Group Membership, Team Preferences, and Expectations

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Abstract

Group membership is a powerful determinant of social behaviour in a variety of experimental games. Its effect may be channelled primarily via the beliefs of group members, or directly change their social preferences. We report an experiment with a prisoner's dilemma with multiple actions, in which we manipulate players' beliefs and show that group identity has a consistent positive effect on cooperation only when there is common knowledge of group affiliation. We also test the robustness of the minimal group effect using three different manipulations: one manipulation fails to induce group identity, and we observe an unsystematic effect of group membership when knowledge of affiliation is asymmetric.

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1. Introduction

There is currently a revival of interest among economists in the effect of group membership on individual decision-making .[1] It is well known that people tend to behave more pro-socially when they interact with members of their own group, but become less generous, less trusting, and less cooperative towards individuals who belong to different groups. However, there is less agreement about why this happens, and in which conditions group membership has a significant effect.

The experiment described in this paper extends research on group membership in two directions. (1) Using a two-person public goods game (or multiple-action prisoner's dilemma), it tries to discriminate between two alternative explanations of group identity effects. Does group membership change people's *goals* (by, for example, modifying the argument of their utility function) or does it change people's *expectations* concerning what other individuals will do? (2) The experiment probes the robustness of group effects comparing three different versions of the classic minimal group paradigm (Tajfel et al. 1971). While the answer to the first question appears rather straightforward – the effect of group membership is channelled mainly through people's expectations – the results on the second front are less univocal. Minimal group manipulations appear to be fragile, and have unsystematic effects when knowledge of group membership is asymmetric. In some sessions group identity increases transfers to fellow group members, in some it decreases transfers, and in others it has no effect at all.

The paper is organised as follows: section 2 sketches the theoretical background and briefly reviews the experimental literature. The design of the experiment is illustrated in section 3, while section 4 describes and discusses critically the main results. Section 5 concludes with a summary and general comments.

2. Literature review

In the classic minimal group experiment Tajfel and co-authors (1971) divided subjects in two groups using an irrelevant and arbitrary criterion. Subjects then allocated money between random in-group and out-group members, and on average gave more to the former than to the latter. It is

[1] See e.g. Akerlof and Kranton (2000, 2010), Sugden (2000), Eckel and Grossman (2005), Bacharach (2006), Cooper and Kagel (2005), Bernhard et al. (2006), Goette et al. (2006), Ruffle and Sosis (2006), Charness et al. (2007), Efferson et al. (2008), Hargreaves Heap and Zizzo (2009), Chen and Li (2009), Sutter (2009), Benjamin et al. (2010), Zizzo (2011).

noteworthy that subjects sometimes sacrificed resources to increase the difference between in-group and out-group payoffs, that is, they behaved spitefully towards out-group members.[2]

It remains unclear, however, *how* exactly the minimal group design generates higher levels of transfer towards in-group members. Possible explanations can be divided in two broad categories: according to *preference*-based models, group identity transforms the utility functions of individuals who are engaged in a collective task; according to *belief*-based models the group identity manipulation changes their expectations, and via this route modifies behaviour.

The simplest preference-based models introduce other-regarding concerns in the utility function of each individual player. "Social preferences" may be altruistic, egalitarian, reciprocal, spiteful, or may reflect a combination of different motives (Fehr and Fischbacher 2002, Cooper and Kagel, in press). Group identity may change the weight of other-regarding relative to self-interested motives, inducing differential treatment of in-group and out-group members. According to an alternative, less orthodox hypothesis, group identity may cause individuals to focus on the maximization of a single *team preference* function (Sugden 2000, Bacharach 2006). An advantage of this framing effect is that some strategic problems are transformed into parametric decisions, where each individual simply pursues the group's goal by choosing a profile of strategies that maximizes collective utility.

Belief-based models in contrast explain the effect of group membership as a manipulation of expectations. In public goods games, for example, individuals with an underlying preference for conditional cooperation must be reassured that others are also willing to contribute. Information about group membership may work as a signal or correlation device that individuals use to coordinate their choices (Bicchieri 2006, Gintis 2009). It is crucial however that group affiliation is common knowledge among players. Suppose for example that *i* believes that *j* does not expect her to contribute to the public good. The minimal group paradigm may change *i*'s behaviour by manipulating her beliefs concerning *j*'s expectations. But *i*'s beliefs can change only if *i* learns that *j* knows that *i* knows that they are fellow group members. [3]

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[2] Subsequent work in social psychology has explored various alternative methods to induce group identity. See e.g. Tajfel (1982), Brewer and Kramer (1986), Isaac and Walker (1988), Orbell et al (1988), Dawes et al. (1990), Kerr and Kauffmann-Gilliland (1994); the social psychology literature is surveyed in Brown (2000) and Hogg and Abrams (2003). We will use the term "minimal group" rather broadly, to include a number of experiments that differ in some respects from Tajfel's. There are various degrees of "minimality", and our experiment probes the robustness of the effect to changes in the manipulation device. Notice also that while Tajfel's subjects engaged in a task that had no payoff consequences for themselves, we follow the experimental economics tradition and study situations where pro-social behaviour has a cost for the decision-maker.

[3] For imagine that only *i* knows about the common group affiliation: since *j* does not know whether she is playing with an in-group or an out-group member, she is unable to infer the correct rule for that situation, and she cannot do better than play randomly. Player *i* as a consequence is also unable to predict the contribution of *j*, and cannot do better than play randomly. The minimal group paradigm should have no significant effect on the average behaviour of experimental subjects in one-shot games with asymmetric information of group membership.

A substantial body of evidence confirms the importance of expectations in sustaining pro-social behaviour (Kagel et al. 1996, Haley and Fessler 2005, Dana et al. 2007, Bicchieri and Xiao 2009, Ellingsen et al. 2011). None of these experiments, however, focuses specifically on groups. Notable exceptions are Yamagishi and Mifune (2008) and Güth et al. (2009), who have tested the importance of mutual beliefs in dictator's games with group identity. They report significant differences between in-group and out-group allocations *only* when group affiliation is common knowledge.[4] Jin and Yamagishi (1997) similarly studied asymmetric knowledge of group membership in a prisoner's dilemma game. They report higher rates of cooperation only with mutual knowledge of affiliation, but we do not know the details of their design because the original paper was published in Japanese.

In this paper we describe an experiment based on a prisoner's dilemma, that in addition probes different manipulation devices and checks their robustness using post-experimental questionnaires. We manipulate players' *beliefs* and compare conditions with common knowledge of group membership vs. conditions with asymmetric knowledge. In the latter, all players are aware of *their own* group affiliation, but some players do not know the affiliation of the other player (who, in turn, knows that the first player ignores this piece of information). If beliefs are crucial, the difference between in-group and out-group cooperation should be larger in the common knowledge than in the asymmetric knowledge condition. As we shall see, our results confirm the hypothesis that beliefs matter: group membership does not affect cooperation systematically, unless both partners are aware of their common affiliation. However, the data also cast doubt on the robustness of the minimal group effect and on subjects' interpretation of the task in the (rather unusual) asymmetric knowledge conditions.

3. Experimental design

The basic structure of our experiment is a 2 x 3 design (across subjects) where we manipulate (1) the group membership of two players in a one-shot prisoner's dilemma with multiple actions, and (2) information concerning the group affiliation of the other player. Along the first dimension, we have pairs of subjects belonging to the same group in some sessions (IN-group conditions), and pairs belonging to different groups in other sessions (OUT-group conditions). Along the second dimension, we have sessions with common knowledge of group membership (CK), and sessions

[4] Interestingly, Güth and co-authors report a significant difference between the asymmetric and the common knowledge conditions only when the dictator's beliefs concerning the recipient's expectations are elicited *in advance* of making her decision. When the dictator's attention is not focused on mutual beliefs, in contrast, the asymmetry of information does not seem to matter.

with asymmetric knowledge where one player is aware of the group affiliation of both players (AK_full) while the other one knows her own affiliation but ignores the affiliation of her partner (AK_partial). In all cases, the prisoner's dilemma game was preceded by a priming session using the minimal group paradigm.

Overall 410 subjects participated in the experiment, drawn from the student population of the University of Trento in the North of Italy. Subjects were recruited using flyers and registered in a dedicated website of the Cognitive and Experimental Economics Laboratory. As they entered the laboratory, subjects were seated randomly at computer desks separated by partitions. An assistant read the instructions aloud and invited subjects to answer six questions to test their comprehension of the experimental task. The assistant then illustrated the correct answer to each question and encouraged further requests of clarification. When all doubts had been dispelled, the experiment began.

Stage 1 of the experiment consisted of a minimal group manipulation. To cross-check the effect of the group identity manipulation, we used different techniques in different sessions. The manipulations are labelled "Guess", "Bracelets", and "Painters".

GUESS: Subjects were asked to estimate the number of students currently registered at the University of Trento. It was made clear in the instructions that the only purpose of this task was to divide them into separate groups on the basis of a similarity criterion (so that each subject would belong to a group of *similar* individuals).[5] Once they had made their guesses, subjects were told that those whose answers lay above the median would be assigned to the "Yellow" group, and those below the median to the "Red" group. The value of the median was then calculated and each subject's group affiliation was communicated privately.

BRACELETS: Subjects picked randomly a coloured bracelet (Red or Yellow), which they were asked to wear during the experiment. The random draw method has been used by several other experimenters before (following Billig and Tajfel 1973); the only difference is that we tried to enhance the perception of similarity using a physical marker that remained salient throughout the task.

PAINTERS: Subjects were asked to evaluate a series of paintings by Vassily Kandinsky, assigning a score from one to ten. The median score was then communicated, and subjects were divided in the Yellow or Red group depending on whether their own score lay above or below the median.[6] To further bolster group identity, subjects engaged in a recognition task (they had to

[5] The word "similar" was underlined in the instructions, to convey an idea of group homogeneity (according to cognitive psychologists homogeneity is an important factor in group framing). However, the arbitrariness of the mechanism used to divide subjects in groups was totally explicit and no deception was involved.

[6] We used this device to replicate Tajfel's original task as closely as possible, but without deception.

identify the authors of five modern art paintings) which earned them five cents for every correct answer provided by a member of their group (including one's own answers). This device was meant to implement the "common fate" condition that according to social psychologists constitutes an important element of group identity. The results (earnings) of this task were communicated at the end of the experiment.

After group identity had been primed using one of these three techniques, *Stage 2* of the experiment began. Subjects were paired randomly and asked to play a two-person linear public goods game (a prisoner's dilemma with $n>2$ discrete actions). Each subject received an endowment of ten euro, to be allocated in units of one euro across two separate accounts. Each unit invested in the "Personal Account" produced exactly one euro for that player. Each unit invested in the "Public Account" was added to those invested by the other player, multiplied by a factor of 1.5, and divided equally between the two players. The production function was therefore

$\pi_i = E - c_i + .75 \times (c_i + c_{j \neq i})$,

where E is the initial endowment, and c_i, c_j are the contributions of the two players.

Subjects were asked to allocate the endowment by entering two numbers (one for the Private and one for the Public Account) in separate boxes on their computer screen. As anticipated in the instructions, the screen contained information concerning the affiliation of the other player. In the *common knowledge conditions* (CK) it said "The other player is Yellow [Red]. He/she knows that he/she is Yellow [Red], knows your colour, and knows that you know both players' colours". In the *asymmetric knowledge conditions*, it said either "The other player may be Yellow or Red" (condition AK_partial), or "The other player is Yellow [Red]. He/she knows his/her colour, but does not know your colour" (condition AK_full). To make group affiliation salient, we represented it visually using two human-shaped icons coloured in yellow or red. When subjects did not know their partner's affiliation, the icon on the right-hand side was coloured in grey and carried a large question mark. When subjects were told that their affiliation had not been disclosed to their partner, the icon on the right-hand side was appropriately coloured (red or yellow) but carried a balloon with a question mark to signify the partner's lack of information. Figure 1 summarizes the various treatments and displays some of the icons that we used.

[Figure 1 about here]

After all subjects had made their decision, they answered a short questionnaire that elicited their subjective experiences of participation in the experiment. One question in particular probed their feeling of identification with the group, and will be discussed in more detail in the next

section. At this point each participant received feedback about the money she had earned, filled in a brief questionnaire requesting generic information about age, gender, university degree, etc., and was paid privately in cash (the average earning was roughly 12 euros).

4. Results

Table 1 includes the relative frequency of contribution choices across the experimental conditions. On the rows we report the results of the three beliefs conditions (CK, AK_partial, AK_full), while on the columns we report some statistical indicators, organized according to the two treatments (IN and OUT). We also disaggregate the data according to the manipulation device that we have used (Guess, Bracelets, Painters), and then aggregate all the data in a pooled sample (at the bottom).

[Insert Table 1 about here]

We start with a broad description of the main patterns, and move subsequently to more detailed statistical analysis. It is immediately clear looking at the pooled sample that with common knowledge of group affiliation (CK) there is a difference of behaviour across the IN and OUT conditions: in-group pairs contribute more. In contrast, IN/OUT contributions barely differ when knowledge is asymmetric. While this is to be expected for those players who know their own affiliation but do not know the affiliation of their partner (AK_partial), the results of fully informed players (AK_full) are theoretically interesting: the data suggest that knowing that the other player belongs to your own group is insufficient, by itself, to induce higher levels of cooperation. This is prima facie evidence that the minimal group manipulation influences the *expectations* of players, rather than changing their preferences directly.

If we look at the three manipulations separately (Guess, Bracelets, and Painters), we notice that the effect of group membership is strikingly consistent in the CK conditions. In contrast, there is more variation in the AK conditions. These differences must be taken with a pinch of salt given the limited number of observations, but nevertheless offer insights in the decision process and invite some methodological reflections that will be outlined later. Consider that in the Guess manipulation fully informed players (AK_full) contribute more when they are matched with an in-group than with an out-group player. But in the Painters manipulation the opposite is true: AK_full subjects contribute more when they are matched with an out-group than when they are matched with an in-group player. Data under the Bracelets manipulation fall roughly in between: IN/OUT behaviour is practically indistinguishable.

To confirm these first impressions, we run a series of Wilkoxon Rank Sum tests across all conditions.[7] The only significant difference in the pooled data concerns the CK_IN and CK_OUT conditions (p = .006). The discrimination seems to originate in a higher propensity to cooperate with in-group members, rather than in a tendency to free ride more with out-group members. This is apparent if we compare common knowledge conditions with asymmetric knowledge conditions: CK_IN is significantly different from AK_partial_IN (p=.028) and AK_partial_OUT (p=.008), while CK_OUT does not differ from AK_partial_IN (p=.594) and AK_partial_OUT (p=.870).[8] It is noteworthy that while the CK_IN vs. CK_OUT difference is significant or close to significance in the Guess and Painters conditions (p=.069 and p=.038, respectively), it fails to reach significance in the Bracelets condition (p=.621). However, this is the only condition where no difference whatsoever is observed across all comparisons, which suggests that the manipulation device failed to generate group identity. We will double-check this hypothesis shortly using some questionnaire data.

The other anomalous results concern the AK_full conditions. While in Bracelets fully informed subjects do not discriminate significantly between IN and OUT partners (p=1.000), in Guess and in Painters they do, but in opposite ways: in Guess they cooperate more when matched with in-group partners (p=.005), while in Painters AK-full subjects cooperate more with out-group players (p=.002). In Painters, however, the anomalously high values observed in AK_full_OUT are due to a single experimental session where ten subjects contributed on average 2.8 tokens to in-group partners and 9.1 tokens to out-group partners. In the other session that we ran with the same manipulation device, the average contributions were 4.3 and 4.75 respectively, very much in line with what we observed in the experiment overall. We conjecture that if we had had the chance to run other sessions, the anomaly of the Painters manipulation would have disappeared.[9]

To improve our understanding of the determinants of contribution we also run a regression estimation.[10] Contribution to the public account is taken as the dependent variable, and alternative experimental conditions are considered as explanatory factors. More precisely, CK is set equal to one when a participant is in the common knowledge condition and zero otherwise; AK_full is equal to one when a participant is in the asymmetric knowledge condition and zero otherwise. The

[7] Since there are more than sixty tests, we report only the most relevant results here. A complete table with all p-values can be found in the working paper version of this article (Guala et al. 2012).

[8] Notice that in theory the data from AK_partial_IN and AK_partial_OUT conditions could be pooled together, given that subjects received exactly the same information. The statistical tests confirm that there are no significant behavioural differences.

[9] This would have made recruiting very challenging because of the large number of participants that had already taken part in previous sessions of the experiment.

[10] We used a Tobit regression analysis to account for the censoring at 0 and 10 in the dependent variable. Since the data are discrete, we compute robust standard errors.

interaction between these two explanatory factors and the group membership of the other player is also considered. The variable IN is set equal to one when the other player has the same colour as the decision maker and equal to zero when the colours are different.[11] We also add a few control variables to the regression: Age captures the age of the decision maker; Female captures the gender of the decision maker; Freshman is equal to one when the decision is made by a first-year student and equal to zero otherwise; Economics is equal to one when the student is an economics major and equal to zero otherwise.

[Insert Table 2 about here]

The regression outcomes of Table 2 show that when data from the three experiments are pooled together (column [1]), subjects in the CK condition tend to cooperate more with IN than OUT members (CK × IN). Contributions in CK_OUT do not differ from those in AK_partial, which we take as our baseline condition. However, LinHyp.1 tells us that contributions to the public good are higher in CK_IN than in the baseline (AK_partial). Concerning AK_full, no significant difference is observed between in- and out- group conditions. Furthermore, only a marginally significant difference is registered between contributions in AK_full_IN and contributions in the baseline (AK_partial).

If we analyse each manipulation separately, heterogeneity of behaviour emerges once again. While contributions in condition CK are never lower when interacting in the in-group condition than when interacting in the out-group condition, in conditions with asymmetric knowledge (AK) behaviour is more volatile. Under the Guess manipulation, a highly significant positive difference between in- and out-group contributions is observed. Moreover, the contributions in condition IN are higher than those in the baseline. In Bracelets the treatments do not produce any significant effect. In Painters we have the same surprising pattern discussed above: contributions in condition AK_full_OUT are significantly higher than in condition AK_full_IN and in the baseline.

To put these data in perspective, we discuss briefly the results of a short questionnaire that subjects completed *after* they had chosen their contribution in the Bracelets and Painters manipulation conditions.[12] The questionnaire included several questions concerning the subjective experience of participating in the experiment. The first one, crucially, asked: "During the interaction did you feel that the two participants were like one group or like separate individuals?" (1=group,

[11] In the reported estimation the variable IN is present only in interaction with dummies CK and AK_full. This specification allows us to obtain the condition AK_partial as a baseline, with no distinction between in- and out-group conditions.

[12] We do not have questionnaire data about the Guess manipulation, unfortunately, because the idea of a manipulation check was suggested by a referee after these sessions had already been done.

2=individuals). In the Painters manipulation, 60% of participants answered positively (they felt as a group) in the CK_IN condition, compared to only 12.5% in CK_OUT. This difference is highly significant ($p = 0.006$, Fischer Exact Test). The answers in AK_full_IN and AK_full_OUT were practically indistinguishable, in contrast (25 vs. 27.8%, $p = 1.000$, FET), which again confirms the importance of common knowledge of affiliation for the creation of group identity. The picture in Bracelets is more blurred, which explains why the behavioural patterns are also rather uninteresting under this treatment. In CK_IN, 40% of subjects felt as group, compared to 35% in CK_OUT ($p = 1.000$, FET); in AK_full the frequencies were 50 and 44.4% respectively ($p = 1.000$, FET).

Questionnaire data support two important methodological points: first of all, the manipulation treatments that we administered had variable effects. We can say with a high degree of confidence that the Painters and, probably, the Guess devices induced group identity effectively, while the Bracelets manipulation did not. This failure may be attributed to the blatantly artificial process of group formation (random draw), and to the fact that subjects in this condition did not engage in any common task before playing the public goods game. The data should make one pause and reflect on all those experiments that have used the "lightest" version of the minimal group design. It is possible that the results reported in the literature suffer from publication bias, and it would be desirable to publish failed replications in the future (see Maniadis et al. 2011).

The second point concerns the anomalous patterns of behaviour observed in the Painters treatment. Recall that subjects with full information in the AK condition cooperated more with out-group than with in-group subjects. The anomalous data are concentrated in one specific session: if we disaggregate the questionnaire results, we find that indeed only 10% of subjects in that session identified with in-group members, compared with a strange 30% identification with out-group members. In the other session, the data are much more in line with the rest of the experiment (40% identification with in-group members vs. 25% with out-group members). We should therefore conclude that the manipulation had a bizarre effect in a single session, which should be discounted from the overall results observed in the experiment.

Are these mere statistical anomalies due to low numerosity, or is there something more to be said? It is not surprising, in our view, that we observed the greatest variance of results in the AK conditions. Contrary to the relatively straightforward situation faced in the CK sessions, in AK the experimental subjects receive contradictory messages: first they are given information about group membership. This information is highly salient, and is probably interpreted as a cue for the decisions they will make in the public goods game. At the same time, however, the signal in AK is not common knowledge and cannot be used as a correlation device (Bicchieri 2006, Gintis 2006).

Subjects probably perceive the contradictory nature of the signal, and struggle to make sense of it in an unusual experimental environment.

This raises important questions concerning the very nature of the minimal group effect. Right from the beginning, Tajfel's paradigm was criticized for its "artificiality". In particular, some critics argued that subjects reacted to an obvious experimental demand to modulate cooperation according to group membership. Responding to his critics, Tajfel agreed with the premise of this argument, but pointed out that not all demand effects are artificial (in the sense of lacking a counterpart outside of the laboratory):

> what was no more than a hint from the experimenters about the notion of 'groups' being relevant to the subjects' behaviour had been sufficient to determine, powerfully and consistently, a particular form of intergroup behaviour. […] The problem then must be restated once again in terms of the need to specify why a certain *kind* of intergroup behaviour can be elicited so much more easily than other kinds […]. [T]he subjects structured the situation for themselves as one involving relations between groups, and […] they behaved in ways similar to those habitual to them in situations of this kind. (Tajfel 1982: 235-6)

Tajfel's considerations may be extended to all experiments that study social norms in the laboratory. To observe the effects of social norms, an experimenter must create expectations about conformity to a behavioural rule that is deemed appropriate to the situation. *All* framing effects (like those investigated by Eckel and Grossmann 2005, for example, or Ellingsen et al. 2011) exploit a demand effect in this sense. The scientific interest of these studies lies in the hypothesis – which is a priori plausible and may be confirmed by field data – that the experimental manipulation cues behavioural rules that have been "imported" in the laboratory from the outside world. If this is the case, the experimental results have external validity *because* the subjects have complied with the demand (rather than "in spite" of it).[13]

Our results add another important nuance to this methodological point: the key mechanism linking group identity with cooperation is subjects' concern about the expectations *of their peers*. Our data, in other words, indicate that subjects are not particularly concerned about the expectations of the experimenter, since removing mutual knowledge of group membership tends to make the effect disappear. The minimal group should be considered a "peer demand effect", rather than an

[13] For general discussions of the problem of external validity in experimental economics see e.g. Guala (2005), Schram (2005), Levitt and List (2007), Bardsley et al. (2009).

"experimenter's demand effect", which makes one think that the validity of group identity extends beyond laboratory walls.

5. Summary and conclusion

When they choose their contribution level to a public good, subjects tend to contribute more if they are matched with an in-group member than if they are matched with an out-group member. Thus, pro-social cooperative behaviour is affected by group affiliation. Systematic discrimination however takes place only if both subjects have access to information about the group membership of the other player. When knowledge is asymmetric, fully informed participants do not cooperate more with in-group than with out-group subjects. Overall their average level of contribution is statistically indistinguishable from that of partially informed subjects. The message is that the minimal group paradigm acts primarily on individual beliefs, and through this channel modifies behaviour in games of cooperation. All theories that postulate a direct link between group identity and preferences – unmediated by mutual beliefs – are therefore refuted by the evidence.

The results of this experiment however raise important questions regarding the robustness of minimal group effects. Out of three attempted manipulations, one certainly failed to induce significant discrimination and must be taken as a warning against attempts to ground group identity on mere random labelling. The other two manipulations successfully replicated the classic in-out effect with common knowledge of group membership, but produced unsystematic effects in the asymmetric conditions. This variance is probably due to subjects' attempts to apply in an unusual context a behavioural norm that is appropriate for situations where group affiliation is common knowledge among players.

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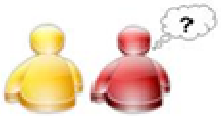
		IN	OUT
Asymmetric Knowledge (AK)	Full		
	Partial		
Common Knowledge (CK)			

Figure 1: Summary of conditions and icons used in the experiment.

Table 1: Contribution levels across conditions and treatments.

		IN				OUT			
		N	Avg	Med	Std Dev	N	Avg	Med	Std Dev
GUESS									
AK_partial	32	4.438	4.500	2.873	31	3.645	2.000	3.498	
AK_full	32	5.906	5.000	3.315	31	3.419	3.000	3.233	
CK	32	5.188	5.000	3.031	32	3.812	3.000	2.934	
BRACELETS									
AK_partial	16	4.500	3.500	3.812	18	5.222	5.000	2.981	
AK_full	16	5.250	5.000	3.022	18	5.333	5.000	3.531	
CK	20	5.100	4.000	3.194	20	4.500	4.000	2.947	
PAINTERS									
AK_partial	20	4.050	4.500	3.332	18	4.056	4.000	2.775	
AK_full	20	3.550	4.000	2.685	18	7.167	8.500	3.185	
CK	20	6.650	6.500	3.407	16	4.000	3.000	4.000	
POOLED									
AK_partial	68	4.338	4.000	3.203	67	4.179	4.000	3.205	
AK_full	68	5.059	5.000	3.195	67	4.940	5.000	3.613	
CK	72	5.569	5.000	3.210	68	4.059	4.000	3.181	

	Coeff. (Robust Standard Error)			
	[1] Pooled	[2] Guess	[3] Bracelets	[4] Painters
Intercept	2.552 (1.010)*	3.776 (2.940)	4.646 (1.427)**	-0847 (5.262)
CK	-0.469 (0.670)	-0.500 (0.897)	-0.973 (0.163)	-0.297 (1.563)
AK_full	0.820 (0.736)	-1.013 (1.006)	-0.224 (1.229)	4.407 (1.462)**
CK × *IN*	2.192 (0.779)**	1.661 (0990) °	0.422 (1.415)	4.039 (1.899)*
AK_full × *IN*	0.483 (0.835)	3.691 (1.214)**	0.823 (1.449)	-4.570 (1.507)**
Age	0.076 (0.039) °	0.007 (0.122)	0.011 (0.030)	0.243 (0.232)
Female	-0.609 (0.468)	-0.211 (0.649)	-1.981 (0.866)*	-1.809 (0.956) °
Freshman	0.353 (0.518)	-0.422 (0.762)	0.956 (0.988)	2.111 (1.253) °
Economics	0.086 (0.487)	0.285	2.723 (1.044)*	-0.954 (0.924)
LinHyp.1	F(1,400= = 6.52*	F(1,181) = 1.67	F(1,99) = 0.19	F(1,104) = 6.58*
LinHyp.2	F(1,400) = 3.74 °	F(1,181) = 7.00**	F(1,99) = 0.23	F(1,104) = 0.03
N	408	189	107	112
Left censored	63	29	13	21
Right censored	60	25	16	19
F	2.15*	1.84°	2.14*	3.35*

*** (0.001); ** (0.01); * (0.05); ° (0.1); significance level

LinHyp.1: CK + *CK* × *IN* = 0

LinHyp.2: AK_full + *AK_full* × *IN* = 0

Table 2: Contribution to public good (Tobit regression)

Appendix: Experimental Instructions (translated from Italian)

You are now taking part in an economic experiment which has been financed by various foundations for research purposes. The instructions which we have distributed to you are solely for your private information. It is prohibited to communicate with the other participants during the experiment. Should you have any questions please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments.

At the end of the experiment you will receive a sum of money proportional to what you have earned during the experiment. The exact amount that you will earn will depend on your decisions and the decisions of the other participants in the experiment. During the experiment your earnings will be calculated in tokens. At the end of the experiment the total amount of tokens you have earned will be converted into real money at the following rate:

1 token = 1 euro

During the experiment you will have the opportunity of making choices that will influence both your earnings and those of other participants. The choices made by each subject however will be totally anonymous. Anonymity will be maintained both during and after the experiment: all the money you will earn will be paid privately when the experiment will be over.

Description of the decision situation

We now introduce the situation you will face during the experiment. Sixteen subjects will participate in each experimental session.

[Guess manipulation]: First, you will have to answer a simple question that will appear on the screen of your computer. Depending on your answers, each subject will be assigned to a group identified by a colour (Red or Yellow). The division in groups will take place according to a similarity criterion: the same colour will be assigned to those individuals who have answered in a similar way to the above question. None of the participants however will know which subjects belong to his/her group.

[Bracelets manipulation]: When you entered the laboratory, you were randomly assigned to a group identified by a colour (Red or Yellow).

[Painters manipulation]: In the first part of the experiment you will be asked to express your judgment and to answer some questions on a series of modern art paintings. You will receive detailed instructions regarding questions and earnings directly on your PC.]

[Asymmetric Knowledge conditions]: At this stage the computer will match you with another subject. Some participants may be aware of the group affiliation of the other subject with which they have been matched, while others may not be informed about this. These details will be explained on your computer screen.

[Common Knowledge conditions]: At this stage the computer will match you with another subject. All participants will be aware of the group affiliation of the other subject with which they have been matched. These details will be explained on your computer screen.

At this point you will have to make an important decision. Each participant will receive an endowment of 10 tokens, and will have to decide how to divide them into two separate accounts.

For each token invested in the Personal Account, the participant will earn one token, which will be converted in money at the end of the experiment. Each token invested in the Public Account, in contrast, will be added to the tokens invested in the Public Account by the other player; the total will then be multiplied by 1.5 and shared in equal parts among the two players.

For example, suppose a subject decides to invest X tokens in her Personal Account and 10 – X in the Public Account. At the end of the experiment she will receive a number of tokens equal to:

$$(X) + \left[\frac{1{,}5 \times (\text{total number of tokens in Public Account})}{2}\right]$$

To help you understand this mechanism, we ask you to answer some questions. Please write your answers on the sheet of paper in front of you:

(1) If both players decide to invest 10 tokens in their Personal Account and nothing in the Public Account, (that is, if X = 10), how much will each player earn?

(2) If both players decide to invest 0 tokens in their Personal Account and 10 in the Public Account, (that is, if X = 0), how much will each player earn?

(3a) If one player decides to invest 5 tokens in her Personal Account, and the other decides to invest 8 tokens in her Personal Account, how much will the first player earn?

(3b) How much will the second player earn?

(4a) If one player decides to invest 5 tokens in her Personal Account, and the other decides to invest 2 tokens in her Personal Account, how much will the first player earn?

(4b) How much will the second player earn?

At the end of the experiment you will be asked to fill in a short questionnaire; when you have finished, wait for the experimenter to indicate the money you have earned. You will be asked to sign a receipt, and you will be paid privately in an adjacent room. We would also be grateful if you did not discuss the experiment with the other participants outside the laboratory.