which is lower than the minimum acceptance threshold of the recipient, the pie will be split as follows:

- the proposer gets 21 – 7
- the recipient gets 0

Please, click “Continue” so we can explain you the rules of the experiment with the button turned on/red.

When the button is turned on/red, if the quantity offered by the proposer is greater or equal than the minimum quantity accepted by the recipient, the amount will be split according to the proposer's offer, as in the previous case.

If however he proposer's offer is lower than the minimum acceptance threshold of the recipient, both members of the couple earn zero.

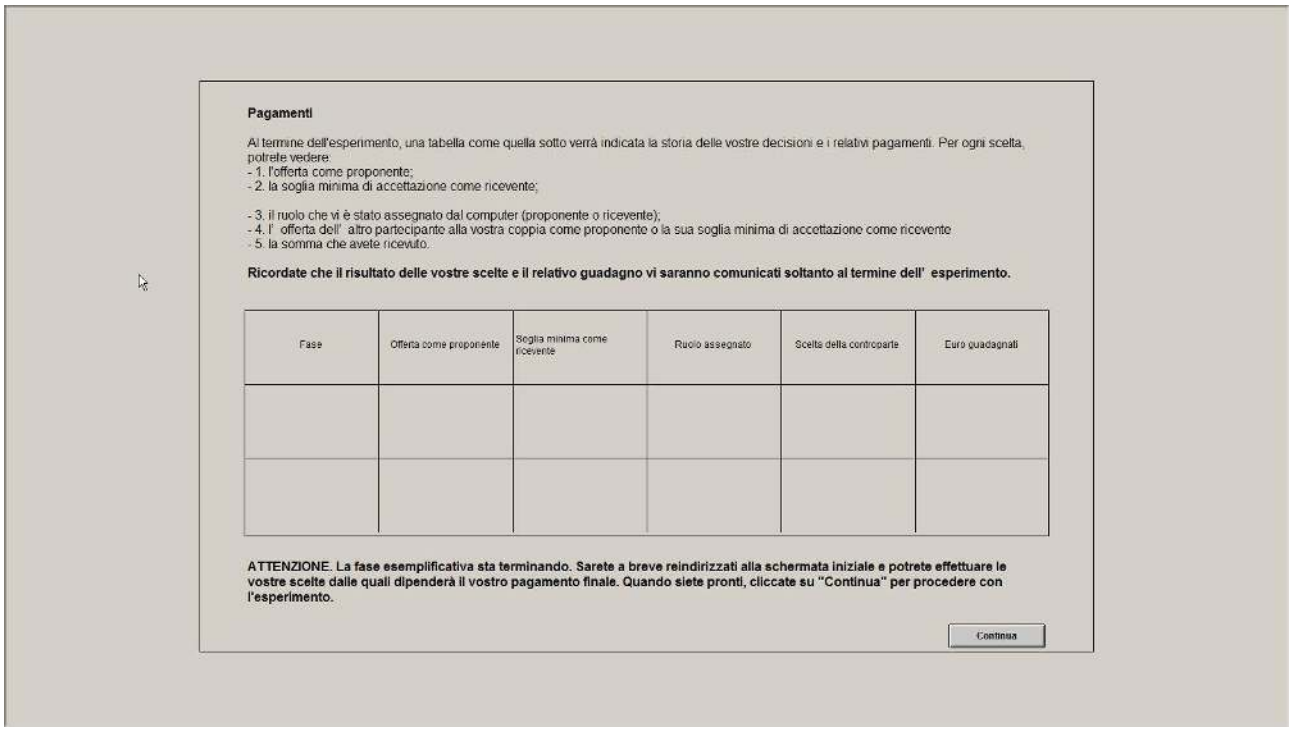
For example, if the proposer is willing to offer 10 to the recipient, whose acceptance threshold is 8, the pie is split as follows:

- 10 will go to the recipient
- 21 – 10 will go to the proposer

If however the proposer offers 7, which is lower than the minimum acceptance threshold of the recipient (8), the pie is split as follows:

- the proposer gets 0
- the recipient gets 0

Please, click "Continue" so we can show you the instructions screen regarding the final payment.



Payment. At the end of the experiment, you will see a table like the one shown on your screen. This table contains all the information about your decisions and the amount you earned for each choice. Specifically, for each phase, you will read:

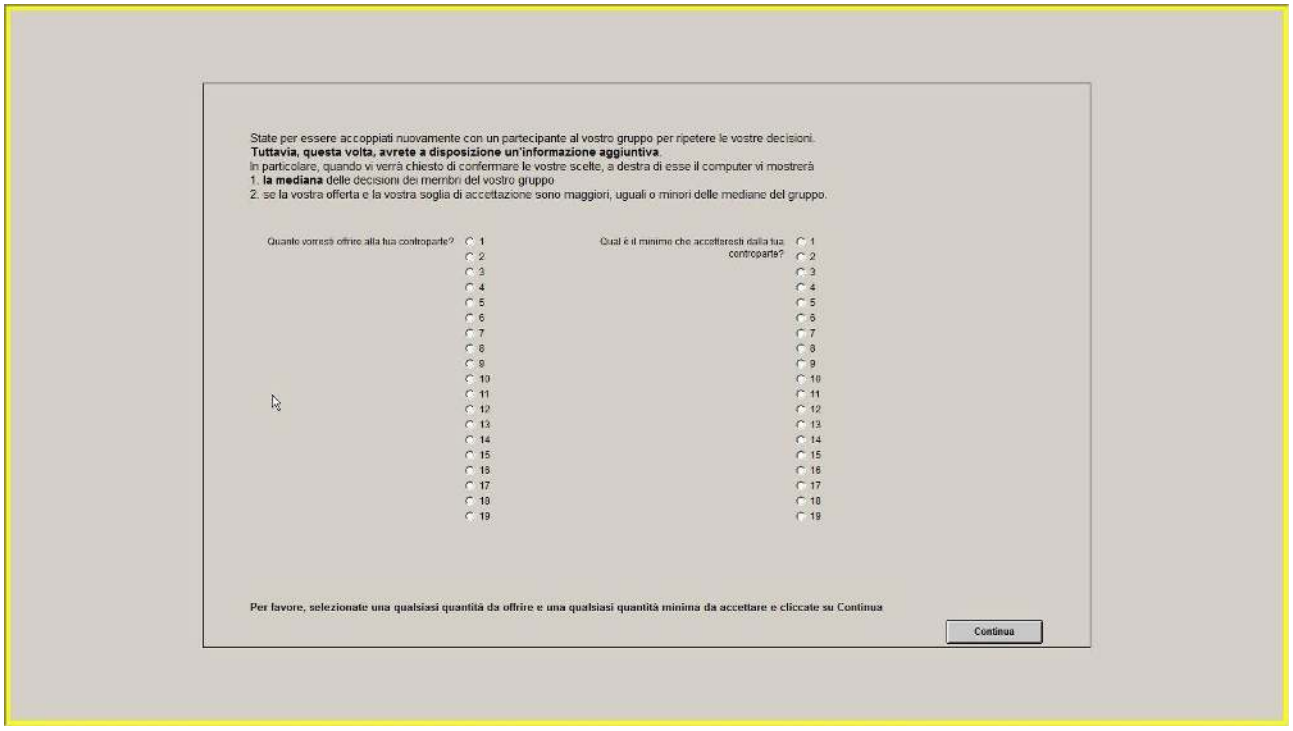
1. Your offer as a proposer;
2. Your minimum acceptance threshold as a recipient;
3. The role that the software assigned you (proposer or recipient)
4. The offer and the minimum acceptance threshold of your partner;
5. The amount you received.

Remember that the amount you earn will be disclosed only at the end of the experiment.

Warning! The instruction phase is now over. You will be soon redirected to the initial screen so that you can make your decisions on which your final payment will depend. When you are ready, please click "Continue" to move on with the experiment.

Phase without information on the median offer and median acceptance threshold.

Warning! You will now continue the experiment with a slight modification to the rules. Please click “Continue” so we can show you how the rules will change.

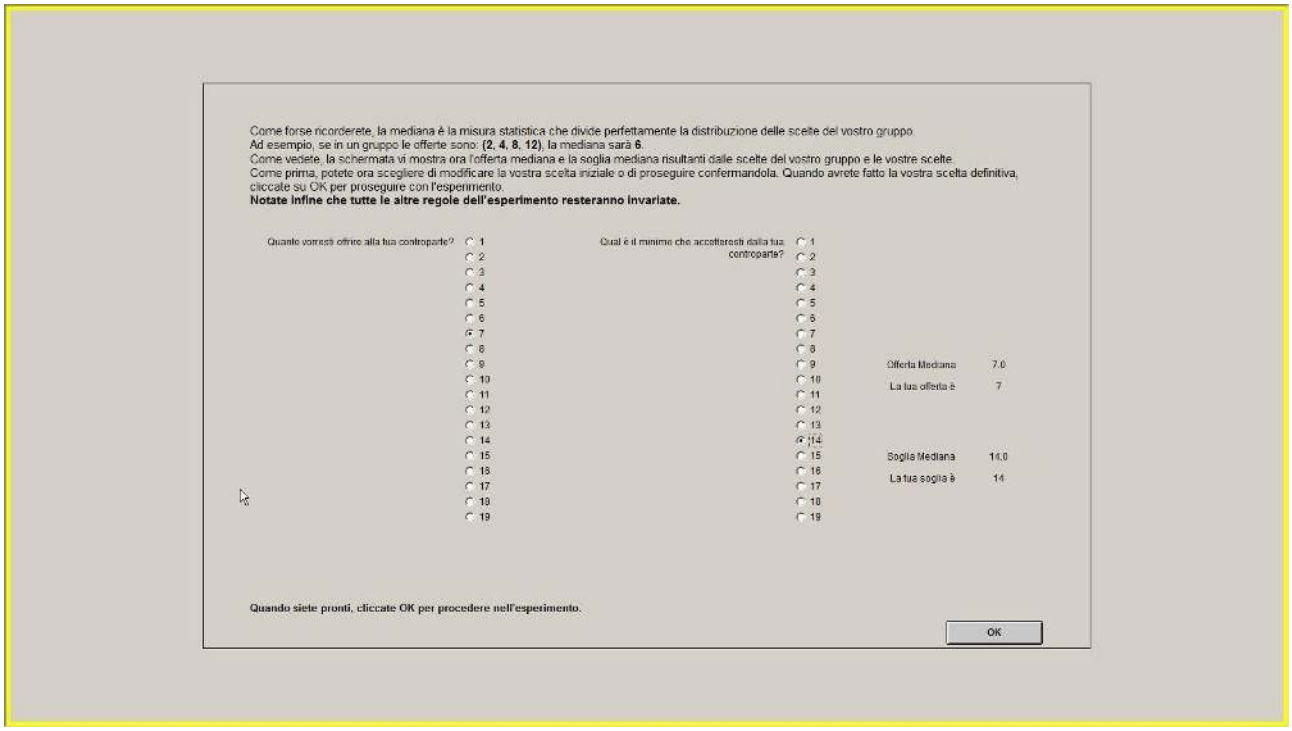


You will be soon paired with another member of your group to make a decision. This time, however, you will receive an additional information. Specifically, when you are required to confirm your final decision, you will see on the right of the screen:

1. the median offer and the median acceptance threshold chosen by the members of your group
2. whether your offer and your acceptance threshold are above or below the median of your group.

As you might remember, the median is a statistic that splits the distribution of the choices of your group in two. For example, if the offers in your group are 2, 4, 8, 12, the median is 6.

Please make a mock offer and select a mock acceptance threshold and click “OK”



As you can see at the right of the screen we show you the median offer and the median acceptance threshold of your group as well as whether your decisions are above or below these values. As before, you can now confirm or change your initial decisions.

Once you are done, please click on “OK” to continue with the experiment. Please note finally that none of the other rules in the experiment will change.

Warning! The actual experiment will now start. You will soon be redirected at the initial screen and you will make new choices on which your final payment will depend. Please click “Continue” to move on with the experiment.

Phase with information about median offer and median acceptance threshold.

Thank you! The experiment is now over. Please complete the questionnaire on your screen with your personal information so that we can proceed with the payment.

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LABSI EXPERIMENTAL ECONOMICS LABORATORY
UNIVERSITY OF SIENA
PIAZZA S. FRANCESCO, 7 53100 SIENA (ITALY)
http://www.labsi.org labsi@unisi.it