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Community Mobilization Around Social Dilemmas: Evidence from Lab Experiments in Rural Mali

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Community mobilization around social dilemmas: evidence from lab experiments in rural Mali.*

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Abstract: Community mobilization is a key feature of community-based development projects. Community mobilization requires facilitating communication between village members and between leaders and the rest of the community. Is communication an effective device through which mobilization may foster collective action? Does informing the community on how to reach a better social outcome key? Should we expect the effectiveness of community-based programs to depend on the quality of leadership in the community? In rural communities of Mali, we find evidence of high levels of cooperation as measured by a standard public good game. Communication between players increases contributions to the public good. Passing of information through a random community member also improves cooperation, and leadership skills matter. We also find suggestive evidence that changes in behavior are mediated through changes in beliefs. The experiments are embedded in a larger randomized controlled trial designed to evaluate the impact of a community-based sanitation intervention. As such, our results are relevant for a large population. Finally, we find that the program help strengthen the capacity for collective action.

JEL: D78, C93, H41
Keywords: Public good experiments, communication, leadership, and community-based development.

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1. INTRODUCTION

Community-based projects are a popular policy tool for developing countries. Most of them aim at improving the delivery of a public good, usually by encouraging community mobilization. The advocates of this participatory approach argue that it strengthens the civic capacity of communities, empowering them to lead changes necessary for development. General disappointment with top-down policy led the World Bank to make them into a cornerstone in the fight against poverty (Mansuri and Rao, 2004). Yet, the evidence on the effectiveness of community-based development projects is scarce and rather mixed (Miguel and Gugerty 2007; Olken, 2007).

Using a series of experiments conducted in the field, we study how a community's capacity to act collectively to produce a public good may be improved by communication and leadership.

Evidence from laboratory experiments show that the free riding problem is not as prevalent as standard economic theory predicts, see Ledyard (1995), Zelmer (2003) and Chaudhuri (2011) for reviews. These findings suggest that agents may not only care about their monetary payoffs, but also about others' actions, payoffs or welfare. Another robust finding in the experimental literature on cooperation is that contributions are sensitive to design features. Communication, either between players or mediated by a specific individual, is found to increase contributions to the public good (Isaac and Walker, 1988; Sally, 1995; Cason and Khan, 2008).

However, evidence from the field is scarcer, especially from developing countries. Cardenas and Carpenter (2008) point out to two shortcomings of the evidence collected so far on games played in the field. First, the relevance of empirical findings is expected to increase with external validity. They recommend not only making the sample more representative, but also showing how

experimental findings relate to the economic decisions of the poor. Second, the authors argue for more policy-oriented research.

We designed and conducted a series of experimental games over 121 communities in rural Mali. These communities were selected to benefit from a sanitation program designed by UNICEF and run by the government of Mali. The intervention relies heavily on community mobilization. Experts argue that adoption of good sanitation practices requires focusing on the whole community rather than on individual behaviors (Kar and Chambers, 2008). According to this view, the limiting factor for ending open defecation is neither informational, nor technical or financial, but rather lies in the capacity of the community for collective action.

Our laboratory experiments in the field help focusing on specific mechanisms through which the Malian community-led sanitation project may produce its impact and test behavioral hypotheses (Card, DellaVigna and Malmendier, 2011). We ran a series of Voluntary Contribution Mechanism games (Marwell and Ames, 1979) with mild framing. We first measure cooperation when **no communication** is allowed. We then investigate the role of communication: does unmonitored open **discussion** between villagers playing the game lead to higher cooperation? Does letting a game participant advise other villagers on the actions needed to reach the socially desirable outcome make a difference? How does this effect depend on the **leadership** skills of the person designated to convey the message to the rest of the group? One can expect that unobserved factors both explain leader quality and levels of cooperation within villages. For instance, previous mismanagement of public resources may affect the ability of villagers to contribute to the public good and to have good leaders. In order to address this issue, we exogenously manipulate the quality of the leader who is chosen. We do so by randomly selecting the person in charge of leading the discussion in each village.

The contribution of this paper is twofold. First, our study is embedded in a broader randomized controlled trial of this large-scale intervention to eliminate

open defecation in rural communities in Mali.[1] The literature combining randomized controlled trials (RCT) to evaluate development projects and lab experiments in the field is relatively scarce.[2] Our design included the lab experiments at the planning stage of the evaluation, enabling us to test if there is any effect of the community-based intervention on cooperation, as measured by the public good games. Our study is based on a large representative sample of program target communities for the region of Koulikoro in Mali. In this sense, the insights gained from our experimental games can be extrapolated to the population targeted by the program in this region and similar rural areas.

Secondly, our games allow us to test some of the links in the causal chain from the program to its impact. There are two reasons for that. One is that participants are drawn from the pool of villagers in the communities targeted by the program. The second is that the experiments, although only mildly framed as a community activity with no mention to sanitation, are designed to replicate some features of a community-based intervention. Community mobilization requires facilitating communication between village members and between community leaders and the rest of the group. Is communication an effective device through which mobilization may foster collective action? Does informing the community on how to reach a better social outcome key? Should we expect the effectiveness of the program to depend on the quality of leadership in the community? Beyond making the exercise policy-relevant, having the experiments played on the field rather in the lab is a necessary feature of our protocol. In this sense, the field provides the relevant context in which the effect of leader quality on cooperation can be assessed.

[1] We collected baseline data in March-June 2011 and follow-up data in March-June 2013 for about 5,000 households. Using random assignment, we divided the village sample into a treatment group, enrolled into the program in November 2011, and a control group, whose participation to the program is postponed until the end of June 2013. The RCT timeline is presented in Appendix Figure A1.

[2] There are, to the best of our knowledge, three studies. Jakiela and Miguel (2014) use a variant of the dictator game to test whether a merit-based scholarship program in Kenya has an impact on respect for earned property rights. Barr et al. (2012) use public games to test whether the introduction of school monitoring committee in Uganda improved cooperation. Fearon et al. (2009) use similar games in communities affected by armed conflict in Liberia to test whether the introduction of community development committees helps raise funds to a collective project.

We find, consistent with other findings in the lab, that communication between villagers improves cooperation. The proportion of players contributing to the public game increases by 8 percentage points compared to a base of 71%. When we instruct a participant to tell all other players that the socially efficient outcome requires them to all contribute, cooperation also improves. Compared to the gains from open discussion, improvement is higher by 2 percentage points.

Interestingly, the leadership attributes of the person passing the advice matter. Because we randomly pick the person who acts as a "leader", we can identify the causal effect of leadership attributes. First, we ask players to rank each other in terms of their capacity to be good community representatives, good conciliators and with respect to their height. We find that relative height has positive and significant effect on group cooperation.

Some leader personal attributes, as measured in the household survey, also matter for cooperation. There is a statistically significant difference according to gender, as male leaders have a strong positive effect on group cooperation. Cooperation increases with the age of the leader. Using an index of social capital, we find that cooperation is greater the higher social capital of the leader is. We find that literacy, in our pool of players where literacy rate is very low (15%), has a negative and significant effect.

Finally, cooperation, as measured by game outcomes, has improved as a result of the program. We find a positive and statistically significant impact of the community-based sanitation intervention on game contributions.

In Section 2, we present the setting. We then describe the experimental design and testable hypotheses in Section 3. Our empirical findings are presented in section 4. We discuss the policy-relevance of our findings in Section 5, and conclude in Section 6.

2. RESEARCH ENVIRONMENT

Community-based sanitation

Our games are embedded in a broader randomized controlled trial of a large-scale intervention to eliminate open defecation in rural communities in Mali. Open defecation is a widespread practice in many rural and peri-urban areas in developing countries. Such practice is believed to have severe health consequences for children such as diarrhea and growth retardation (Spears, 2013).

The programs aimed at eliminating open defecation have used various approaches ranging from high subsidies for sanitation hardware and sanitation marketing to community-based approaches that aim at fostering behavioral change (and combinations of all of the above). One challenge faced by many of these interventions is usage of the sanitation facilities, despite improved access.

The intervention carried out in Mali is called Community Led Total Sanitation (CLTS) and relies heavily on community mobilization as a way to foster collective action and achieve a cleaner environment. Typically, facilitators in charge of the program gather the community with the objective of triggering the adoption of good sanitation practices. During this initial gathering of the community, a number of activities are conducted to raise awareness on the risks associated with open defecation and help develop a plan to build latrines. Ultimately, the objective is to end open defecation. To attain this objective, everyone in the community has to have access to a private latrine with a cover that is equipped with a hand washing station (bucket with water and ashes or soap). This initial gathering of the community is followed by a period of intensive monitoring to encourage progress towards goals agreed upon (building, repairing and using latrines). Finally, when the initial plan is met, the community is certified as Open Defecation Free with a celebration that is valued by community members.

CLTS is an intervention aiming at solving a classic example of a collective action problem, whereas each member of the community bears the private cost of contributing by building and using latrines and the benefits through better health outcomes depend on what the rest of the group do. The benefits of improved sanitation are higher the higher the proportion of people in the community adopting better sanitation practices.

We focus on the community mobilization feature of CLTS and are interested in looking specifically at the factors facilitating communication among village members, and between community leaders and the rest of the group.

Koulikoro village sample

The region of Koulikoro is divided in three agro-ecological zones, which reflect three distinct economic and social organizations. The Northern zone or Sahel zone is very arid, with a long dry season lasting between 9 and 11 months. The main activity is transhumant nomadic stock rearing with subsistence agriculture. The middle zone, the Sudan zone, is semi-arid and sub-humid. There, agricultural activities are more intensive. Stock rearing is sedentary with seasonal migration, and is more integrated with crop production. The Southern zone is humid with production oriented towards agriculture.

The sample is designed to help assessing the impact of the sanitation intervention in Koulikoro. The sampling frame thus includes all small rural villages with low latrine coverage and no sanitation program in place.[3] We obtain a sampling frame with 402 villages. Our main source of information for sampling is the Census data from 1998 (*Infrastructure du Recensement* 1998). We use updated village size by applying population growth rates from the 2009 Census.[4] We also complemented

[3] These are villages with 30-70 households and with less than 60% of household having access to private latrines.

[4] Unfortunately, the 2009 Census was not yet released at the date we built the sampling frame.

these data with a list of villages that already benefitted of the intervention that we obtained from the Koulikoro Sanitation Office (*Direction Régionale de l'Assainissement de Koulikoro*).

We opted for a systematic sampling method that allowed us to add a minimum spacing criterion between villages in order to limit contamination from neighboring communities.[5] Indeed, physical contamination of fecal elements through air and water from neighboring communities may limit the benefits from the intervention and discourage the adoption of clean practices in the targeted villages. If the program is brought up to scale, contamination should not be such a concern. This, in turn, implies that the impact for our effectiveness trial can be considered as the actual impact for the scaled-up intervention.[6]

We draw a systematic sample based on the following steps:

1. We pick a village (the primary sampling unit) at random from the sampling frame,
2. We draw a circle of radius 10km around the village and we pick another village at random from the sampling frame excluding the area around the previous village,
3. We repeat steps (1) and (2) until we get 121 villages or exhaust the sampling frame.

We then conducted a census of all households in the sample villages. Our main survey module (the household questionnaire) gathered detailed information on households living in the sample villages with at least one child below age 10. We also collected information at the village level, and at the household and individual levels for all household members.

[5] Any two villages must be at a minimum 10 km distance from each other.

[6] In contrast, in Miguel and Kremer (2004), positive externalities accounted for most of the program impact, so missing out on them would have led to under-estimating the actual program benefit.

Game participants sample

The sampling frame here comprises all surveyed households. In each of the village, every other household is randomly selected to send an adult household member to participate to the games. Clearly, selection within household is not likely to be random.[7] But this actually is similar to the way the community-driven sanitation program operates: they invite households to participate in community meetings, and it is the household who chooses who to send.

An advantage of this sampling framework is that, once we apply sampling weights, our game results are representative of the intervention-targeted population in the region of Koulikoro and similar rural areas.

Sample descriptive statistics

Descriptive statistics from the survey data is presented in Table 1. The household data covers 121 villages, about 4,500 households, and more than 34,000 individuals. There are 37 households per village on average, and 7 members per household. Literacy rates are low: only 16% of the population over 8 years old knows how to read and write. The population is young, 19 years old on average. The main ethnic group is Bambara (68%). Most of the labor force is in agriculture and livestock rearing.

Looking at the sample of game participants (Table 2A), we conducted 363 sessions (3 per village) with over 3,000 players. Sessions gathers 23.4 players on average. As expected, game participants are not representative of the village population. Only 28% of them were male. Average age is 35. More than 75% of them

[7] Our sampling strategy yields a representative sample of households from which game participants were selected. But the last step in the selection process is not random. Game participants had to be at least 15 years old. We ask the household to preferably send the head of household or a spouse. If neither of them were available, then the household could send another adult household member to the game.

are illiterate, and 85% of them never went to school. Based on questions on their attitudes towards the community (belonging, trust, altruism, reciprocity, solidarity), we constructed an index of social capital. The average value of this index is 2.89 in the game participants sample, compared to 2.83 in the household survey sample. The difference is not surprising: game participants are older on average, and social capital increases with age.

3. EXPERIMENTAL DESIGN AND HYPOTHESES

Treatments

Our research design consisted in three within-subject treatments of a public good game. The **base treatment** is a standard public good game without communication. In the two other treatments, we allow some form of communication. In the unmonitored **open discussion treatment**, participants are allowed to talk to each other freely for five minutes. In the **leader treatment**, a randomly selected participant is designated as a leader: she is told what actions everyone should take in order to maximize the group payoff and she is instructed to convey this message to the rest of the group.

The three treatments have the same monetary payoff structure (Marwell and Ames, 1979). There are two goods, a private one and a public one, and m participants. The experimenter provides each participant $i = \{1, \dots, m\}$ with one token. Choice set includes two options $x_i = \{0,1\}$, to keep the token ($x_i = 0$) or to invest it in the public good ($x_i = 1$).[8] If the token is kept, it yields a payoff p to player i only. If the token is invested in the group project, it yields a payoff of a to every player j including i. In sum, the payoffs function is given by: $y_i = p(1 - x_i) + a(\sum_{j=1}^{m} x_j)$. Thus, the public good produced depends linearly on each individual's contribution. All decisions are made simultaneously and privately, without knowing

[8] Knowing the challenges regarding literacy and simplicity, we have used a simple dichotomous cooperation decision-making setting (Cardenas & Jaramillo, 2007) that requires no use of pencil.

what others will do. Assuming participants only care about their monetary payoffs, and as long as $a < p$, there will be no incentives to contribute to the group account, i.e., $\forall i = \{1, \dots, m\}: x_i^{Nash} = 0$, resulting in a socially inefficient outcome. In this case, each player obtains $y_i = p$, and the group outcome is $\sum y_i = mp$. However if every player contributes to the group account, i.e. , $\forall i = \{1, \dots, m\}: x_i^{soc.opt.} = 1$, then the social optimum is obtained. In this case, the earnings for each player are $y_i = ma$, and the group outcome is $\sum y_i = m^2 p > mp$.

In our setting, if the player invests the token in the public account, his token and those of others in the group account yield a return of $a = 1$ for every other participant (including those who kept their tokens). A player who keeps his token earns an additional $p = 10$.

Procedures

We recruited on average 20 to 25 players for each session. Each participant played in three sessions. Because we expect that the order of the rounds may matter for contributions, we randomly manipulate the order of open discussion and leader treatments. All individual decisions are kept private and confidential. We explained the base game extensively to make sure that players understood it.[9] At the end of the experiment, group actions are revealed publicly for each treatment, so that players know how many points they earned depending on their own action. Earnings are revealed to each participant in a private way at the end of the three sessions when they collect their rewards. After participants make their decisions, but before they learn about their earnings, they are requested to privately report their predictions on the group's actions. In Appendix Figure A2, we show the timeline for the games.

[9] Experimenters worked in teams of five, each individual with specific tasks to perform (see Appendix Table A1). Given the number of experimental sessions, instructions to experimenters were made as simple as possible. Experimenters were trained on this protocol for 8 days.

In order to incentivize participants, players earn points that are then translated into rewards. In order not to interfere with the sanitation intervention that took place in some of these villages,[10] we converted the points into small valuable household items unrelated to sanitation (e.g. batteries, pens, paper pads, lighters) instead of providing monetary payments. The complete game protocol (in French) is available upon request.

Framing of the games

There is a wide range of possibilities for presenting the games to participants, from an abstract game with no reference to a particular cooperation problem to a heavily framed situation that can hint players to the study's larger purpose, i.e., studying their behavior in order to understand how the community-driven sanitation program may affect them. Here, we chose a weak framing that serves to have participants' mindset on collective action. This mild framing is meant for villagers to act according to past experience and underlying social norms.

Our public good games are framed as ***foroba* games**,[11] i.e., games of the common pot. The name given to the token is *niyoro*, also a Bambara term for a token used in common transactions. Use of *foroba* and *niyoro* as labels should remind them of a familiar setting in which people usually contribute to a common pot and get a valuable amount in return. We decided against framing the public good according to the sanitation issue that is central to the research project in order to not contaminate our results with specific issues with the intervention that took place. Yet, we maintain a weak framing to collective action.

[10] UNICEF considered that the community-based approach to sanitation would have been compromised if we were to distribute monetary payments to some individuals in intervention villages. In order to keep the support of UNICEF to the larger evaluation project, we agreed on incentivizing the games with in-kind payments.

[11] In Bambara, the lingua franca most widely used in Mali, *foroba* refers to a cooking pot and also to a gathering of neighbors for a community cook out where every member brings an input and everyone benefits from the meal produced.

Ranking games

At the end of the three rounds, we conduct "Rankings games", with the objective of identifying leaders and influential individuals among players. The games consist of a series of rankings, where participants have to rank themselves in a circle according to some specific criteria. First, the participants have to rank themselves according to height, from taller to shorter.[12] The last three rankings were framed after extensive focus groups with community specialists. For the second ranking game, villagers have to rank each other according to who would better represent them as dancers in a hypothetical regional competition.[13] For the third ranking game, participants have to rank according to who would represent better the community in the hypothetical situation where an official in Bamako made a decision which is considered detrimental for the community and someone needs to convince him not to execute it. In the fourth and last ranking game, participants rank according to whom would best help them to resolve a conflict between community members.

Hypotheses

Our first hypothesis is based on previous experimental research on communication (Isaac and Walker (1988), Cason and Khan (1999), Bochet and Putterman (2009), among others).

Hypothesis 1 (**open discussion**): Unmonitored open communication between villagers improves cooperation.

Hypotheses 2 and 3 pertain to the role of leadership in communication. Assuming that leaders are in favor of collective action, we first test whether,

[12] Height is a sign of social status. Taller individuals may have benefitted from early-life investment in nutrition and may come from wealthier households. Height also correlates with cognitive ability (Lindquist, 2012).

[13] Dancing is a popular activity in Mali, which imparts status to talented individuals.

regardless of quality of leadership, simply having one community member inform others on how to reach the socially desirable outcome may affect cooperation. Secondly, leaders vary in term of their skills. Thus, a natural hypothesis to test is that the extent to which cooperation may be improved depends on the quality of the leader.

Hypothesis 2 (**leader treatment I**): controlled communication (one randomly chosen person is instructed to tell all other players that the group as a whole can attain the highest payoff if everyone contributes) improves cooperation.

Hypothesis 3 (**leader treatment II**): Controlled communication leads to greater contributions the higher the quality of the leader.

There are previous experimental results on model of leadership-by-example proposed by Hamerlin (1998). In this model, a leader is informed about the social return from cooperation and he passes this message to uninformed followers. In our experiment, as in other previous experiments, a leader is picked at random. The main difference is that, in previous work, the contribution of the leader is revealed to the rest of the group before they make their decisions, while in our field experiment, it is not (see, for instance, Moxnes and van der Heijden 2003, Potters 2007, Arbak and Villeval 2013). Instead, participants, who know each other, use what they know about the person designated as a leader, as well as the informational content of the message he is instructed to convey, when making their decision to contribute to the public good. We thus test whether the observable attributes of imposed leaders may influence group cooperation.

Finally, our last hypothesis is related to the community-based intervention we evaluate. Community-based intervention, by fostering a participatory approach, may strengthen the capacity of the community for collective action.

Hypothesis 4 (**RCT**): Cooperation is higher as a result of the program.

Testing the last two hypotheses provide a rationale for conducting the experiments in the field rather than in a lab.

4. RESULTS

In the base treatment, 71% of the participants contribute to the *foroba* (Figure 1). Cooperation level is quite high in these villages compared to what is usually found from lab experiments with university students, but similar to those obtained from lab experiments in the field in developing countries (Cardenas and Carpenter 2008).[14]

Contributions are higher in the discussion and leader treatment, respectively 79% and 81% (Figures 1 and 2). The differences between treatments are all statistically significant (Table 11). So we cannot reject hypothesis 1 (**open discussion**) and hypothesis 2 (**leader treatment I**). We interpret these differences as causal impacts of the treatments. Although we did not reveal contributions until the end of the three treatments, one may be still concerned that in a within-subject design treatment effects may be confounded.[15] Because we randomly manipulate the order of the communication and leader round, timing effects are averaged out. Hence, we interpret the 8-percentage point (p.p.) increase in cooperation as a result of communication between village participants. In addition, villagers who had already participated in the games at baseline are not contributing differently than those who are playing for the first time.[16]

[14] In Zimbabwe, Barr (2001) find that participants to a VCM contribute between 48 and 52% of endowment. In Vietnam and Thailand, it is respectively between 72 and 76% and between 61 and 73% (Carpenter et al. 2004). In Kenya, Ensminger (2000) find that people contribute 58% of their endowment. In Peru, Karlan (2005) finds that 81% of participants contribute in a threshold public game. Figures for the U.S. are lower (between 30-40%).

[15] Strategic effects may happen when contributions are revealed between rounds. In our setting, participants learn about their payoffs only at the end of the three sessions. In repeated public games for which outcomes are revealed between rounds, cooperation tends to decrease through time.

[16] This is obtained from combining baseline (2011) and follow-up (2013) data on games. Results available upon request.

The difference between leader treatment and base treatment is an effect from passing information on how to reach the socially desirable outcome. Since the leader is randomly picked, average contributions in the leader treatment corresponds to average contributions under average leader quality. So it is the passing of information through an average community member that increases cooperation by 10 p.p., an statistically significant effect (Table 11).

Interestingly, beliefs follow the same patterns as contributions (Figures 3 and 4). In the base treatment, 48% of participants believe that everyone would contribute (average is 69%). In the communication (leader) treatment, 57% (61%) believe that everyone would contribute. Beliefs on contributions by others are higher in the communication and leader treatment, a statistically significant difference (Table 11). Again, we interpret these changes as causal effects of the treatments (open discussion and leader treatment) on beliefs. Taken together, the evidence on the effects of communication on contributions discussed earlier and these findings are consistent with communication affecting contributions through beliefs. However, the design of our experiments does allow us to be conclusive on this point.

In Table 3-8, we present estimates of the causal effects of leader attributes on players' contribution levels and beliefs in the leader round. Overall, we find that a number of leader characteristics influence group contributions, so hypothesis 3 (**leader treatment II**) is not rejected. Tables 3-4 pertain to the leader attributes as measured in the ranking games. Relatively taller leaders elicit higher contributions than shorter ones (Table 3). Compared to a leader ranked last (based on a 23 rank ladder)[17], a leader ranked first would lead 2.16 people to switch to cooperation on average.[18] This effect is not significant in the base specification without covariates,

[17] There are on average 23 players in each village.

[18] A one-point increase in rank is associated with a 0.41 p.p. point increase in contributions. With linear effects, a 23 point difference in ranking is associated with a 9.43 p.p. increase in the fraction of

and marginally significant at 10% in a specification with covariates. No other leader attribute from the ranking games significantly affects players' cooperation.

Leader's relative height also matters for beliefs (Table 4) and the magnitude of the effect is similar to the one on cooperation decisions. This finding suggests that a good leader (where quality is proxied by height) shapes beliefs, resulting in increased cooperation. Good leaders make other participants believe that many more people contribute than what they thought, and this change in beliefs may then translate into actions for some of them.

In Tables 5 and 6, we show that cooperation also depends on some of the personal characteristics of the leader, as measured in the household survey. This includes age, gender, literacy, social capital and relationship to the head of household. We find that most of these attributes matter (column 1).[19] The effect of age is positive, statistically significant and large: each additional year of age is associated with a 0.21 p.p. increase in average contribution. Literacy has a negative and statistically significant effect: a literate leader reduces contributions by 7.2 p.p.. This surprising effect may be explained by the fact that 85% of the villagers are illiterate. We find that, compared to female leaders, male leaders significantly increase contributions by 8.55 p.p.. Cooperation also significantly increases with the level of social capital of the leader. However, we find not statistically significant effect pf leader's age, gender, literacy, social capital or status in the household on players' beliefs (Table 6).

Finally, we show how the leader's contribution decision and belief at base game influences other players' actions in the leader round (Table 7). [20] Group

players who contribute. For a group of 23 players, that is equivalent to $9.43 * \frac{23}{100} = 2.16$ additional contributors.

[19] Only leader gender and social capital are significant in a specification with covariates (column 2).

[20] In contrast to the rest of the experimental literature, we do not reveal leader's action or beliefs to the rest of the group before they make their decision (or at any other time). So, if villagers' actions

contributions are higher if the leader contributed in the base round than if he did not. Contributions also depend positively on leader's beliefs in base round. In addition, group beliefs are positively affected by leader's action and beliefs (Table 8). This again points to updating in beliefs as a possible mechanism through which communication by a leader affects overall cooperation.

We find a positive and statistically significant impact of the community-based sanitation intervention on cooperation, as measured in the games (Table 9). This implies that we cannot reject hypothesis 4 (**RCT**). We find a 4.5-5 p.p. gain in cooperation that can be attributable to the intervention. In comparison, the gains from open discussion and leader treatments are respectively 8 and 10 p.p.. This suggests that fostering open discussion and leadership position is a key feature in the community-based approach.

5. POLICY-RELEVANCE

Extrapolating lab experiment results beyond a specific institutional environment is complicated. However, our results suggest two relevant implications. First, leadership and communication matter for addressing collective actions problems. Furthermore, our large sample is representative of rural Koulikoro. In this sense, the sample of players for our games is representative of the population targeted by the community-based sanitation intervention through community mobilization activities. Second, our mild frame allows us to interpret our results for a wider set of community-based interventions, whenever a community needs a high level of mobilization in order to achieve the provision of public goods.

Similarly to Cason and Kahn (1999), our results support the idea that community-based development programs that rely on collective action should stress the role of communication, either among community members or mediated

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are found to depend on their leader's action, it is because they know the person and may consider her as trustworthy.

by a leader as a way to achieve their goals. In the realm of community-based sanitation, this view is already put into action, as found in the guidelines offered to field practitioners that stress the role of leadership and communication as key factors in the success of CLTS programs (Kar and Chambers 2008).

Finally, our results suggest that games in the field, with the required representativeness, can become a useful tool for testing underlying theories about what may be working (or not) in community-based interventions.

6. SUMMARY OF FINDINGS AND CONCLUSION

In rural communities of Mali, we find evidence of high levels of cooperation as measured by a standard public good game. Expectations about others behavior is also high. Communication between players both increases contributions to the public good and expectations. This finding is consistent with lab experiments. The proportion of contributors to the public good increases 8 p.p., compared to a base of 71%, which is already high compared to lab experiments, but in line with other findings in developing countries. Passing of information through a random community member on how to achieve the socially desirable outcome also improves cooperation: contributions increase by 2p.p. compared to the open unstructured discussion. Since the leader is randomly chosen, this is the gain from "passing advice" for a leader of average quality. We also find that some characteristics of the leader matter for increasing group contributions and expectations about how others behave. A good leader is someone who is relatively taller than other participants. In the setting of rural Mali, height is an indicator of good health and higher cognitive skills. Other attributes such as gender, age, literacy and social capital also influence cooperation.

In our games, contrary to other examples in the lab, actions and beliefs of the leader are not revealed after she addresses the participants, or at any other time.

However, we find that leader's action and beliefs in the base round have a positive effect on players' contributions. This suggests that leaders who cooperate or believe the rest of the group cooperates are better at conveying a message about collective action.

The experiments are embedded in a larger randomized controlled trial designed to evaluate the impact of a community-based sanitation intervention. This has two implications. First, our results are relevant for a large population. We find that the program help strengthen the capacity for collective action, and these effects are statistically significant. Second, given the mild frame used in the experiments, our results may be relevant for a wider set of community-based interventions, whenever a community needs a high level of mobilization in order to facilitate the provision of public goods.

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Table 1A: Descriptive statistics

Variable	N	Mean	SD
Average number of households by village	121	37.455	13.341
Average number of member per household	4532	7.603	3.891
Literacy (age >=8)	17412	0.168	0.374
Ethnic group Bambara	20230	0.686	0.464
Average age	34406	18.788	17.515
Male	34435	0.490	0.500

Table 1B: Main economic Activity

Variable	N	%
Agricultural and horticultural crops	4,504	28.16
Livestock and poultry	738	4.61
Fishing	25	0.16
Forestry	458	2.86
Trade	644	4.03
Processing industry	75	0.47
Communal (medical practice, education, etc.).	82	0.51
Transport	22	0.14
Mining and extraction	147	0.92
Construction	1,199	7.5
Unemployed family member	4,730	29.58
Other	3,369	21.07

Table 2A: Participants characteristics

Variable	N	Mean	SD
Literacy (1=read and write)	2860	0.151	0.358
Age	2967	35.789	12.230
Sex (1=Male)	2985	0.276	0.447
Mother language (Bambara=1)	2997	0.735	0.441
Social Capital	2983	2.880	0.725
Number of players	2997	23.340	2.804

Table 2B: Round contributions and beliefs averages

Variable	N	Mean	Std. Dev.
Contributions at base round	2798	0.713	0.453
Contributions in discussion round	2799	0.791	0.407
Contributions in leader round	2798	0.806	0.396
Beliefs in base round	2778	0.691	0.368
Beliefs in discussion round	2781	0.747	0.354
Beliefs in leader round	2785	0.766	0.351

Table 3 : Effect of leader's characteristics (Ranking indices) on contributions in the leader round

Dependent Variable Contribution in the leader round	(1)	(2)	(3)
Leader representativeness	-0.0001	-0.0006	-0.0006
	[0.0026]	[0.0025]	[0.0027]
Leader conciliator	-0.0003	0.0009	0.0015
	[0.0026]	[0.0026]	[0.0027]
Leader height	-0.0034	-0.0041*	-0.0039
	[0.0027]	[0.0024]	[0.0026]
Leader dance	-0.0001	-0.0006	-0.0002
	[0.0024]	[0.0024]	[0.0025]
# of players	0.0041	0.0052	0.0036
	[0.0056]	[0.0052]	[0.0058]
% Bambara speakers by village			0.0076
			[0.0590]
% Crime by village			0.2466*
			[0.1473]
% Organizations, participation by village			-0.0771
			[0.0478]
% Social capital by village		0.1551**	0.1622**
		[0.0594]	[0.0678]
Cercle dummies			Yes
Constant	0.7525***	0.2871	0.3177
	[0.1196]	[0.2128]	[0.2652]
Observations	2,797	2,797	2,797
R-squared	0.0043	0.0159	0.0250

Clustered robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effect of leader's characteristics (Ranking indices) on beliefs in the leader round

Dependent Variable Beliefs in the leader round	(1)	(2)	(3)	(4)	(5)
Leader representativeness	0.0003	-0.0001	-0.0003	-0.0001	-0.0004
	[0.0031]	[0.0029]	[0.0028]	[0.0029]	[0.0028]
Leader conciliator	0.0002	0.0011	-0.0001	0.0011	-0.0003
	[0.0024]	[0.0025]	[0.0025]	[0.0025]	[0.0025]
Leader height	-0.0052**	-0.0058**	-0.0048*	-0.0089***	-0.0077**
	[0.0026]	[0.0025]	[0.0025]	[0.0029]	[0.0030]
Leader dance	-0.0007	-0.0011	-0.0014	-0.0011	-0.0014
	[0.0021]	[0.0020]	[0.0021]	[0.0020]	[0.0021]
Height ranking				-0.0038**	-0.0036**
				[0.0015]	[0.0014]
Interaction height ranking*leader height				0.0002**	0.0002**
				[0.0001]	[0.0001]
# of players	0.0007	0.0016	-0.0011	0.0021	-0.0005
	[0.0059]	[0.0058]	[0.0064]	[0.0059]	[0.0065]
% Bambara speakers by village			-0.0299		-0.0322
			[0.0507]		[0.0504]
% Crime by village			-0.1206		-0.1257
			[0.1613]		[0.1609]
% Organizations, participation by village			-0.0162		-0.0192
			[0.0507]		[0.0508]
% Social capital by village		0.1313**	0.1506**	0.1269**	0.1460**
		[0.0628]	[0.0613]	[0.0627]	[0.0610]
Cercle dummies			Yes		Yes
Constant	0.8114***	0.4178*	0.4847*	0.4669*	0.5381**
	[0.1297]	[0.2494]	[0.2692]	[0.2488]	[0.2683]
Observations	2,784	2,784	2,784	2,765	2,765
R-squared	0.0114	0.0220	0.0366	0.0237	0.0390

Clustered standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Effect of leader's characteristics on contributions in the leader round

Dependent Variable Contribution in the leader round	(1)	(2)
Leader male	0.0855**	0.0777**
	[0.0348]	[0.0351]
Leader age	0.0021*	0.0018
	[0.0013]	[0.0013]
Leader literacy	-0.0720*	-0.0632
	[0.0391]	[0.0416]
Leader social capital	0.0441**	0.0421*
	[0.0222]	[0.0217]
Leader household head	-0.0780	-0.0763
	[0.0485]	[0.0496]
% Bambara speakers by village		-0.0473
		[0.0662]
% Crime by village		0.1488
		[0.1359]
% Organizations, participation by village		-0.0348
		[0.0557]
Cercle dummies		Yes
Constant	0.6070***	0.6697***
	[0.0891]	[0.1118]
Observations	2,797	2,797
R-squared	0.0187	0.0232

Clustered robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effect of leader's characteristics on beliefs in the leader round

Dependent Variable Beliefs in the leader round	(1)	(2)
Leader male	0.0140	0.0151
	[0.0470]	[0.0470]
Leader age	0.0017	0.0018
	[0.0013]	[0.0014]
Leader literacy	-0.0001	0.0117
	[0.0372]	[0.0411]
Leader social capital	0.0151	0.0262
	[0.0242]	[0.0249]
Leader household head	-0.0428	-0.0407
	[0.0576]	[0.0571]
% Bambara speakers by village		-0.0805
		[0.0548]
% Crime by village		-0.1856
		[0.1811]
% Organizations, participation by village		-0.0213
		[0.0567]
Cercle dummies		Yes
Constant	0.6645***	0.7244***
	[0.0931]	[0.1270]
Observations	2,784	2,784
R-squared	0.0048	0.0192

Clustered standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effect of leader's contribution and beliefs at base round on contributions in the leader round

Dependent Variable Contribution in the leader round	(1)	(2)	(3)	(4)	(5)	(6)
Leader's contribution at base game	0.0873**	0.0715*	0.0778**			
	[0.0370]	[0.0389]	[0.0387]			
Leader's belief at base game				0.1128***	0.0965***	0.0958**
				[0.0353]	[0.0355]	[0.0370]
% Bambara speakers by village			0.0085			-0.0006
			[0.0578]			[0.0590]
% Crime by village			0.2777*			0.2583*
			[0.1431]			[0.1426]
% Organizations, participation by village			-0.0516			-0.0520
			[0.0510]			[0.0499]
% Social capital by village		0.1173*	0.1316*		0.1170**	0.1266*
		[0.0593]	[0.0668]		[0.0568]	[0.0657]
Cercle dummies			Yes			Yes
Constant	0.7438***	0.4172**	0.3616	0.7326***	0.4061**	0.3754*
	[0.0319]	[0.1685]	[0.2220]	[0.0309]	[0.1664]	[0.2181]
Observations	2,797	2,797	2,797	2,797	2,797	2,797
R-squared	0.0100	0.0166	0.0274	0.0121	0.0187	0.0280

Clustered robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Effect of leader's contribution and beliefs at base round on beliefs in the leader round

Dependent Variable Beliefs in the leader round	(1)	(2)	(3)	(4)	(5)	(6)
Leader's contribution at base game	0.0513	0.0374	0.0452			
	[0.0338]	[0.0335]	[0.0323]			
Leader's belief at base game				0.1720***	0.1619***	0.1677***
				[0.0396]	[0.0388]	[0.0392]
% Bambara speakers by village			-0.0387			-0.0503
			[0.0530]			[0.0492]
% Crime by village			-0.0802			-0.0944
			[0.1664]			[0.1690]
% Organizations, participation by village			-0.0182			0.0143
			[0.0524]			[0.0533]
% Social capital by village		0.1023	0.1258**		0.0724	0.0902
		[0.0622]	[0.0603]		[0.0580]	[0.0557]
Cercle dummies			Yes			Yes
Constant	0.7291***	0.4443**	0.4137**	0.6540***	0.4520***	0.4140**
	[0.0288]	[0.1807]	[0.2012]	[0.0331]	[0.1722]	[0.1857]
Observations	2,784	2,784	2,784	2,784	2,784	2,784
R-squared	0.0044	0.0107	0.0268	0.0357	0.0389	0.0533

Clustered standard errors at the village level in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Effect of Community Led Total Sanitation on contributions and beliefs

Dependent Variables	(1) Contributions	(2) Contributions	(3) Beliefs	(4) Beliefs
Treatment	0.0323	0.0478*	0.0450*	0.0510*
	[0.0276]	[0.0269]	[0.0263]	[0.0258]
Discussion round	0.0777***	0.0777***	0.0561***	0.0560***
	[0.0143]	[0.0143]	[0.0131]	[0.0131]
Leader round	0.0930***	0.0930***	0.0748***	0.0748***
	[0.0150]	[0.0150]	[0.0127]	[0.0127]
% Bambara speakers by village		-0.0524		-0.0643
		[0.0402]		[0.0448]
% Crime by village		0.1561		0.0218
		[0.1189]		[0.1493]
% Organizations, participation by village		-0.1107**		-0.0626
		[0.0454]		[0.0448]
Cercle dummies		Yes		Yes
Constant	0.6968***	0.8013***	0.6684***	0.7835***
	[0.0205]	[0.0568]	[0.0202]	[0.0600]
Observations	8,392	8,392	8,341	8,341
R-squared	0.0108	0.0224	0.0117	0.0193

Clustered standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Contributions in the base, discussion and leader treatment.

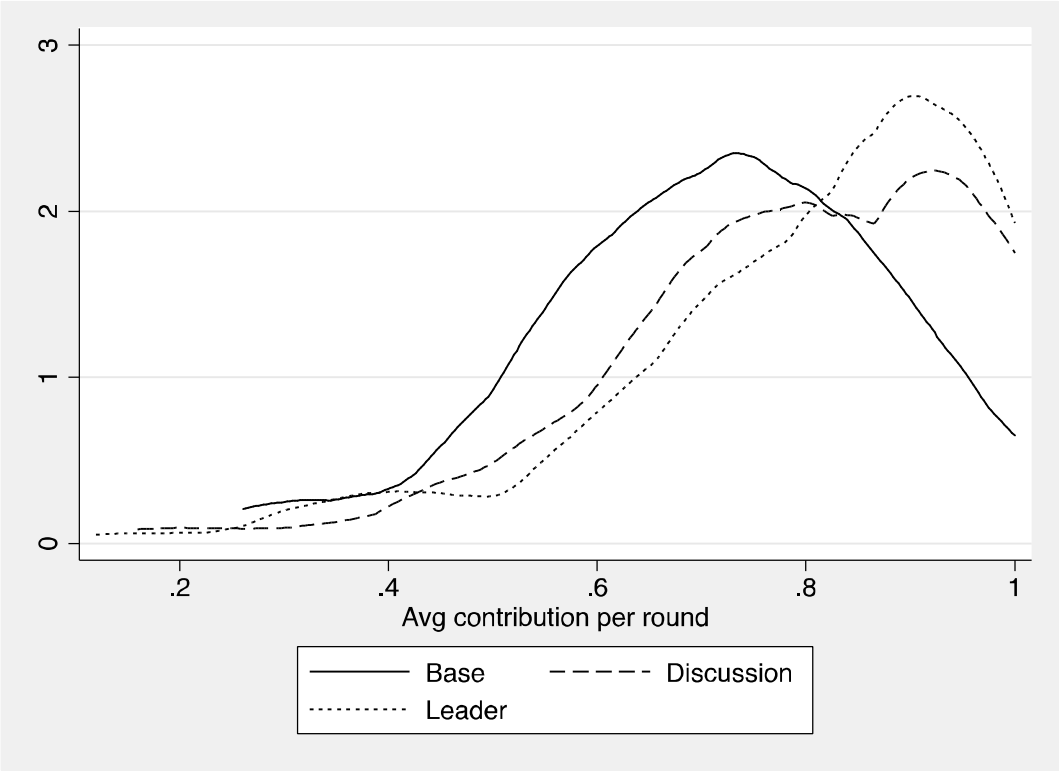


Figure 2: Gain in contributions in discussion and leader treatments compared to base treatment.

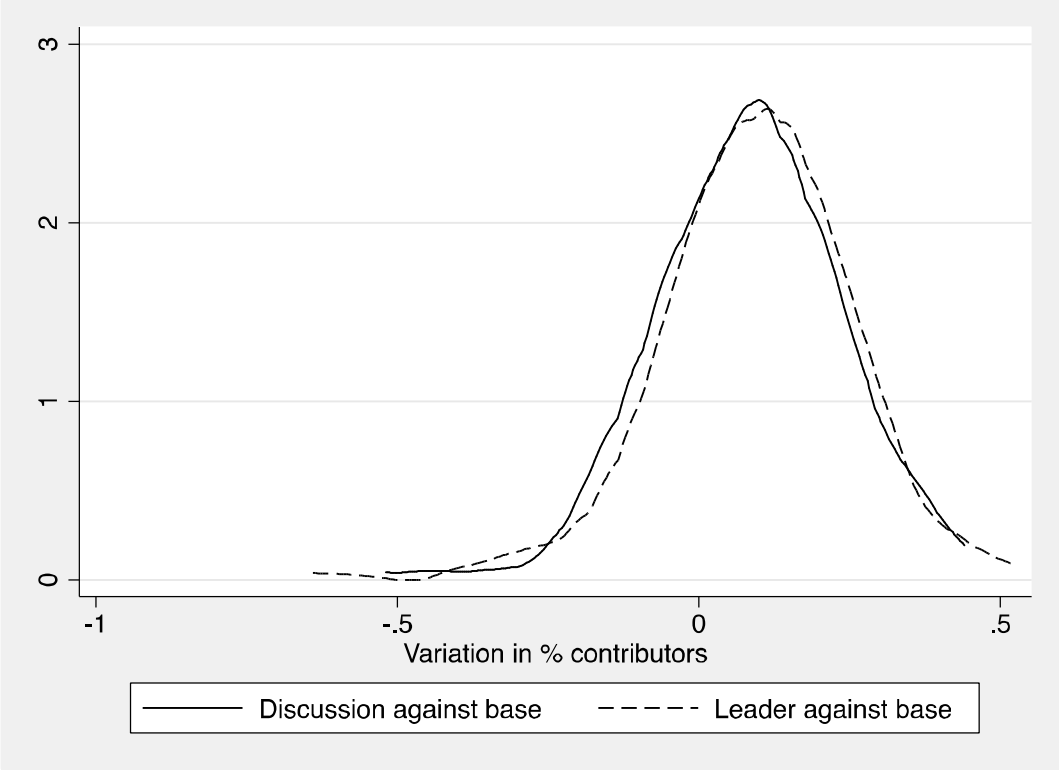


Figure 3: Beliefs in base, discussion and leader treatments.

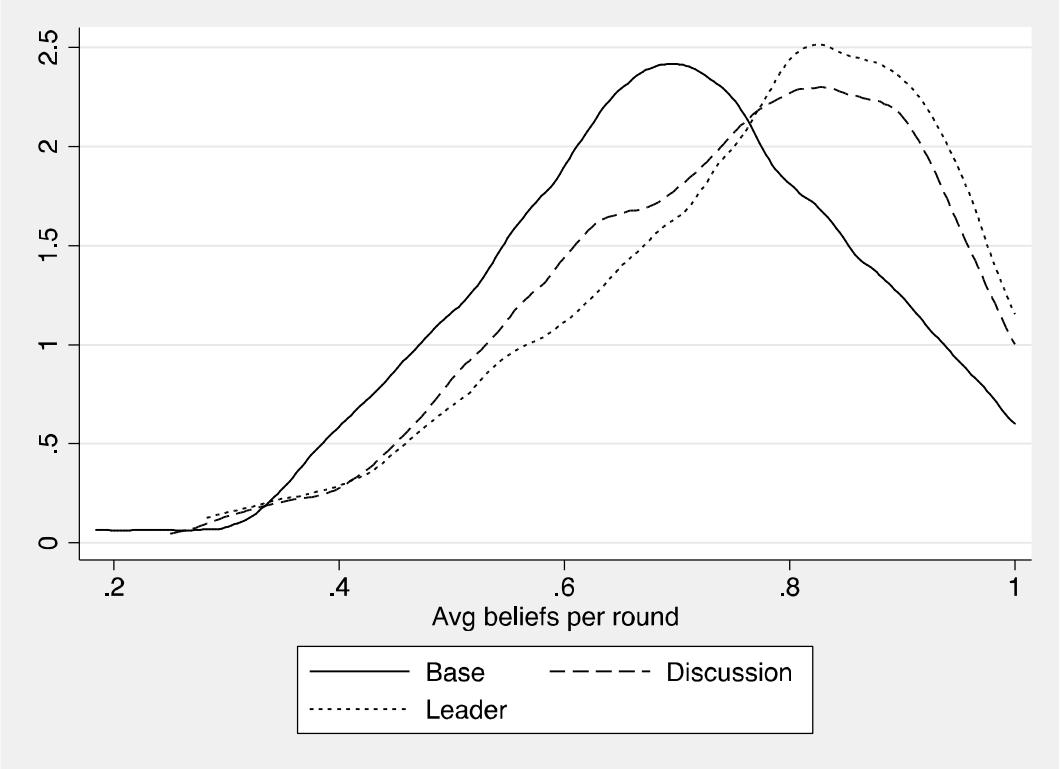
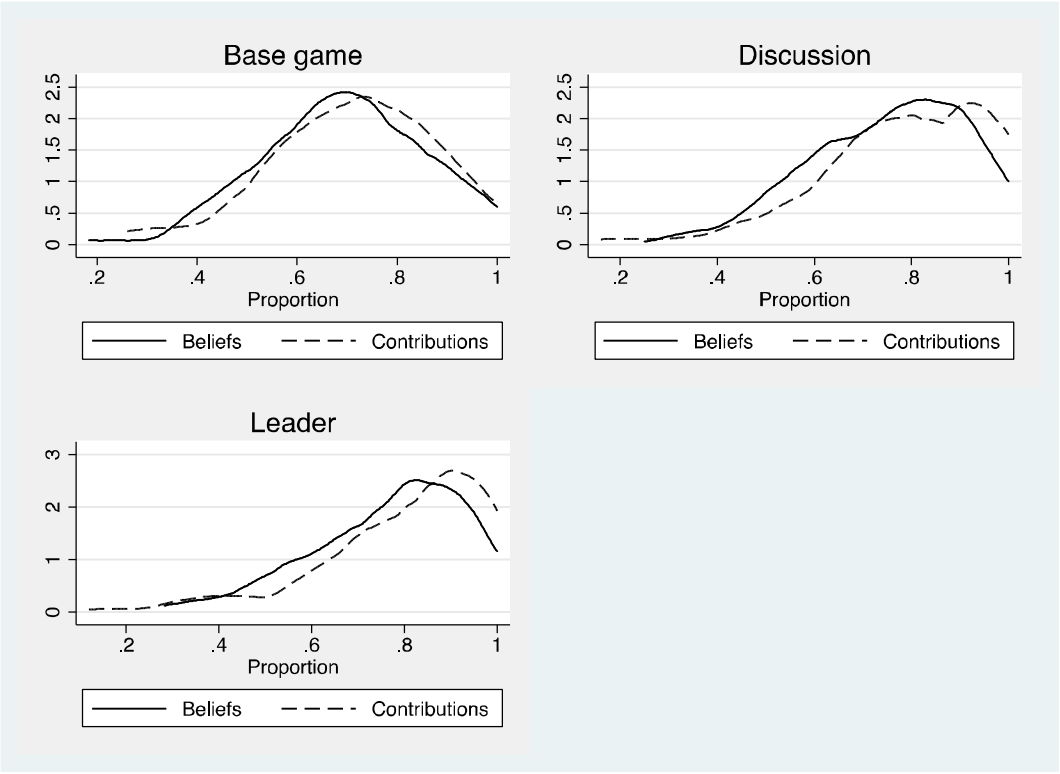


Figure 4: Contributions and beliefs in the three treatments.



Appendix A

Figure A.1:Timeline for the CLTS intervention

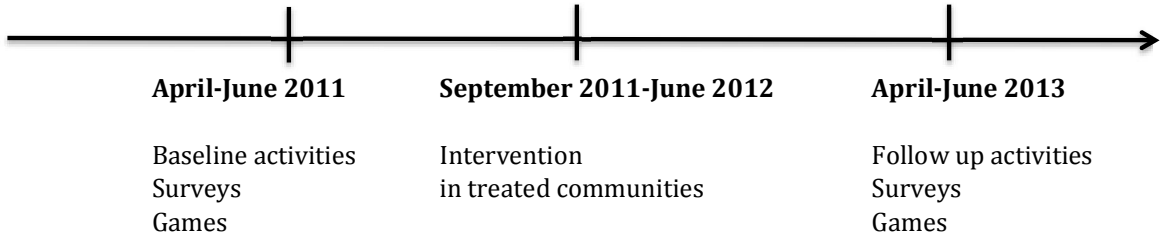


Figure A.2:Timeline for experimental sessions

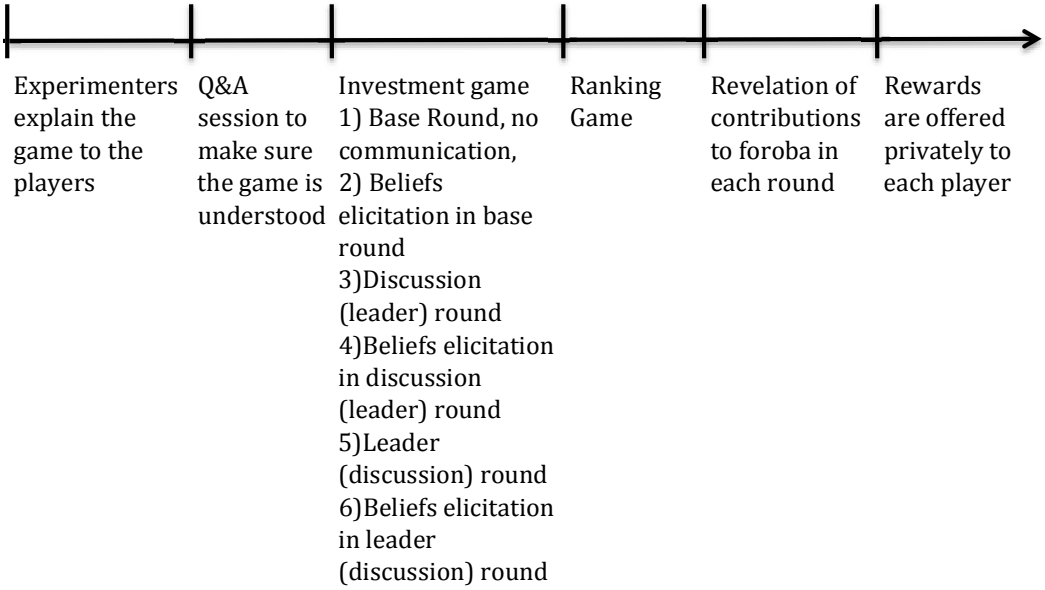


Table A1: Composition of the experimenters team

Recruiter (*Recruter-Installateur*): Individual in charge of going through households and conditioning the place set for the games.
Facilitator (*Animateur*): Individual explaining the games to players
Accountant (*Comptable*): Individual in charge of counting the contributions and calculating the rewards
Observer (*Observateur*): Individual taking notes on specific features of the games such as players comments or unusual circumstances
Supervisor (*Superviseur*): Individual in charge of overlooking the team of experimenters