ENDOGENOUS LEADERSHIP
SELECTION AND INFLUENCE

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Abstract

In a social dilemma game, why would some people be willing to bear the cost of being a leader? To answer this question, we designed a public good experiment with endogenous timing. In an additional treatment, we provide information about group members' attributes. In a last treatment, the leader is chosen randomly in the group. We observe a high proportion of leader candidates. We show evidence of various leading behaviors and we suggest that a fraction of the first movers have a concern for the team outcome whereas another fraction is more self-oriented. Some attributes of the group members influence the decision to lead, probably because they are interpreted as a signal of the attitude towards cooperation. Voluntary leaders improve efficiency but are not more influential than imposed leaders because of a sorting effect.

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I. INTRODUCTION

Among the major commitments to be a leader, Michael C. Jensen insists on the following: "Be committed to delaying gratification" (Jensen 2005). And he adds: "the message is the same as that for physical conditioning, no pain, no gain." (Ibid, p.3). Leadership, which we distinguish from hierarchical authority, requires personal sacrifice, energy, patience, and it is not always associated with a direct monetary compensation. Yet, voluntary leadership is frequently observed in groups of peers, such as work teams, public research institutes, classrooms, clubs, associations ... A natural question arises: why are some people willing to bear such a cost to be a leader?

In this paper, to study the motivations guiding the emergence of leaders, we design an experiment based on a one-shot public good game that reproduces the main features of teamwork, i.e. a dilemma between an individual incentive to free-ride on others' effort and a social optimum that requires a full cooperation. Our PG game is two-staged. Each player has the possibility to contribute once and to decide whether to move first before others, or after having observed the first mover's contribution, if any. Only a single leader –i.e. first mover- is allowed. When there are multiple volunteers to lead, the actual leader is randomly selected among them. The rejected candidates are allowed to revise their proposed leadership contribution after having observed the actual first mover's effort. This artifact allows us to examine to which extent the players condition their contribution on their role and on the first mover's actions. This constitutes our "*Benchmark treatment*".

In this setup, cooperation is voluntary since a leader has no coercive or punitive powers. Therefore, a player can lead only through her example. Of course, in real settings, other dimensions such as inspiration, vision, charisma, reputation, and communication play a role in leadership. We have deliberately designed an abstract setup that rules out these

considerations by considering a simple setup in which any follower with selfish motives has always an incentive to free-ride whatever the leader's action, and therefore in which no leader should rationally emerge. If we observe leaders, the possibility to analyze both the first and second contributions of these subjects will help in identifying motivations.

In such a context, the motivation to lead may be supported by social preferences. Altruistic individuals may accept to lead and sacrifice their own well being for raising the welfare of others. Andreoni (1990) suggests that seemingly altruistic behavior may be motivated by positive emotions, i.e. "warm-glow," experienced by contributing to a socially beneficial cause. If motivated by the team outcome, leaders may also be willing to teach their team members that full cooperation is payoff maximizing for the group. Whether altruists or concerned by the group outcome, these individuals should contribute as much as leaders and as followers in our game and they should not revise their contribution downward if not selected among several candidates.

The motivation to lead may be also driven by self-oriented motives. Varian (1994) proposes a theory in which those who value the public good least have an incentive to move first by making small contributions, transferring the burden of funding the public good to the followers. A selfish subject could therefore contribute little both in the role of a leader and in the role of a follower. Initial contributions may be preferred to contributing later also for opportunistic reasons. Indeed, some as Huck and Rey Biel (2005) suggest that leadership may arise endogenously if some agents dislike effort differentials and conform. The expectation that the partners will reciprocate initial contributions, as first proposed by Sugden (1984), may be attractive to opportunistic individuals. We may hypothesize that opportunistic individuals may choose to move first to exploit the anticipated conformism or reciprocity of followers. Others, like

Glazer and Konrad (1996) and Harbaugh (1998), suggest that large donations in PG game may be credible demonstrations of an individual's underlying characteristics such as status. We can therefore hypothesize that leading may buy status or prestige. Some individuals value being influential, that is achieving the title of having made, or at least having tried to make, a positive social impact in one's own group (Duncan, 2004).[1] If guided by opportunism or by a taste for influence, these subjects should contribute more as leaders than as followers and they should revise their contribution downward if not selected among several candidates.

The first contribution of our paper is both to analyze whether in such a sequential public good game leadership emerges and to identify its cost. We also search for evidence of socially-oriented and self-oriented motivations in the individual decision to lead, without pretending to weight each of the previous possible motivations since some of them are not mutually exclusive.

A second contribution of this paper is to analyze whether the self-selection of leaders is better predicted by the subjects' characteristics or by their environment. The first option can be related to the psychological theory of traits (see Terman 1904 and Cowley 1931, its critics by Stodgill 1948, and its reappraisal by Judge, Bono, Ilies, and Gerhardt 2002). The second option focuses on the interactions between subjects and can be related to the behavioral theory of leadership (Bass 1985; Burns 1978). In our "*Attribute treatment*", subjects are informed about the gender and charitable behavior of their team members before deciding on moving or waiting. We analyze whether making these attributes visible conditions the decision to lead. In addition, we administered a personality test, namely the Five-Factor Personality Inventory Test, which allows us to correlate the decision to lead with the personality of the subjects.

A third contribution of our paper is related to the comparison between self-selected and randomly chosen leaders as regards efficiency. On the one hand, self-selected leaders are probably more intrinsically motivated to contribute than random leaders; this may both induce higher contributions and have an incentive effect on followers. On the other hand, the sorting effect of voluntary leadership may be such that pro-social subjects constitute a lower proportion of self-selected followers than when roles are allocated at random. By comparing our benchmark with the "*Imposed-leader treatment*", in which the leader is chosen randomly, we aim at determining which effect dominates and which organizational design generates the highest efficiency.

Our paper constitutes the first attempt to investigate experimentally the motives underlying the self-selection of leaders in public good games, with a control for personality traits and an analysis of the leaders' influence controlling for the endogeneity of the leader's selection. Our main findings are that a high proportion of subjects are willing to lead although we show that on average leaders sacrifice by making publicly observable their initial contributions. The decision to lead is influenced by the subjects' gender, generosity and openness, but personality factors have no strong predictive power. Context matters in the sense that the donation behavior of others seems to be interpreted as a signal of their future attitude toward cooperation; therefore, it influences one's decision to act first. We also provide evidence of the heterogeneity of leading behaviors. A cluster analysis identifies notably a group of selfish leaders, a group of opportunistic leaders and a group of socially-oriented leaders. Our results suggest that leading involves expected non-pecuniary satisfaction; in particular, males seem to derive some fulfillment from achieving the role of leaders, while females seem to be more concerned with the final group outcome. Lastly, we confirm that both the presence of a leader and her effort have a strong impact

on total contributions in a group. Leadership-by-example can thus support efficient outcomes as suggested by some theoretical models (Hermalin, 1998; Arce, 2001). Voluntary leaders increase efficiency because they contribute more than imposed leaders. However, due to the sorting effect, they are not more influential.

The remaining of the paper is organized as follows. Section II reviews the related experimental literature. Section 3 details our experimental design and the procedures. Section 4 displays the main results and Section 5 discusses the results and concludes.

II. RELATED EXPERIMENTAL LITERATURE

Most experimental papers on leadership in groups typically consider a framework in which the leader is randomly chosen and receives private information on the state of nature. Hermalin (1998) proposes a theory of leadership-by-example in which a leader receives private information regarding the returns from a public good. Through her contribution, the leader signals the state of nature to her uninformed followers. Many experiments have shown the influence of leaders on followers' contributions in such a framework (Andreoni 1998; Vesterlund 2003; Potters, Sefton, and Vesterlund 2001; Potters, Sefton, and Vesterlund 2005; Meidinger and Villeval 2003; Moxnes and van der Heijden 2003; Levati, Sutter, and van der Heijden 2005). These experiments show that reciprocity plays a major role in the willingness of the players to follow the leader's example. One can find other examples of the positive influence of early announcements and sequential contributions on later contributions in the empirical literature on donations, including Silverman, Robertson, Middlebrook, and Drabman (1984), List and Lucking-Reiley (2002), and Shang and Croson (2004). Testing a sequential public good game with *ex ante* symmetric information and random leaders, Gächter and Renner (2006) show that leaders act as "belief managers" and exert a long-lasting

6

influence on followers' beliefs. There is no difference between groups with and without a leader in that the same beliefs trigger the same behavior; but in the groups with a leader, the latter shapes the beliefs.

There are only a few experiments with endogeneous leadership. In a context of *ex ante* symmetric information, Gächter and Renner (2005) have designed an experiment in which a subject is designated to be a leader based on his contribution behavior in the first part of the experiment. Efficiency is increased when past free-riders become leaders because they act opportunistically: they increase their contribution as leaders because they anticipate the followers' reciprocity. Kumru and Vesterlund (2003) assign the role of leader on the basis of the subjects' status that is based on their success in a general knowledge quiz. They observe that the leader's influence on followers increases in their status. In a context of *ex ante* asymmetric information in favor of a random leader, Potters, Sefton, and Vesterlund (2005) give the group members the possibility to vote in favor of either a sequential or a simultaneous game. In some parametric cases, the more informed player chooses to lead in order to maximize her own wealth in Bayesian equilibrium. These games endogenize leadership, but the leader does not fully self-select. Even in Potters, Sefton and Vesterlund (2005), the informed party is chosen randomly. Self-selection is clearly an originality of our paper.

With players who have to self-select as leaders in their group, our game is closer to endogenous timing games. For example, Huck, Müller and Normann (2002) investigate a duopoly game in which a firm chooses between moving first or moving after observing the decision of the other firm. While theory predicts the emergence of endogenous Stackelberg leadership, they observe more often endogenous Cournot outcomes. Other experimental tests of leadership in duopoly games can be found in Fonseca, Huck, Norman (2005). Like in these games, our subjects decide to move first

or second; in contrast with them, we consider a public good game in which theory predicts that everybody should wait and move simultaneously.

III. EXPERIMENTAL DESIGN AND PROCEDURES

<u>Design</u>

The experiment is a three-player sequential public good game, consisting of three treatments. It was implemented using a stranger matching protocol. The experiment was followed by the administration of a personality test.

The Benchmark Treatment. Each of the three group members is endowed with 20 units in each period. Each subject can choose either to contribute a portion of this endowment to a group account or to keep it. All funds in the group account pay an equal positive return to each member of the group. The marginal per capita return of the group account is set to 0.5 throughout the experiment.

The game is two-staged. In the first stage, subjects decide whether they would like to lead the group. If they choose to do so, they are allowed ("*to make [their] contribution decision[s] immediately*"). The leader's contribution is then made public before her group members can make their own contributions. In the second stage, those who decided not to move first – i.e. the followers – choose their contributions simultaneously, after being informed of the first mover's contribution, if any. Then, the payoff of subject *i*, whether he contributes in the first or the second stage, is given by :

$$\pi_i = 20 - c_i + \alpha \sum_{j=1}^{3} c_j \quad with \ \alpha = .5 \tag{1}$$

At the end of each period, each member is informed of the total group contribution, individual contributions of her group mates, and her own payoff.

We limit the maximal number of leaders to one in each group and this is made common knowledge in the instructions (see Appendix).[2] If only a single subject volunteers to lead, the procedure described above applies. Since we may have none or more than one leader candidates, two other outcomes are also possible. If no participant is willing to lead, the three group members move directly to the second stage and contribute simultaneously to the public good. In this case, the game is similar to the standard voluntary contribution mechanism game, apart from the fact that simultaneity is achieved endogenously. If there are multiple leader candidates, a random draw determines the actual leader. Only the contribution of the selected candidate is indicated to others. The first stage contributions of eliminated candidates are neither taken into account nor made public. Instead, the eliminated candidates are treated like second stage players and are allowed to modify their proposed contributions.

Our design ensures that only eliminated candidates are aware of the existence of multiple leader candidates. This procedure also allows us to measure the revision of contributions of the leader candidates when they have not been selected. The extent of the revision may help disentangle between various motives for volunteering to lead. A socially-concerned individual should not revise much her proposed first-stage contribution when not selected. In contrast, an individual motivated either by opportunism or by personal influence is likely to revise her contribution drastically if eliminated, other things equal.

Two additional treatments. In the Benchmark treatment, only information regarding the contribution of each group member is provided. The *Attribute treatment* aims at studying if contribution and timing decisions are influenced by supplementary information about the group members. The treatment replicates the same structure as the Benchmark treatment. The only difference is that at the beginning of each period, ,

we announce the gender and charitable giving behavior of the group members, by means of pictograms.[3]

The charitable giving behavior is elicited in the beginning of the session. Once the first part of the instructions is read aloud, each subject is given a show-up fee of €6, part of which can be donated to an actual charity of his or her choice.[4] The difference between the show-up fee and the donation is added to the subject's account. The information about the subjects' donation is displayed as follows. A subject is awarded a yellow circle is her donation is strictly above the session average. Otherwise, she receives a gray circle.[5] It is important to note that the donation exercise may not be an exact measure of the true generosity of our subjects. When they make their donations, the subjects are aware of the rules game and thus know that this information will become public throughout the session. So, a donation may also be used a strategic tool.

In the Imposed-leader treatment, leadership is no longer endogenous. Each group is led by a single, randomly selected subject. As above, the leader moves first and others contribute simultaneously after the leader's contribution is announced. No information about attributes is displayed. This treatment bears resemblance to Gächter and Renner's (2005) protocol and allows us to address legitimacy issues. On the one hand, by contrasting the Benchmark and Attribute treatments we investigate the motives behind the self-selection process. On the other hand, contrasting the Benchmark and Imposed-leader treatments allows us to highlight the impact of self-selection on efficiency. As consequence of these comparisons, we analyze whether a voluntary leader contributes more than a designated one and whether second movers are more willing to follow a voluntary leader.

The theoretical predictions with purely selfish subjects are similar in the three treatments. In the absence of strategic reasons to cooperate, the subgame perfect

equilibrium is to contribute nothing in the second stage since every individual is better off by keeping his endowment for himself regardless of what the others allocate to the public good ($\alpha < 1$). Expecting such a dominant free-riding strategy, no subject contribute a positive amount in the first stage. We should therefore expect all subjects to free-ride in all three treatments. In contrast, the efficient outcome in all treatments is for each subject to contribute all her endowment to the group account ($n\alpha > 1$).

A personality test. At the end of the session, we administer a personality test to our subjects in order to investigate whether specific traits distinguish leaders and followers in the endogenous leadership treatments. This test allows to address the question of whether specific psychological features lead people not to behave as predicted by the subgame Nash equilibrium. We used the French version of the Five-Factor Inventory personality test commonly known as the "Big Five" (NEO-FFI) (see Costa and McCrae 2004; Rolland, Parker, and Stumpf 1998; Rossier, DeFruyt, and Rolland 2003). This test, providing a concise measure of the five basic personality factors (Costa and McCrae 1992), consists of 60 items, presented alternatively in positive and negative phrasing. It is based on voluntary self-assessment. Each subject is given an additional €2 for having completed the test. Respondents are asked to consider each item in the questionnaire and to decide, using a five-point Likert-type scale, how much they agree or disagree with each proposition (from '*strongly disagree*' to '*strongly agree*'). These items are related to five dimensions of personality (neuroticism, extraversion, openness, agreeableness and conscientiousness) that psychologists consider being able to summarize the personality of an individual.[6]

The questionnaire took 15 minutes to be completed. After the validation of the questionnaires, we factored the items for each gender[7] and computed a t-score for each factor that relates each individual score to the mean and the standard deviation of the

sample of participants. This allows us to compare directly the scores obtained by males and females and to include them in our econometric analyses.

Procedures

The experiment was computerized by utilizing the REGATE software (Zeiliger 2000). Sessions were conducted in the experimental laboratory of the Groupe d'Analyse et de Theorie Economique (GATE) in Lyon, France, by the same experimentalist. 141 subjects (72 females and 69 males) were recruited from undergraduate classes in the three local engineering and business schools. All subjects were inexperienced in public goods experiments. We ran 8 sessions under a stranger matching protocol.[8] Each session consisted of 3 sets of 10 periods alternating between two treatments. The ordering of treatments in the sessions is detailed in Table 1.

Table 1. Ordering of treatments in the experimental sessions

Periods 1-10	Periods 11-20	Periods 21-30	Nb sessions	Nb sujets
Benchmark	Attribute	Benchmark	3	54
Attribute	Benchmark	Attribute	2	36
Benchmark	Imposed-leader	Benchmark	3	51

Upon arrival, each subject drew a label from a bag, indicating the name of his computer, and entered the laboratory. The instructions (phrased in neutral terms, see Appendix) for the preliminary and the first parts of the session were distributed and read aloud. We added a short description of each of the three humanitarian NGOs and a form to be filled out by the participants requesting a receipt to prove the payment of the total donations to these NGOs. The subjects then filled out a questionnaire enabling to check their understanding of the rules of the game. Questions were answered in private. The subjects could then decide on the amount of their donation to a charity. Once all the subjects entered their decisions, the program matched them randomly and anonymously.

Groups were reshuffled after each period. At the end of the first (second) set of periods, the instructions of the second (third) part were distributed, with no questions allowed. Last, the personality test was administered and a final question was asked about car ownership; the answer to this question was used as an (imperfect) index of wealth.[9]

An average session lasted about 70 minutes. Each point earned during the experiment was convertible to Euro at 80 points = €1. The participants gave on average €1.04 to a charity (standard deviation = €1.61). They earned an average €15.70, corresponding to the sum of the payoff earned in each period and the fraction of the show-up fee they did not donated. An assistant who was not aware of the content of the experiment helped subjects with their donations and payments in private, all of which was made common knowledge in the instructions. This procedure was used to prevent any feeling of shame that could have biased the donation behavior if the payment was to be made in front of the experimentalist who conducted the sessions.

IV. RESULTS

We find a substantial proportion of subjects who are willing to lead, in contrast with the equilibrium predictions. In what follows, we first focus on the analysis of the decision to lead and its cost. Second, we examine the behavior of the non-selected leader candidates. Third, we concentrate on the leader's influence on followers. Last, we produce a cluster analysis of the subjects' behavior both as leaders and followers in order to examine the various motives to lead.

Leaders' behavior

We first give descriptive statistics for leaders' behavior. We then consider the determinants of such behavior based on regression analysis. Table 2 presents a

summary of descriptive statistics. A brief examination of the table reveals the existence of voluntary leadership, despite the implied cost of contributing before others.

Table 2. Descriptive statistics

Treatment	Benchmark	Attribute	Imposed-leader
Number of observations	2460	1260	510
Number of leaders (%)	618 (25.12)	336 (26.67)	170 (33.33)
% groups with a leader	56.46	59.29	100
Groups with a leader (averages)			
Candidate's contribution	11.97 (6.65)	12.12 (6.58)	
Actual leader's contribution	11.84 (6.71)	11.84 (6.61)	9.65 (7.39)
Actual follower's contribution	5.52 (6.89)	5.23 (6.68)	5.03 (6.60)
Size of the public good	22.87 (15.10)	22.29 (14.36)	19.71 (16.28)
Leader's payoff	19.46 (4.69)	19.16 (4.67)	20.06 (4.40)
Follower's payoff	25.79 (5.53)	25.77 (5.48)	24.69 (5.30)
Groups without a leader (averages)			
Contribution	1.84 (4.42)	1.40 (3.36)	-
Size of the public good	5.51 (9.25)	4.19 (6.61)	-
Payoff	20.79 (3.50)	20.56 (2.76)	-

Note: Standard deviations in parentheses. In the endogenous treatments, the number of leaders indicates the number of leader candidates.

As shown in Table 2 and contrary to standard predictions based on selfishness, we observe a significant proportion of subjects who are willing to lead in both endogenous leadership treatments. Figure 1 displays the evolution of this proportion over time by treatment. It appears that in the first set of ten periods, the proportions of subjects who are willing to lead their group are 33% in the Benchmark treatment and 36% in the Attribute treatment. Although these proportions decline over time, there are still 18% of subjects who are willing to lead in the Benchmark treatment and 22% in the Attribute treatment in the last set of periods. As a consequence, 57% of the groups have a leader in the endogenous treatments and this proportion is still 46% in the last set of periods.
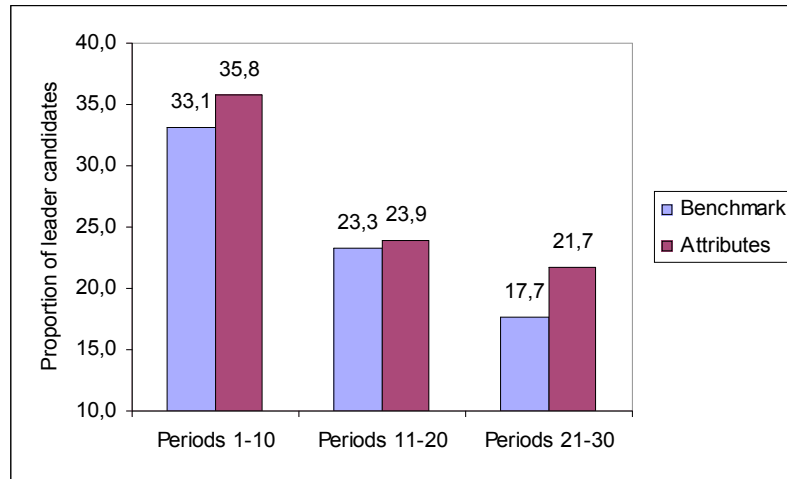
Fig.1. Evolution of the proportion of leader candidates by treatment

Voluntary leadership is surprisingly common despite the cost of contributing first. A first indication of this cost can be found in the comparison between leader candidates' and actual followers' average contributions in groups with a leader. Table 2 indicates that the leaders contribute on average twice as much as the followers. The ratio of average leaders' contribution to average followers' contribution is 2.14 in the Benchmark treatment, 2.26 in the Attribute treatment and 1.92 in the Imposed-leader treatment. Table 3 shows the evolution of average leader candidates' and actual followers' contributions over time and displays the ratios between the two values. The average leaders' contribution decreases less over time than the average follower's contribution. We find that the leaders' influence progressively vanishes and that the leaders are less and less paid in return for their efforts.

Table 3. Evolution of average leaders' and followers' contributions over time in groups with a leader

Periods	Treatments	Average leader candidates' contribution (1)	Average actual followers' contribution (2)	Ratio (1)/(2)
Sequence B-A-B				
1-10	Benchmark	12.30	6.92	1.78
11-20	Attribute	12.05	4.84	2.58
21-30	Benchmark	10.01	3.73	2.68

Sequence A-B-A				
1-10	Attribute	12.54	6.44	1.95
11-20	Benchmark	11.80	4.76	2.48
21-30	Attribute	11.51	4.06	2.83

A second indication of leadership costs can be found in the analysis of payoffs. As shown by Table 2, and in accordance with the different contribution levels examined above, in all treatments the self-selected leaders earn dramatically less than the followers in groups with a leader. The difference is larger when the leaders self-select. In the Benchmark treatment, on average a leader earns 75% of the follower's payoff. The corresponding values are 74% in the Attribute treatment and 81% in the Imposed-leader treatment. It could however be acceptable for an individual to lead at the price of earning less than the followers if this allows her to earn more than in the absence of a leader in the group. This is not what the data show. Contrasting the average payoffs in groups with or without a leader, we find that actual leaders earn slightly less than the average subject in groups without a leader. In the Benchmark treatment, the leader earns 19.46 points on average vs. 20.79 for any group member when the group has no leader and in the Attribute treatment, she earns 19.16 points compared with 20.56. If we consider the last set of periods only, leading requests a bigger sacrifice. In periods 21 to 30, the difference in payoffs between a leader and any member of a group without a leader is 2.14 points in the Benchmark treatment (instead of 1.32 in the first set of periods) and 1.79 in the Attribute treatment (instead of 1.21). Leaders are less willing to lead over time because subjects react to relative prices.

These statistics confirm that it is always better for a materialist subject to be in a group with a leader, since the size of the public good is larger (see Table 2), but not to be *the* leader. Leaders sacrifice to set the example in all treatments. They however sacrifice

16

less when they have been randomly imposed the role of a leader in the Imposed-leader treatment. In contrast, voluntary leaders seem to obtain some non-pecuniary satisfaction from fulfilling their roles. The immediate questions to be answered are therefore the following: Who are the subjects who accept to sacrifice for moving first? And, what do these leader candidates buy? The analysis of the determinants of a leader candidate's decisions provides the first elements to answer these questions.

Determinants of the decision to lead. We study the probability to run for leadership using random-effects probit models for pooled and separate treatments accounting for the fact that each individual repeats his decision a number of times. In these regressions, the exogenous variables include the subject's gender, the amount of points donated to a charity ("*donation*"), and the t-scores for each personality factor. We include a time trend to identify a possible evolution over time ("*period*") and a dummy for car ownership to account for wealth effects. In addition, the gender variable is interacted with the donation variable for being able to discern the effect of gender on donations (see Eckel and Grossman 2000). The donation variable is also interacted with a dummy indicating whether the benchmark treatment is part of a sequence including the Imposed-leader treatment ("*donation*BIB*"). Indeed, in this sequence strategic donations are ruled out since it is common knowledge that the donation will never be made public at any stage of the experiment. Interacting these variables allows us to control for the strategic nature of donations in the endogenous treatments. In the regression for the Attribute treatment, we also add four variables indicating that the subject is teamed with two low donors (subjects who gave a donation equal or lower than the average), two high donors (subjects who donated more than the average), two females or two males. Last, we include session dummies, the first session being the reference one. Table 4 reports the estimations of two models; the first model pools the

data of the two endogenous treatments, including a dummy for the Attribute treatment, whereas the second model only considers the data from the Attribute treatment.

Table 4. The decision to lead (random-effect probit models)

Variable: Leader choice	Endogenous treatments		Attribute treatment	
	Coefficient	Marginal effects	Coefficient	Marginal effects
Attribute treatment	0.087	0.024		
	(0.064)			
Period	-0.034***	-0.009***	-0.033***	-0.009***
	(0.003)		(0.006)	
Gender (male=1)	0.384**	0.103**	0.394	0.105
	(0.181)		(0.283)	
Donation (in points)	0.002***	0.0006***	0.003**	0.0007**
	(0.001)		(0.001)	
Donation * Gender	-0.002*	-0.0006*	-0.003*	-0.0008*
	(0.001)		(0.001)	
Donation * BIB	0.001	0.0002		
	(0.001)			
Car ownership	-0.143	-0.038	-0.167	-0.043
	(0.159)		(0.236)	
Neuroticism	0.005	0.001	0.015	0.004
	(0.008)		(0.011)	
Extraversion	-0.006	-0.002	-0.015	-0.004
	(0.008)		(0.012)	
Openness	0.013*	0.003*	0.009	0.002
	(0.007)		(0.011)	
Agreeableness	-0.009	-0.002	-0.013	-0.003
	(0.008)		(0.012)	
Conscientiousness	0.011	0.003	0.012	0.003
	(0.008)		(0.012)	
Match with 2 low donors			-0.208**	-0.054**
			(0.102)	
Match with 2 high donors			0.222	0.063
			(0.158)	
Match with 2 females			-0.104	-0.027
			(0.116)	
Match with 2 males			0.062	0.016
			(0.120)	
Session dummies	*Yes*		*Yes*	
Constant	-1.581		-1.041	
	(1.004)		(1.557)	
Observations	3720		1260	
Log-Likelihood	-1726.992		-581.932	
Wald χ^2	163.82		57.60	
Prob>χ^2	0.000		0.000	

Note: *** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

The probability to lead is decreasing over time in both estimations. This is consistent with both a learning hypothesis and the previous finding that the relative cost of leading increases over time. Those who donate a larger amount are more likely to be a leader candidate, suggesting that (genuinely or strategically) "generous" individuals are more willing to bear the cost of leadership. Both strategic and non strategic donations have similar impact as the coefficient associated with the "*donation*BIB*" variable is not significant. This is consistent with the descriptive statistics indicating that the average donation amounts to 104.49 points among the leader candidates and 79.65 points among those subjects who are not candidates. Descriptive statistics also indicate that the proportion of females who are willing to lead is 23% in the Benchmark treatment and 27% in the Attribute treatment, while the corresponding values for males are 26% and 28%, respectively. Other things equal, our regression finds that being a male increases significantly the probability to lead by 10% when we pool the data from the endogenous leadership treatments. The gender difference is however no longer significant when we only consider the Attribute treatment, either because females require more information about their group members than males to invest in leadership (they are more "conditional" than males)[10] or because they value the dissemination of information about own attributes when they run for leadership. In both regressions, females who donate more are also more likely to lead. [11] We find that the marginal effects of donation and donation by gender are very slightly larger when these attributes are observed by others (i.e. in the Attribute treatment), but when data are pooled, the probability to lead is not affected by the nature of the treatment (the coefficient of the "*Attribute treatment*" variable is not statistically significant).

Regarding the personality factors, only openness increases significantly but marginally the probability to be willing to lead when we pool all endogenous treatments together.

Personality factors have no significant impact in the Attribute treatment. The influence of openness is consistent with psychological studies of leadership. Judge, Bono, Ilies, and Gerhardt (2002) recall that in Bass's (1985) analysis, being original or creative is the primary predictor of leadership. They also note that originality and divergent thinking are primarily related to openness. It might mean that leaders are less conformist than followers and that subjects who are relatively less open than others are more likely to conform and may thus prefer to follow rather than lead. As a whole however, we do not find in our data a strong support for a theory of traits able to predict the likelihood of being a voluntary leader on the basis of the personality profile.

The estimates of the second model show that when provided additional information, people condition their decision to lead on some attributes of their group members. Indeed, being teamed with two low donors reduces the likelihood of running for leadership. The low relative donation of the group members may be taken as a signal of their lower willingness to contribute. The reluctance to becoming a sucker may reduce the likelihood of being a leader candidate. This impact is not symmetric: being matched with two high donors does not increase the likelihood to run for leadership. The positive effect of donations may be counteracted by a belief that at least one of the high donors will decide to move first. Lastly, the gender composition of the group does not affect the willingness to lead.

Leaders' contributions. Next, we turn to the determinants of a leader's contribution given that she has or not self-selected her role in the first stage of the game. We estimate random effect tobit models considering the first stage contribution proposed by every leader candidate as the independent variable, and accounting for the censuring of the data both on the left and on the right. The first model pools the data of all the treatments, whereas the second model pools the data of both endogenous

treatments and the third one only considers the data from the Attribute treatment. Table

5 reports the results of these estimations.

Table 5. Determinants of the leader candidate's contribution (random-effect tobit models)

Variable: leader candidate's contribution	All treatments	Endogenous treatments	Attribute treatment
Period	-0.215***	-0.216***	-0.096**
	(0.027)	(0.026)	(0.047)
Attribute treatment	1.348**	1.308**	
	(0.640)	(0.606)	
Imposed-leader treatment	-1.418*		
	(0.774)		
Gender (=1 if male)	0.801	1.268	0.729
	(0.784)	(0.854)	(1.391)
Donation (in points)	0.006	0.006	0.007
	(0.004)	(0.004)	(0.006)
Donation * gender	-0.005	-0.006	0.006
	(0.005)	(0.006)	(0.010)
Donation * BIB	0.004	0.001	
	(0.005)	(0.006)	
Car ownership	0.882	0.670	0.527
	(0.693)	(0.747)	(1.175)
Match with 2 low donors			-2.774***
			(0.902)
Match with 2 high donors			0.831
			(1.302)
Match with 2 females			-0.471
			(0.968)
Match with 2 males			-0.656
			(1.027)
Personality factors	*Yes*	*Yes*	*Yes*
Session dummies	*Yes*	*Yes*	*Yes*
Constant	14.707***	16.012***	18.251**
	(3.918)	(4.112)	(7.336)
Observations	1124	954	336
Left censured obs.	99	58	11
Right censured obs.	332	294	114
Log-Likelihood	-2835.842	-2407.131	-851.533
Wald χ^2	135.440	136.830	58.150
Prob>χ^2	0.000	0.000	0.000

Note: *** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

We find a negative time trend in the three regressions. The main findings from the estimation of the first tobit model are that imposed leaders contribute less than their volunteer counterparts, while announcing the attributes of the group members increases the voluntary leaders' contributions. These estimations supplement the simple comparison of the proportions of censured data across treatments. In the Imposed-

leader treatment, 24% of the leaders contribute nothing whereas 22% contribute their full endowment; the respective proportions are 8% and 29% in the Benchmark treatment, and 3% and 34% in the Attribute treatment.[12] The observation that voluntary leaders contribute more than imposed ones can be driven by at least two explanations: less constrained actions translate into higher levels of effort (see for example Falk and Kosfeld 2006 and Eriksson, Teyssier, and Villeval 2006); and free-riders are sometimes randomly selected as leaders in the Imposed-leader treatment. As observed by Gächter and Renner (2005), even free-riders try to lead when given the role of a leader if they expect followers to mimic their attitude. Our study shows, however, that they lead with a lower contribution than self-selected leaders. The intrinsic motivation of self-selected leaders is such that they invest more effort in their activity to set the good example.

We also observe that most personal variables have no significant impact on the leader's contribution, as if the role of a leader subsumed almost all the individual characteristics. In contrast, some attributes of the group members influence significantly the leader's contribution. In the Attribute treatment, having two low donors as group members reduces the amount contributed by the leader candidate. Again, at least two interpretations are possible. The leader candidate risks a lower amount of money in the collective investment if less generous donation behavior is taken as a signal of selfishness, making her anticipating less reciprocity from less generous followers. Alternatively, if the subject is willing to lead because she is mostly concerned with her personal influence on the group outcome, she may believe that she may get a good image by investing less when teamed with low donors.

Rejected leader candidates' behavior

When there is more than one leader candidate in a group, a random draw eliminates the excess candidate(s). 25% of the leader candidates (155 out of 463) have been

eliminated in the Benchmark treatment and 26% (87 out of 249) in the Attribute treatment. The rejected candidates can update their contribution in the second stage after being informed of the actual leader's contribution. 22% of the rejected candidates revise their contribution upwards and 41% revise downwards. This design allows us to compare the initial and the revised contributions of rejected leaders when they become followers, conditional on the actual leader's behavior. Since descriptive statistics indicate that males and females do not react the same way to a rejection, figure 2 displays the revision of contributions for females and males separately. A negative value implies that the second, revised contribution of the rejected leader is lower than her initial proposed contribution. The revision is related to the comparison between the actual leader's contribution and the original proposed contribution of the rejected candidate. We contrast the situation in which the selected candidate makes an inferior contribution and that in which she makes a superior contribution.
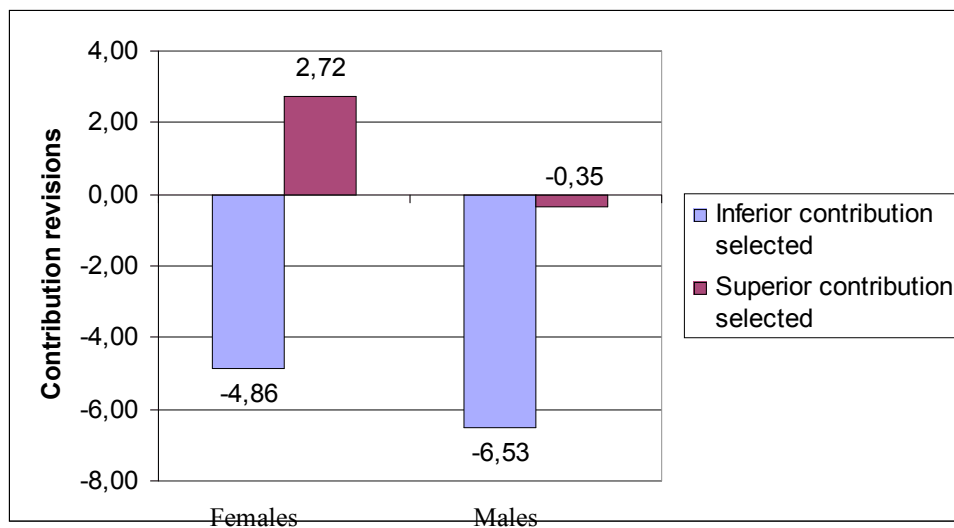
Fig.2. Revision of contributions by rejected leaders in the endogenous treatments according to the actual leader's relative contribution

When the actual leader contributes less than the amount originally proposed by the rejected candidate, the latter reduces her contribution. This revision is stronger for males. When the actual leader contributes more than the amount initially proposed by

the rejected leader, males and females have a different behavior. Females increase their contributions and follow the actual leader. In contrast, rejected male leaders slightly decrease their contributions and do not follow the actual leader.

To understand the determinants of the revision of a rejected candidate's contribution conditional on the actual leader's effort, we estimate two models on the pooled data from both endogenous treatments. We first estimate an ordered probit model with robust standard errors, in which the revision is the dependent variable, equal to +1 if the revision is upwards, 0 if no revision occurs, and -1 if the revision is downwards. Then, we estimate a GLS model in which the amount of the revision is the dependent variable. In both regressions, we include a time trend to identify a possible evolution over time and a dummy for the Attribute treatment. We measure the influence of the actual leader's contribution, controlling for gender, donation behavior, personality factors and session dummies. Table 6 reports these estimates.

Table 6. Determinants of a revision of the rejected candidates' contributions

| Variable: revision of contributions	Ordered probit model	GLS model
Prob>χ^2	0.000	0.000
Period	-0.002	0.027
	(0.009)	(0.047)
Attribute treatment	0.057	-0.196
	(0.210)	(1.018)
Actual leader's contribution	0.073***	0.522***
	(0.013)	(0.064)
Gender (=1 if male)	-0.382**	-2.520***
	(0.176)	(0.950)
Donation	0.001	-.0001
	(0.001)	(0.004)
Car	0.113	0.657
	(0.175)	(0.975)
Personality Factors	Yes	Yes
Session dummies	Yes	Yes
Constant		-4.324
		(6.119)
Observations	242	
Log-Likelihood	-234.591	
R^2	0.092 (pseudo)	0.294
Wald χ^2	51.040	89.540

The two regressions turn out to be quite similar. They confirm that the revision is positively influenced by the amount of the actual leader's contribution, but that males are less inclined than females to revise upwards. This suggests that the motivations behind the decision to move first could differ for males and females. In contrast, time, donation behavior, car ownership and personality factors exert no statistically significant impact on revisions.

Rejected leader candidates revise their contribution to the public good in the second stage of the game. But do they contribute in the second stage as any self-selected follower (those who did not apply for leadership) or are they still closer to the actual leaders? Figures 3a and 3b display the contributions of actual leaders, rejected leader candidates, and self-selected followers, for females and males respectively.
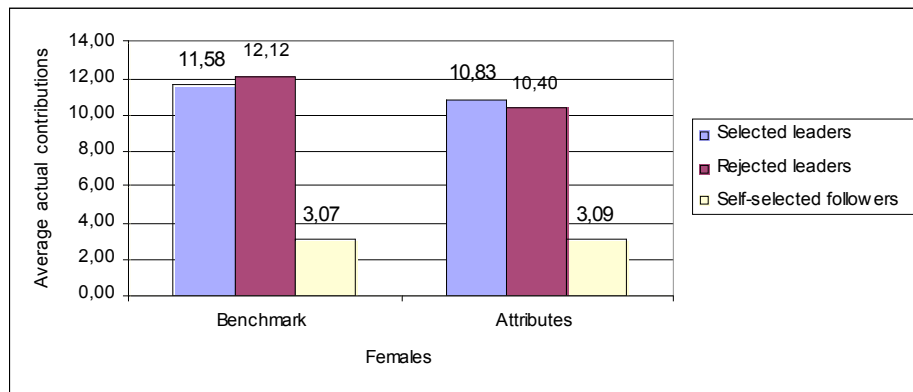
Fig.3a. Average actual contributions of females in the endogenous treatments
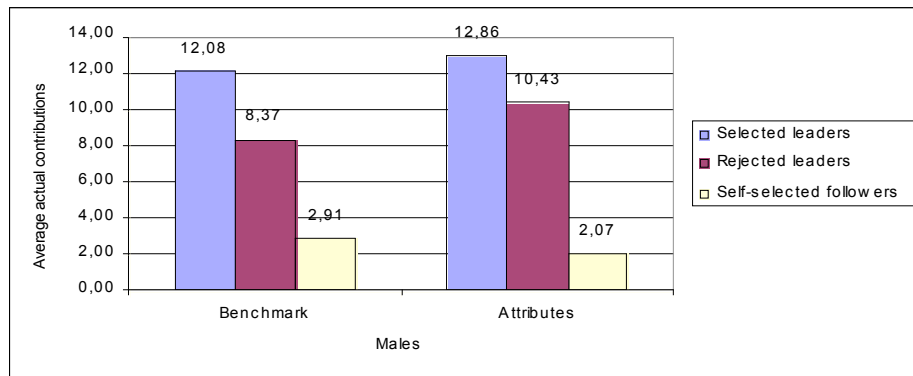
Fig.3b. Average actual contributions of males in the endogenous treatments

We observe that in both Benchmark and Attribute treatments, rejected female leaders contribute almost the same amount as actual leaders. In contrast, rejected males contribute significantly less than actual male leaders. The actual position seems to matter more for males than females. In either case, the contributions of rejected leaders are however significantly greater than the contributions of self-selected followers.[13]

The influence of leaders

Do leaders exert an influence on followers and if so, is this influence stronger when the leader self-selects than when she is randomly chosen? Influence may be measured in two different ways: first, by comparing the average second stage contributions in groups with and without a leader, and second, by relating the follower's contribution to the leader's one. In groups with no leader, average contributions are 1.84 in the Benchmark and 1.40 in the Attribute treatment. In groups with a leader, the average followers' contributions are 5.52 in the Benchmark treatment (+200%), 5.23 in the Attribute treatment and 5.03 in the Imposed-leader treatment (+274%). These descriptive statistics show that having a leader in a group makes a big difference in contribution behavior. We observe that a follower contributes 47% of the leader's contribution in the Benchmark treatment, 44% in the Attribute treatment and 52% in the Imposed-leader treatment. The coefficients of pairwise correlation between the second stage contribution and the actual leader's contribution in the group are 0.38 in the Benchmark treatment, 0.33 in the Attribute treatment and 0.48 in the Imposed-leader treatment. These statistics indicate that self-selected leaders do not seem to exert a stronger influence on their group members than randomly chosen leaders.

To analyze the determinants of the followers' contribution, we estimate random-effects tobit models. We include either a variable indicating whether the group has a leader or not ("*leader in group*") or the actual leader's contribution to measure his influence. A

dummy indicates whether the subject has been a leader candidate in the current period. We control for the usual variables, such as gender and donation behavior. Table 7 reports the results of several estimations.

Table 7. Determinants of the follower's contribution

Variable: Follower's contribution	All treatments	Benchmark and Attribute treatments		Attribute treatment	Imposed-leader treatment
	With leader	All groups	With leader	With leader	
Period	-0.317*** (0.030)	-0.455*** (0.027)	-0.274*** (0.030)	-0.358*** (0.058)	-0.792*** (0.199)
Attribute treatment	-0.332 (0.703)	-0.020 (0.565)	-0.425 (0.678)		
Imposed-leader treatment	0.679 (0.773)				
Leader in group		6.476*** (0.503)			
Leader's contribution	0.614*** (0.040)		0.589*** (0.944)	0.531*** (0.077)	0.760*** (0.087)
Rejected leader		5.286*** (0.786)	5.244*** (0.707)	6.560*** (1.167)	
Gender (=1 if male)	1.183* (0.691)	0.176 (0.634)	0.213 (0.753)	0.160 (1.289)	1.135 (1.671)
Donation (in points)	0.014*** (0.004)	0.010*** (0.003)	0.009** (0.004)	0.017*** (0.006)	0.006 (0.008)
Donation * gender	-0.009** (0.005)	-0.007* (0.004)	-0.007 (0.005)	-0.010 (0.008)	0.028** (0.012)
Donation * BIB	0.005 (0.005)	0.010** (0.005)	0.009 (0.007)		
Match with 2 low donors				-1.944* (1.026)	
Match with 2 high donors				-1.254 (1.341)	
Match with 2 females				1.416 (1.096)	
Math with 2 males				-1.535 (1.150)	
Car ownership	-0.192 (0.600)	0.236 (0.538)	-0.080 (0.642)	0.422 (1.071)	0.059 (1.515)
Personality fact.	Yes	Yes	Yes	Yes	Yes
Session dummie	Yes	Yes	Yes	Yes	Yes
Constant	-0.629 (4.001)	3.781 (3.590)	0.110 (4.273)	9.761 (7.319)	-18.563* (10.112)
Observations	1764	3008	1424	498	340
Left censured	854 (48%)	1906 (63%)	678 (48%)	241 (48%)	176 (52%)
Right censured	171 (10%)	180 (6%)	148 (10%)	51 (10%)	23 (7%)
Log-Likelihood	-3538.451	-4699.990	-2856.810	-1008.371	-675.309
Wald χ^2	448.380	702.860	394.870	157.460	117.080
Prob>χ^2	0.000	0.000	0.000	0.000	0.000

Note: *** significant at the 0.01 level; ** at the 0.05 level; * at the 0.1 level.

In the first estimation, we pool the data from the three treatments, we include dummies accounting for the Attribute and the Imposed-leader treatments, and we only consider groups with a leader. In the two next estimations, we analyze the data from both endogenous leadership treatments, considering successively all the groups, then the sole groups with a leader. The fourth and fifth estimations analyze contributions in groups with a leader in the Attribute and in the Imposed-leader treatments, respectively.

All these estimations show that the major determinants of the follower's contribution are the presence of a leader in the group and the amount contributed by this leader –self-selected or not. The presence of a leader however does not prevent the decay of followers' contributions over time in all treatments. In addition, being a rejected leader candidate pushes contributions upward, which is consistent with the results of the previous sub-section. Follower's contributions increase in the generosity of donations in most regressions, but in the Imposed-leader treatment this is true only for males.

If the previous results confirm the influence of leaders on followers, the first estimation shows however that the amount contributed by a follower is not significantly different across treatments when we control for the other dimensions. In other words, self-selected leaders are not more influential than random leaders. A potential explanation is related to the sorting process. In the endogenous treatments, leaders contribute more but self-selected followers are on average more selfish than leaders, whereas in the Imposed-leader treatment, selfish subjects may be designated as leaders and pro-social subjects as followers. In addition, in the Attribute treatment, followers condition their contribution on the relative donation behavior of their group members and not only on the leader's contribution. In particular, being matched with low donors influences this effort (marginally) negatively, probably because the subjects infer from a lack of generosity a lack of reciprocity from the other follower. This is consistent with what

Gächter and Renner (2006) name the "belief effect" when they observe that followers'
beliefs put more weight on the other followers' past behavior than on the current
leader's behavior. An alternative specification (not reported here) indicates that the
leader's attributes exert no additional influence because followers only pay attention to
her actual contribution when deciding on their own effort.

If self-selected leaders are not more influential than random leaders, we have seen
however that they contribute more on average. As a consequence, in groups with a
leader the average size of the public good is higher when leadership is endogenous than
when it is randomly assigned. Indeed, on average the public good amounts to 22.87 in
the Benchmark treatment, 22.29 in the Attribute treatment and 19.71 in the Imposed-
leader treatment. In contrast, when there are no leaders, the public good is only 5.51 in
the Benchmark and 4.19 in the Attribute treatment. Efficiency is higher when
leadership is based on a voluntary decision if and only if there are candidates; when
there are no candidates, efficiency requires designating any team member as a leader.

<u>Heterogeneity of behavior towards leadership</u>

Our econometric analysis enables to understand the major determinants of the
subjects' behavior conditional on their role. To better understand the diversity of
motivations behind the decision to lead when leading is voluntary, we turn now to a
cluster analysis. Instead of starting from pre-defined strategies, we derive these
strategies from the results of the cluster analysis. This method helps in identifying
homogenous groups of subjects following the same type of behavior during the game.
In order to partition the sample, we retain three variables that summarize each
individual's decisions in the two endogenous leadership treatments: the relative
frequency of the decisions to lead, the average first-stage contribution as a leader
candidate, the average second-stage contribution as a follower. We apply the

hierarchical Wald method based on the minimization of the intra-group variance

$(\sum_{k=1}^{p}(x_{ki}-x_{kj})^{2})$ to identify the clusters that sum up the participants' strategies. We obtain

four main clusters. Table 8 summarizes the statistics regarding each cluster; for

memory, it also reports the average donation in each cluster but this variable is not

active in the identification of the clusters.

Table 8. Cluster analysis

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	All subjects
Relative frequency of the decision to lead	18.60	20.33	28.14	43.72	25.77
Mean 1st stage contribution	4.83	18.49	10.90	16.91	10.62
Mean 2nd stage contribution	1.62	1.47	4.10	8.54	3.91
Mean donation	67.37	16.00	86.67	116.92	83.40
Number of observations	38 (27%)	5 (4%)	60 (43%)	26 (18%)	141

Cluster 1 consists of subjects who are less often willing to lead than the rest of the

population and who contribute less than the average both as leaders and as followers.

The singularity of this group lies mostly in the average first-stage contribution that only

represents 45% of the average leaders' contribution in the whole population. Cluster 2

consists of subjects who do not lead much more frequently than those belonging to

cluster 1 but are characterized both by the maximum first-stage contribution (close to

full cooperation) and the minimum second-stage contribution (close to full free-riding)

in the population. This cluster groups a very few number of subjects but it is robust to

many alternative specifications. Cluster 4 is characterized by the highest frequency of

the decision to lead (in more than 43% of the periods), accompanied by a high average

first-stage contribution and also the highest average second-stage contributions. In this

cluster, the average followers' contribution is more than twice as high as that in the

whole population. Cluster 3 represents an intermediate category with characteristics

close to the averages.

This cluster analysis provides a clear-cut indication of the coexistence of various motives in the decision to lead. Behavior in cluster 1 is close to that predicted by Varian's model (1994), in which the leaders are the selfish individuals: they move first and they free-ride. In addition, we observe that the mean donation of these subjects is below the average of the population. Behavior in cluster 2 can be interpreted as motivated either by opportunism or by a strong concern for personal influence: these subjects contribute a lot as leaders but they fully free-ride when followers; in addition, they donate almost nothing to the charities. These subjects expect the followers to conform but are not conditional cooperators themselves. In contrast, behavior in cluster 4 seems to denote either altruism or a strong concern for teaching: these subjects lead very often with relatively high first-stage contributions although they learn the relative cost of leading. Among these subjects, those who continue to be willing to lead in the last set of periods are probably more motivated by altruism than by a willingness to teach since they are able to observe the negative time trend in followers' contributions. The average donation of these subjects is 40% higher than that in the whole population.

V. DISCUSSION AND CONCLUSION

Informal leadership in groups is frequent although setting a good example is costly and is not associated with direct remuneration, in contrast with authority. In this paper we tested whether voluntary leadership can emerge without any direct communication between players in a cooperation game where free-riding is a dominant strategy. We designed a public good game with endogenous timing in which each subject chooses between contributing first or after the announcement of the leader's contribution, if any. An artefact allows us to observe the revision of contributions

between the first and the second stages for a part of the candidates. Last, we examine the relative influence of self-selected versus imposed leaders on other group members.

Our primary finding is that a high proportion of subjects are willing to lead although they earn considerably less than followers and even less on average than when the group has no leader. This result is in contrast with experiments on endogenous timing in duopoly games observing that Stackelberg outcomes are not frequent. The decision to lead is influenced by own traits, such as gender, generosity and openness. Personality factors have, however, no strong explanatory power. Context matters in the sense that some information about the team members conditions the decision to lead; in particular, to form beliefs about the likely attitude of others towards cooperation the subjects interpret the relative donation behavior as a signal. In groups with a leader, voluntary leadership improves efficiency since self-selected leaders contribute more than imposed leaders. However, followers are not more influenced by self-selected than by imposed leaders.

No single theory is able to explain our findings but the information we have collected enables to suggest complementary explanations of the decision to lead. Our cluster analysis has identified a fraction of subjects who lead frequently and contribute a large proportion of their endowment. Among these cooperators, altruism is a potential explanation that is supported by the positive correlation between the amount of the donation to a charity and the probability to lead. It is also supported by the number of remaining candidates in the last set of periods although the subjects have been able to learn the cost of leading. Cooperators may also be people who are concerned by the group outcome and who try to teach others that the payoff maximizing strategy for the group is to coordinate on full cooperation. Both explanations are consistent with the fact that the behavior of rejected candidates in the second stage is closer to actual

leaders' than to self-selected followers' behavior. However, if altruism can explain that there are still candidates in the last periods, the teaching explanation cannot.

In contrast with these socially-oriented motives, our experiment also provides evidence for self-interest in the decision to lead. A fraction of subjects move first and free-ride. Selfishness may explain such behavior. These subjects do not try to set an example; they make it clear that the burden of the public good is transferred to the others. Another group of subjects contribute a high amount as leaders but free-ride as followers. This opportunistic behavior mimics socially-concerned leaders to exploit the reciprocity of others. These subjects expect to earn more by contributing first when they realize that followers reciprocate. In a follower's position, they exploit the leader's effort. This behavior may also express a concern for personal influence: some people value the public announcement of their first contribution since it makes their personal role in the group outcome common knowledge. With such a motivation, investing the same amount is not meaningful when the individual moves second. This concern might also explain why some rejected leader candidates –especially males- revise their contribution downwards. This downward revision is consistent with concern for personal influence and opportunism, but neither with altruism nor concern for the group outcome.

Our experiment concludes by noting the heterogeneity of strategies and types. These results add to a growing body of experimental research that shows the importance of heterogeneity of types in the dynamics of cooperation in humans (Burlando and Guala, 2005; Kurzban and Houser, 2005; Bardsley and Moffatt, 2005; Gächter and Fischbacher, 2006). Once the role of the type composition of groups has been established, further research is needed to see how the manipulation of group formation could improve the efficiency of leadership.

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[1] Explaining why blood donations might be adversely influenced by the introduction of material incentives (as shown by Titmuss 1970), Arrow (1972) suggests that charitable behavior may be motivated not merely by a desire to increase someone else's welfare, "but from the fact that the individual himself has contributed to that satisfaction," (p. 348). These approaches highlight the fact that individual may be interested in what others think, bearing close resemblance to the model of Bénabou and Tirole (2005) in which individuals are concerned with maintaining a positive social image in their reference group.

[2] If we allowed for a multiplicity of leaders, we could observe 3 leader candidates who would then contribute simultaneously like in the standard game. There would be no difference between a three-leader group and a group without any leader. Our design presents also the advantage of allowing us to study the revision of contributions between the two stages by non selected leader candidates.

[3] The choice of the number of attributes is directed by the willingness to characterize an individual without putting his anonymity into question. The choice of the attributes themselves is driven by the same considerations.

[4] The charities were Handicap International (http://www.handicap-international.org/), Médecins sans Frontières (http://www.msf.org/), and the United Nations Children's Fund (UNICEF) (http://www.unicef.org/). We offered the choice between three NGOs to avoid that some subjects refuse to donate not because of the idea of giving up money but because they dislike a specific organization.

[5] We do not display the amount of the donation to avoid that people recognize another player after several repetitions of the game.

[6] A subject's neuroticism score helps us distinguish individuals with low self-esteem from those who are calm. The extraversion score opposes outgoing and talkative subjects to inhibited persons while the openness score distinguishes original from conservative subjects. Agreeableness contrasts trusting and forgiving individuals to rude ones. Conscientiousness distinguishes reliable from disorganized subjects.

[7] A high number of successive identical responses is considered as raising doubt on whether the subject answered trustfully. We did not find such cases in our sample, each questionnaire has therefore been used.

[8] 7 sessions involved 18 subjects and 1 session involved 15 participants.

[9] Only a small minority of these students is working. Asking the participants whether they have a job is not informative. Asking about the parents' income gives typically a low response rate. Ownership of a car is an imperfect but indicative measure of resources. 61% of the participants own personally a car (64% of the females and 58% of the males). A two-sample test of proportion accepts the null hypothesis of no difference between the proportion of car owners among females and males (p=.47).

[10] The greater conditionality of females' economic decisions has been observed with respect to the attitudes towards competition (see Gneezy, Niederle, and Rustichini 2003 Datta Gupta, Poulsen, and Villeval 2005).

[11] Females make greater charitable donations than males, 88.89 vs. 77.68 points on average, and they seem to be less strategic than males. In the sessions (with the BEB sequence) in which it is common knowledge that no information about donation will be revealed during the experiment, females donate on average 73.60 points and males 55.38; in the sessions where it is common knowledge that this information will be displayed at some point in time, females donate 97.02 and males 91.16.

[12] The Exogenous treatment is only played in periods 11 to 20. If we only consider these periods, we still observe that the proportions of leaders who contribute nothing are 6% in the Benchmark and 5% in the Attribute treatments; the proportions who contribute their full endowment are 38% and 33%, respectively.

[13] The use of a stranger matching protocol does not provide enough independent observations to do non parametric statistics. An imperfect alternative is to use the data from the first three rounds of the pooled endogenous treatments considering that the rematching of groups is such that at the beginning of the game most people are teamed with new subjects at each new repetition. Mann-Whitney U tests conducted in these conditions accept the null hypothesis of no difference between female actual and rejected leaders' actual contributions (p=0.385) but reject it when comparing rejected leader's and self-selected follower's contributions (p=0.006). Similar tests for males reject both null hypotheses (p=0.009 and 0.022, respectively).

APPENDIX. Instructions for the Benchmark – Attributes - Benchmark sessions (other instructions available upon request)

You are now taking part in an experiment on decision-making. During this experiment, your earnings depend on your decisions and the decisions of others. It is therefore important that you read these instructions with care.

In most cases, the amounts evoked during this experiment are expressed in points. The conversion rate of points into Euros is:

$$80 \text{ points} = 1 \text{ Euro}$$

During this session, your earnings in points will be put on your account, cumulated and converted to Euros. The total amount of the compensation you will receive is confidential. It will be paid in cash in private in a separate room by a person who is not aware of the content of this experiment.

All your decisions are anonymous.

This session is divided into four parts. The instructions relative to the parts 2 to 4 will be distributed later.

Before starting the first part, we give you a show-up fee of €6. With this show-up fee, you can put Euros on your account and make a donation to a charitable organization.

❑ You can put Euros on your account. The amount of the show-up fee that you put on your account will be added to your earnings made during this session and paid to you in cash at the end of the session.

❑ You can make a donation to a charitable organization, among the three following: *Handicap International, Médecins sans Frontières,* ou *UNICEF*. You can find a description of each of these organizations in Appendix to these instructions.

If so, your donation will be made in private at the end of the session in a box in the payment room in presence of a person who is not aware of the content of this experiment.

We commit on our honor to give the entirety of these donations to these organizations. If you want to receive personally a receipt justifying the payment of all the donations to the three associations, please fill out the form attached to these instructions.

To make your decision, you are required to click one of the combinations displayed on your screen (from €0 for the donation and €6 put on your account, to a €6 donation and €0 put on your account). If you have chosen to make a donation, you will then indicate whom of the three organizations you want to give your donation to.

The information on your donation can be disseminated, anonymously, to the other participants during this session, as follows:

❖ A yellow disc indicates that your donation is higher than the average donation made by the participants to this session.

❖ A grey disc indicates that your donation is equal to or lower than the average donation made by the participants to this session.

You will also be requested to indicate your gender. This anonymous information is also liable to be disseminated to the other participants during the session. In all cases, you will be informed in the instructions preliminary to the dissemination of these pieces of information.

First Part

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly.

Decision-making in each period

The three members belonging to a group can participate in a project, by constituting an amount that will be shared equally among them. This amount results from the individual contributions of the three group members.

At the beginning of each period, you receive an endowment of 20 points.

Each period consists of two stages.

❑ **In the first stage**, you decide if you are willing to make your contribution decision immediately or if you prefer to wait for the second stage.

Make your decision immediately means that you choose in the first stage the amount of your contribution to the project. This amount can take any possible value between 0 and 20 points.

The two other group members are informed on this contribution before making their own contribution decisions in the second stage.

In the group, only one member can contribute in the first stage. Three cases can occur.

➢ *1st case*: only one member has chosen to make his contribution decision in the first stage. The procedure described above applies.

➢ *2nd case*: more than one member in the group have chosen to make their contribution decisions in the first stage. A random draw determines the one whose contribution is taken into account. This random draw is independent on the chosen amount. The one or those who have not been randomly drawn are informed; their first stage contribution is not accounted for and the other group members are not informed about this contribution; they move to the second stage and they can modify the contribution they had previously indicated. Only those who were involved in the random draw and have not been drawn are informed about the existence of this random draw.

➢ *3rd case*: no member in the group has decided to contribute in the first stage. The three group members move directly to the second stage.

❑ **In the second stage**, after being informed of the contribution made by the member who has made his decision in the first stage, if any, the group members who have not decided in the first stage choose simultaneously the amount of their endowment they contribute to the project, i.e. any value between 0 and 20 points.

After all members have made their decisions, each one in the group is informed about the amount of each member's contribution in the second stage, the total amount of the project and his own payoff for the current period.

Calculation of your payoff in each period

❑ Your income consist of two parts:

➢ the amount of your endowment which you have kept for yourself (i.e. 20 points – your contribution to the project),

➢ your income from the project: this income represents half of the total contribution of all 3 group members to the project, whatever your personal contribution. In other words, we increase the amount of the project by 50% of the contributions and the total amount of the project is shared equally among the members of the group.

Your total income is therefore calculated by the computer program as follows:

> (20 points – your contribution to the project)
>
> + 50% (total contributions to the project)

The income of each group member is calculated in the same way, this means that each group member receives the same income from the project.

For example, suppose the total contributions of all group members is 40 points. In this case each member of the group receives an income from the project of 1/2 (40) = 20 points. If the total contribution to the project is 5 points, then each member of the group receives an income of 1/2 (5) = 2.5 points from the project.

For each point of your endowment that you keep for yourself you earn an income of 1 point. For every point you contribute to the project instead, the total contribution rises by one point. Your income from the project would rise by 1/2 (1) = 0.5 point. The income of the other group members would however also rise by 0.5 point each, so that the total income of the group from the project would rise by 1.5 point. Your

contribution to the project therefore also raises the income of the other group members. On the other hand you earn an income for each point contributed by the other members to the project. For each point contributed by any member you earn 1/5 (1) = 0.5 point.

It is prohibited to communicate with the other participants during the experiment. If you violate this rule, you will be excluded from the experiment and from payments.

If you have any question regarding these instructions, please raise your hand. We will immediately answer to your questions in private.

* * *

Second Part

[These instructions were distributed at the end of the first 10 periods]

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly.

The rules for decision-making are the same as before, except for one thing.

At the beginning of each period, you are informed about the attributes of each member of your group and the other members of your group are informed about your attributes. These anonymous attributes are your gender and the color corresponding to your donation (a yellow disc for a donation above the average donation made in the session and a grey disc for a donation equal to or below the average).

Each contribution, made either in the first or in the second stage, is displayed on your screen beside these attributes.

The payoffs of each period are calculated like in the first part.

* * *

Third Part

[These instructions were distributed at the end of the first 20 periods]

This part consists of 10 periods. The participants are divided into groups of three. In each new period, the composition of your group is modified randomly.

During this part, the instructions are those in use during the first part.

* * *

Fourth Part

This fourth part consists of a questionnaire comprising 60 affirmations. Please read each of them carefully. For each item, please circle that of the five boxes which fits your opinion best:

Circle **SD** (Strongly Disagree) if the affirmation is quite wrong or if you strongly disagree.
Circle **D** (Disagree) if the affirmation is rather wrong or if you disagree.
Circle **N** (Neutral) if the affirmation is almost equally wrong or true or if you cannot choose or if have no opinion.
Circle **A** (Agree) if the affirmation is rather true or if you agree.
Circle **SA** (Strongly Agree) if the affirmation is quite true or if you strongly agree.

There is no "good" or "bad" answer. The aim of the questionnaire will be reached if you describe yourself and if you express your opinions as exactly as possible. Answer to each question. If you made a mistake or if you change your mind, do not erase. Put a X on the incorrect answer and circle the correct answer.

You will earn 2 additional Euros for filling this questionnaire out. Your answers are of course still anonymous and will never be communicated to anyone. I thank you for filling this questionnaire sincerely.