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Public participation and willingness to cooperate in common-pool resource management: a field experiment with fishing communities in Brazil

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Abstract

The primary evidence about the factors determining successful self-governance of common-pool resources (CPR) has come from case studies. More recently, this observational evidence has been complemented by insights from economic experiments. Here we advance a third approach in which the role of local deliberation about the management of a fishery resource is investigated in a field experiment. Using three control and three treatment communities in a freshwater fishery, we tested if participation in developing specific measures for community-based sustainable CPR management increased the willingness to contribute to the implementation of these measures. Each community was also exposed to information about their community leader's advice about the proposed measures. Both participation and leader advice affected the willingness of participants to contribute to one of three concrete proposals. However, the strongest influence on individual willingness to contribute was exerted by the individual beliefs about the cooperation of others in CPR management.

Keywords: local deliberation, participatory research, willingness to contribute, beliefs, fishing resources, field experiment

1. Introduction

Common-pool resources (CPR) are defined as natural or man-made resources in which (a) exclusion of users is nontrivial (but not necessarily impossible) and (b) resource use by one user decreases the availability of the resource for other users (Ostrom *et al.*, 1992). At least since Gordon (1954), it has been known that individuals jointly using a CPR have incentives to ignore the external harm they impose on others, leading to outcomes that are not rational from the perspective of the group. Garrett Hardin (1968) argued that the users of common resources are trapped in an inevitable dilemma that leads to the destruction of the resources on which they depend. Policy proposals for resolving CPR dilemmas often follow one of two alternatives. The first approach is to use a governmental organization to restrain people from extracting the common resource by fines and punishment. The second approach solves the dilemma by privatization, i.e., by defining property rights that transform a common resource into a private one.

However, both approaches can be difficult to implement. In many cases, governmental intervention is prohibitively expensive. Especially in settings where the common resources are spread in large and remote areas, sufficient monitoring is impossible with limited resources, a situation often encountered in developing countries. Furthermore, there are numerous examples where governmental intervention has failed (e.g. IUCN, 1999) because common resource users did not perceive the intrusion of external agents as legitimate and therefore did not follow the imposed rules (Anderies *et al.*, 2004). Privatization, on the other hand, does not solve the dilemma in case of migratory resources (Clark, 1990) and raises difficult questions concerning the division of the property rights (Baland & Platteau, 1998).

A growing body of research suggests self-governance by local user groups as an alternative to the two standard approaches. There is considerable evidence that self-governance by local users can be successful (Ostrom, 1990; National Research Council, 2002; Ostrom & Gardner, 1993; Bray *et al.*, 2005; Acheson, 1975; Cordell, 1989; Begossi, 1995; Leal, 1998). A rapidly growing theoretical and empirical literature including laboratory experiments explores the key factors that affect the likelihood of successful cooperation in the provision of public goods and in the management of common pool resources (Ostrom, 2000). From a development perspective, factors that can potentially be actively promoted as a means to improve cooperative self-governance are of particular interest.

A central finding from laboratory experiments is that face-to-face communication among members of a group is the most effective factor promoting cooperation in groups (Hackett *et al.* 1994; Ostrom & Walker, 1997). This effect of communication is not consistent with currently accepted economic theory, because verbal agreements in these experiments are not enforced (Ostrom, 2000). However, the finding agrees with experience from real-world settings. In the context of common resource management, the communication process may help establishing trust and cooperation among resource users, which is essential for avoiding excessive extraction of common resources (Cardenas *et al.*, 2000).

One possibility to stimulate communication about resource use in a meaningful way is by allowing public participation in decisions about resource management. Public involvement in a decision process may have benefits over and above those of learning about efficient and sustainable resource use and management. Resource users who can themselves have an impact on the rules guiding resource management may for this very reason be more willing to actually

follow those rules even if the rules restrict their short-run gains from resource extraction (Stiglitz, 2002; Ostrom, 2000).

The current evidence about the effects of public participation on the likelihood of cooperation in resource management is largely based on observational studies (e.g. Patel *et al.* 2007). However, with observational evidence alone it is difficult to isolate the role of participation and understand its importance for the likelihood of cooperation and other forms of collective action relative to other important factors such as individual characteristics or existing beliefs about the cooperation of others.

We are not aware of any study that has experimentally examined the effects of public participation on the willingness to cooperate in CPR management or in the provision of public goods. Perhaps the closest to our study is a recent experiment which examined the effect of a participatory educational program on the participants' willingness to contribute to a public good (Urama & Hodge, 2006). In this study, the authors report that participatory research can "positively" affect responses in a survey experiment, that is, people stated a higher willing to contribute to a public good.

Here we present the result from a field experiment with six fishing communities facing severe problems of over-fishing. Fishermen in three out of the six sampled communities participated in the development of proposals for a more sustainable fishery resource management. We then used a survey to examine and test if participation increased the willingness to contribute to the implementation of each of three final proposals. To examine the robustness of stated contributions to "expert advice", we further tested how knowledge of the local community leader's opinion about the proposed measures affected the responses.

Both participation and leader advice affected the willingness of participants to contribute to one of three concrete resource management proposals. However, these effects were weak relative to the influence of individual characteristics, in particular the individual beliefs about the cooperation of others in sustainable management actions.

The paper is organized as follows. Next we review relevant literature on public deliberation and its effect on cooperation in CPR management. The third and fourth sections describe the study area and methods. Section 5 presents the results, followed by the conclusions.

2. Public deliberation and cooperation in CPR management

2.1 Public deliberation

The type of public participation we examined in the present study is a form of “deliberation” as defined by political scientists (Chambers, 2003; Delli Carpini *et al.*, 2004).¹ Chambers (2003, p. 309) defines deliberation as follows:

Generally speaking, we can say that deliberation is debate and discussion aimed at producing reasonable, well-informed opinions in which participants are willing to revise preferences in light of discussion, new information, and claims made by fellow participants. Although consensus need not be the ultimate aim of deliberation, and participants are expected to

¹ The form of public participation pursued in this study has also been termed participatory research (Wiber *et al.*, 2004). Participatory research (Brandao, 1999) or “action research” (Thiollent, 2000) is a communication-intensive process with the aim to find how the efficiency of resource management can be increased. A central aim of participatory research is that resource users with different social conditions learn independently of external intervention (like the government) to plan, organize and achieve changes in resource extraction in a conscious, free and intelligent way with the maximum reflection possible (Barbier, 2002).

pursue their interests, an overarching interest in the legitimacy of outcomes (understood as justification to all affected) ideally characterizes deliberation.

The term public deliberation emerges from deliberative democratic theory where public deliberation is seen as a cornerstone of participatory democracy and representative government (e.g. Dewey, 1927; Dahl, 1989; Habermas, 1996). In contrast to economic understandings of democracy in which fixed preferences and interests compete via fair mechanisms of aggregation, deliberative democracy focuses on communicative processes of opinion and will formation that precede voting (Delli Carpini, 2004).

In their review of the empirical literature on public deliberation and citizen engagement, Delli Carpini *et al.* (2004) find that it is generally expected that public deliberation is a means to more sound individual and collective decisions and to greater support for responsive public officials (e.g. Gastil, 2000). While much of the empirical literature focuses on intermediary variables, such as political learning (as measured by pre-post tests of factual knowledge), perceived legitimacy, or consensus rather than more direct efficiency benefits, the evidence for beneficial effects on those variables is substantial.

However, not all studies are universally positive in their conclusions about the benefits of public deliberation. Not all citizens may wish to engage more directly in political decision-making through deliberation (e.g. Sunstein, 2001). Moreover, it has been pointed out that public deliberation can also be unrepresentative, subject to conscious manipulation, and disconnected from actual decision-making. Thus, satisfaction with deliberative participation depends heavily on whether the form of deliberation is suitable to the issue and the groups involved (Mansbridge, 1983).

2.2 Participation/deliberation and efficiency in CPR management

Common-pool resource dilemmas, especially in developing countries, have been a key interest of researchers examining how deliberation (and communication more generally) can promote efficient resource use through enhanced cooperation (e.g. Basurto, 2005, Armitage, 2005; Primmer *et al.*, 2006). Recently, researchers have complemented the findings of these observational studies by laboratory experiments in which opportunities to communicate could be directly manipulated in situations similar to CPR settings (reviewed by Ostrom, 2006).

Case study research has found that involving stakeholders can promote sustainable management (e.g. Patel *et al.*, 2007), but it has also been found that community-based project design with participatory mechanisms may not solve management without concomitant political and statutory backing (Carter & Hill, 2007). Furthermore, it appears that field settings, unlike experimental settings, produce highly variable results which highlight the important role of contextual factors beyond those examined in the laboratory experiments (Delli Carpini, 2004; Levitt & List, 2007). This result suggests that interesting further insights could be gained by experiments that manipulate opportunities for communication in a field setting.

In assessing more specific hypothesized effects of public deliberation on cooperation in resource management it seems useful to distinguish effects through impacts of deliberation on the individually available information set (including information about efficiency gains of cooperation and about the likely behaviour of other individuals) and effects mediated through perceived “procedural” benefits of participatory decision-making.

2.3 Effects through the available information set

The communication involved in participatory approaches may promote cooperation in common-pool resource management in at least two important ways.

First, communication may help individuals to establish trust and mutually agree on cooperation. It is well known that many people follow rules only if they believe that others follow and enforce these rules as well (e.g. Fehr *et al.*, 2003; Ostrom, 1992). There is empirical evidence from the laboratory as well as from the field that contributions to a public good depend on the contributions of peers (Shang & Croson, 2005). For example, holding a “positive” belief implies that people are more likely to spend money for charitable donations or are more likely to pay their taxes correctly (Frey & Meier, 2004; Fellner *et al.*, 2006). As a consequence, making one small change in the structure of laboratory experiments by enabling subjects to engage in face-to-face communication between decision rounds enables them to approach socially optimal behaviour rather than severely overexploiting the commons (Ostrom, 2007).

Second, communication can improve cooperation because more information on complex resource issues can be brought to bear (e.g. Luskin *et al.*, 2002). Randall & Hoehn (2000) suggested that behaviour is influenced by resource quality information. Information gathering and provision by local leaders can play a key role in consensus building and thus facilitate collective action (Palmer, 2006). Urama & Hodge (2006) argue that preferences about complex resource issues are “weakly held due to an incomplete appreciation of the welfare implications of the environmental change scenario(s)”. One way to isolate the role of exchanging information about the welfare implications of alternative management is to experimentally study the effects of providing leader opinions to ordinary citizens with low levels of factual knowledge. In choices

about complex resource issues, it has been shown that access to such information, particularly advice by trusted experts with known political orientation, can strongly enhance the consistency of individual decisions (Lupia, 1994; Lupia & Matsusaka, 2004; Schläpfer *et al.*, 2008).

Effects through perceived procedural benefits

Giving people the opportunity to voice their opinion increases their sense that the process is fair and the outcome legitimate, regardless of whether they agree substantively with the outcome (Tyler, 1994, 2001). Experimental research on jury deliberations suggests that the perception of “procedural justice” (i.e., the perception that the process by which a decision was reached was fair) leads to greater support for the group’s decision (Delli Carpini *et al.*, 2004). Frey *et al.* (2004) and Stutzer & Frey (2006) argue that people derive utility from the processes involved in decision making over and above the utility gained from outcomes.

In the context of resource management, Pouta *et al.* (2002) compared two planning methods in otherwise uniformly designed valuation scenarios, the actual planning, which the public criticized as being bureaucratic, and a hypothetical one in which the planning procedure was described as participatory. Their results indicated that the planning method had a significant effect on people’s willingness to contribute to nature conservation. In addition, procedural effects may also feed back on the available information set, as individuals whose opinion counts in politics are more likely to gather and process relevant information (Benz & Stutzer, 2004).

The present study contributes to the literature by experimentally examining effects of a participatory process on willingness to contribute to sustainable common resource management. Furthermore, given a complex resource issue in which payoffs of cooperation may not be as

easily understood as in previous laboratory experiments, we also experimentally examined at the same time how willingness to contribute to sustainable management is affected by advice from local community leaders.

3. Study area

Our research was conducted with fishermen in the protected area “Área de Proteção Ambiental Lago de Pedra do Cavalo” (APA) in the state of Bahia in Brazil. A large fraction of the individuals living in the APA are fishermen and farmers, and the natural resources in the protected area provide the basis for living for most of the local population. The lake Pedra do Cavalo is also of major importance for the State of Bahia; it provides water to four million people. About 40’000 families live in the APA, and most of them depend directly on at least one of the three common resources fish, game and natural and planted vegetation. An earlier research project in two communities of the area had revealed that these resources are indeed not used in a sustainable way (Cavalcanti, 2003). One of the main reasons was the overexploitation and degradation of the resources. According to the local fishermen, the decrease of the fish stock, which is of concern in the present study, is likely due to the fact that most fishermen catch small fish and do not stop fishing during the recovery period. From 2002 to 2004 the Centro de Recursos Ambientais Bahia (Environmental Resources Centre of the State of Bahia) and the local University of Feira de Santana-Brazil worked together to form a Management Council (MC) for this area with the aim of promoting discussion of the local problems and of finding solutions jointly with the local stakeholders. The members of the MC are the communities’ leaders, representatives of public and private institutions, NGOs and the municipal governments located

in the protected area. It is hoped, that the MC as a new institution will help to develop practical and relevant proposals that foster the sustainable use of the resources in the APA.

4. Methods

4.1. Experimental design

The participatory process that we initiated involved six distinct steps (Figure 1). First, the project was presented to the MC of the APA. Second, when the MC had guaranteed to support the participatory process, we interviewed fishermen from six communities about the current fishing situation. This was done with a questionnaire that contained questions about personal data and the socio-economic status of participants. Third, we conducted meetings in three of the six fishing communities (treatment group with participation) where the fishermen had the possibility to discuss their problems and to develop proposals for ways to solve them. We assigned communities arbitrarily to the treatment group with the restriction that they should geographically be well interspersed with the control group communities (no participation). Fourth, in cooperation with representatives of the MC, we selected some of the proposals developed in the treatment group. Fifth, we presented these “final proposals” to the leaders in each of the six communities². The leaders were asked to state whether they approved or disapproved of each proposal. The final step was an interview in which each participant was confronted with questions regarding each of the final proposals. A randomly selected subset of respondents (half of the participants in each community) also received their local leader’s recommendations on

² These leaders had been elected by the inhabitants of their communities during meetings held to form the MC. The role of the leader is to represent his/her community in the meetings of the MC and thereafter inform the fishermen about the decisions taken in these meetings.

each proposal. In this second questionnaire, the fishermen were also asked questions about their beliefs about the behaviour of other fishermen. The respondents of the first and second questionnaire could be matched for 142 out of 197 participants of the first questionnaire. This allowed us to link the socioeconomic variables which were assessed in the first questionnaire with the stated willingness to contribute and stated beliefs elicited in the second questionnaire.

4.2. Interaction and survey process

Step 1: Interaction with the Management Council of the protected area

Our interaction began with the Management Council (MC) of the APA. In a meeting, we asked the members of this institution about their opinions regarding our research project and if they were willing to support the participatory process. All MC members responded positively and agreed to take part in the participatory process.

Step 2: Survey of socioeconomic variables through the first questionnaire

As a next step, we conducted a questionnaire in the six fishing communities Ilha de Antonio Cardoso, Fazenda Pernambuco, Novo Porto Castro Alves, Trapia/Mamona, Tupiacu/Timborinha and Xavante. The goal of this step was to obtain an overview of the current fishing situation and socioeconomic variables. The interviews were conducted in August 2006 by the first author and three several trained helpers. The helpers were biology students of the third and seventh semester of the University of Feira de Santana-Bahia and were familiar with the situation of the fishermen

in this area. In total, we interviewed 197 fishermen before the following intervention steps (table 1).

Step 3: Implementation of participation in three communities

In three of the six communities we held community meetings with the goal to develop concrete proposals to improve the fishing situation (Tupiacu/Timborinha, Ilha de Antonio Cardoso and Fazenda Pernambuco). In Tupiacu/Timborinha 26 fishermen showed up in the meeting, in Fazenda Pernambuco 16 fishermen and in Iha de Antonio Cardoso 15 fishermen. The meetings were held in August/September 2006 and lasted 4–5 hours each.

A participatory meeting consisted of two parts. In the first part, we presented the fishermen the data of the questionnaire from step 2. Thus they learned what the beliefs, perceptions and knowledge of members of their own community were. In the second, much longer part of the meeting we started a discussion between the fishermen about the main problems related to the use of the fishing resources and asked them to develop proposals on how to solve these problems. We tried to be as neutral as possible to not influence the development of the proposals. Each community developed 3-4 proposals. For each meeting, we recorded a short protocol summarizing arguments and specific proposals.

Step 4: Development of final proposals with the MC

Following the meetings with the communities, we presented and discussed the proposals with members of the MC. We asked them which proposals in their opinion were likely to successfully

promote sustainable resource management. We tried to focus on the practicability of each proposal and its potential for implementation and enforcement within a short period of time. The representatives chose and modified some of the original proposals and thus helped us formulating the final proposals we used in the following steps (see Results section for proposals).

Step 5: Solicitation of leader opinions

In each of the six communities we provided the fishermen with basic information about the participatory process which had produced the proposals and with the final proposals themselves. In each community we also identified the community leader and asked him about his opinion regarding each of the final proposals. More specifically, we recorded for each proposal if he had “no doubt”, “a bit of doubt” or “a lot of doubt” that the proposal would improve the situation for the fishermen.

Step 6: Survey of beliefs and stated willingness to contribute to the proposals

After the intervention (steps 3–5) we interviewed all participants with a second questionnaire. The opinion of each leader was given to half of the participants of his own community whereas the other half did not receive any information from their (or any other) leader. The aim was to examine whether and how participation or opinions from leaders affected the individual fishermen’s willingness to contribute to the developed proposals, alongside with socioeconomic variables and beliefs about the contribution of others.

Table 2 summarizes the number of observations in each of the four groups formed by participation and opinion leader treatments. Table 3 shows the number of participants who answered the second questionnaire and the percentage who reported that they had already participated in the first questionnaire.

4.3. Hypotheses

We tested the following hypotheses: (a) the participatory process and the leader opinions affect willingness to contribute; and (b) socioeconomic variables and individual beliefs also influence willingness to contribute. More precisely, we hypothesized that the participation affects the willingness to contribute positively, whereas the influence of the leaders depends on the content of their opinions. Furthermore, socioeconomic characteristics and beliefs about contributions of others should also positively influence willingness to contribute.

4.4. Statistical analysis

We used ordinary least squares (OLS) regression and ordinal regression (logit link) to analyze the influence of participation, opinion leaders and individual beliefs on the willingness to contribute to suggested proposals for sustainable fishing. Additionally, we used OLS regression to test the effects of the socioeconomic variables education, age, gender and religiosity on individual beliefs. We summarized the results of these analyses in tables containing the regression coefficients with their standard errors and t-values and in analysis of variance or deviance tables (ANOVA; McCullagh & Nelder 1989).

First, we fitted a complex model which included socioeconomic and belief variables as covariates together with the two presence/absence factors participation and leader opinion. Within the factor leader opinion, we fitted a contrast reflecting the degree of support of the opinion leader for a proposal. In the second model we omitted this contrast. In the third model we additionally omitted the socioeconomic variables. In the fourth model (only used for proposal two, see below), we kept one belief variable together with the two factors participation and leader opinion as explanatory terms. In the fifth model, we further removed the remaining belief variable so that only participation and leader opinion were left as explanatory terms. We provide ANOVA tables for the first and the third model (Appendix).

5. Results

We present the data and analyses in three main sections. First, we give an overview about the current fishing practice in the protected area. Second, we present the three final proposals that were developed by the fishermen and the MC. Third, we analyze the impact of participation and opinion leaders on the willingness to contribute to the proposals and how willingness to contribute was related to individual variables such as socioeconomic status and beliefs about the contribution of other fishermen to sustainable resource use.

5.1. Current fishing practice in the APA

Table 4 gives a summary of the fishing behaviour of our subject pool. Fishery is a traditionally male profession; hence, it is not surprising that 87% of the 197 completed first questionnaires

were filled in by men. The participants in this first survey were on average 36.5 years old and had 3.7 years of school education. Most of them were catholic and considered themselves as “somewhat” religious. In total 147 participants professionally catch fish and shrimp. On average they reported a catch of 11.5 kg of fish and 79.7 l of shrimp per week.

5.2. Proposals developed by the fishermen together with the MC

Below, we present the three proposals that were developed by the fishermen and selected and finalized by the MC. In addition, we report the stated voluntary contributions to each of these proposals (sample pooled over all of the six communities).

Proposal 1: Selling of catch in one centralized place

A first suggestion by some fishermen was create a centralized market where their catch would be sold exclusively. The aim of this proposal was that the catch could be better controlled and the sale of illegal catch (small fish) discouraged. Their idea was to use the network of an existing organization, the Colonia. The Colonia is a fishing association that was formed by the representatives of the MC and the fishermen in the protected area with the aim of helping the fishermen to organize themselves to struggle in favour of their rights. It is through the Colonia, for example, that fishermen can receive the fishing card, which gives them benefits during the recovery period of the fish and at the time of retirement of the fishermen. The proposal extended the use of the Colonia to a place where fishermen bring their catch and organize the selling of the catch. We asked the fishermen how many hours they were willing to volunteer in this place per

week. Nearly all fishermen were willing to volunteer at least some hours. Almost 25 % wanted to work two hours per week (Fig. 2).

Proposal 2: Self-monitoring

Most fishermen wish more controls which prevent that small fish and shrimp are caught or sold. According to the fishermen there are presently few controls by the responsible governmental institution for inspection, the IBAMA (Brazilian Institute of Environment and Renewable Natural Resources). Many fishermen learned during their discussions that they need to monitor themselves which size of fish and shrimp are caught by others in order to avoid over-fishing and to enforce the law which specifies the size of fish and shrimp that is allowed to be caught. The proposal suggested that inspection would be more effective if the fishermen themselves would denounce misbehavior and report it to the IBAMA. We asked the fishermen their willingness to denounce misbehaviour. The fishermen varied considerably in their willingness of denunciation (table 5). In our second questionnaire 16 fishermen claimed that they would never denounce another fisherman who caught fish or shrimp smaller than the allowed size, 35 fishermen would only denounce another fisherman who caught a large fraction of small fish and more than half of the fishermen would already report another fisherman catching a few small fish.

Proposal 3: Replacing plastic-bottle traps by more sustainable traps

At present, modified plastic bottles, or garrafas, are the standard gear to catch shrimp. Garrafas are locally believed to be harmful for the shrimp population because small shrimp can be caught

in a large quantity with these traps. Locals think that these traps may be the main reason for the diminishing shrimp population. Some years ago, another trap, the so-called cofo, was used more frequently. The cofo is a bamboo basket in which mainly big shrimp get caught. One of the reasons why the cofo was replaced by the garrafas is that the material to manufacture cofos is comparatively expensive. The MC was already aware that it would be important that fishermen could obtain the necessary material at an affordable price and it was already looking for an organization that was willing to donate bamboo, one of the essential materials to manufacture the cofos. The third proposal was thus to replace garrafas with cofos, that is, fishermen would have to hand over a considerable fraction of their garrafas in exchange for receiving bamboo to manufacture cofos. We asked the fishermen, how many of their garrafas they were maximally willing to give up if in return they received bamboo for manufacturing 120 cofos (Fig. 3). The majority of the fishermen said they would be willing to hand in a substantial number of their garrafas. Around 70 percent were willing to give at least 120 garrafas in exchange for material for 120 cofos.

5.3. Influence of participation, opinion leaders and individual beliefs on stated willingness to contribute (WTC)

Results of the analyses of the influence of participation, opinion leaders and individual beliefs on the willingness to contribute to the three proposals are summarized in tables 7–9 and 11–13 in the Appendix. The explanatory variables included in the models are presented in table 6.

Participatory Process and Willingness to Contribute

Our results suggest that the initiated participatory process can increase the willingness to contribute. The fishermen who took part in a participatory process were more willing to contribute to proposal 2, that is, they were more willing to denounce fishing misbehaviour. In table 8, we can see that the participation dummy is positive and significant on the 90 percent level (models 2 and 3), although not significant in the models with all controls. In models 4 and 5 where we do not control for the belief about the mesh size other fishermen use, the participation dummy is positive but not yet significant.

Leader Opinion and Willingness to Contribute

There is a strong effect of the leader opinion in the last proposal. In models 2 and 3 the leader's opinion significantly affects the willingness to exchange garrafas (table 9). Fishermen who were informed about the opinion of the leader were willing to contribute 55 garrafas more on average. However, this effect vanishes if we control for the direction of the leaders. What can be also seen in this model is that the exact opinion of the leaders, that is, how strongly they supported this proposal, did not matter. In the other two proposals, there is no effect of the opinion leader dummy or the direction of the dummy. It seems, if at all, that just access to information, but not the direction of it, might have influenced fishermen's willingness to contribute.

Beliefs and Willingness to Contribute

For each of our proposals, we extracted the beliefs of the fishermen. More precisely, we asked the fishermen their beliefs about other fishermen's contributions to each of the three proposals. For the first proposal we asked them how many hours they believe the others were willing to volunteer for the colonia. For the second proposal, we wanted to know what they believe how many out of ten fishermen were willing to denounce misbehaviour. Finally, for the third proposal, we wanted to know how many unsustainable traps they believed the other fishermen of their community were willing to hand over in exchange for materials to manufacture sustainable traps.

We find that beliefs played a very important role for each of our three proposals. In tables 7 and 9, we can see that the field belief variable is always significant at the 99 percent level, and in table 8 it is significant at the 95 percent level. Also the magnitude of the coefficient is large. For instance, fishermen who believed the other fishermen were willing to volunteer in the colonia one hour more are increasing their willingness to volunteer by about 50 minutes. Or, they are willing to hand over about 30 garrafas more if they believe the others hand over 100 garrafas more. Moreover, they are also more likely to denounce misbehaviour if they believe the others do so as well.

The Beliefs and Socioeconomic variables

Since beliefs have a strong influence on the willingness to contribute to the three proposals developed by the fishermen, we also examined if socioeconomic variables do explain some

variation in them (table 10). We use regression analyses (OLS) for all three field beliefs. The socioeconomic variables we use in the analyses are education, age, gender and religiosity. For two of the three field beliefs find no effects of the socioeconomic variables. For the field belief in the last proposal, we find gender and education to be weakly significant. Women seem to have more negative beliefs than men; they believe that the other fishermen would hand in 86 garrafas less than the men believed. Religious fishermen were somewhat more optimistic and believed other fishermen would hand in a more garrafas in exchange of cofos.

6. Conclusion

The aim of this research was to examine the effects of a participatory process on the willingness to contribute to cooperative common-pool resource management in a protected area in Brazil. We conducted a field experiment to isolate the effects of public participation in the design of resource management proposals. In a community-level experimental treatment we manipulated the opportunity for community participation in developing proposals for cooperative resource management. In the second treatment, we manipulated individual access to local expert evaluations of the resulting resource management proposals.

The experiment demonstrates that it is possible to experimentally investigate how public involvement affects cooperation in community-based resource management. Our results suggest that a participatory approach in developing management proposals may promote cooperation in situations where resources are difficult to monitor and efficient management may hence rely on informal sanctioning institutions. In particular, we find that the participatory process initiated in this study made fishermen think about the role of self-monitoring in resource management. Under

the participation treatment, the fishermen were more willing to denounce fishing misbehaviour. This finding agrees with laboratory studies showing that altruistic punishment of un-cooperative acts is a key element in promoting cooperation (e.g. Fehr & Gächter, 2000).

The effects of the leader opinion are less clear. In fact, we find a significant effect in just one model of the responses to one proposal. A possible explanation is that the fishermen had in this case already formed consistent beliefs and willingness to contribute based on the information set available in the survey – even without access to the advice of their community leaders. This finding contrasts to the results by Schläpfer & Soliva (2006) and Schläpfer *et al.* (2008) who showed that knowledge of expert evaluations strongly affected stated preferences for public goods.

A strong pattern in our data is that beliefs and the willingness to contribute are highly correlated. Many fishermen reported to contribute more if they believed others would contribute as well. While this correlative result does not allow a direct causal interpretation, our finding is at least consistent with the interpretation that many fishermen are conditionally cooperative (c.f. Frey & Meier, 2004; Shang & Croson, 2005). In principle at least, participatory processes offer an opportunity to favourably influence beliefs. Our findings suggest that an increased attention to beliefs may be useful for a better understanding of individual cooperation in the management of common-pool resources. The enhanced communication initiated by participatory research could help develop reputation and trust among the participants, and this may in turn change the beliefs in a direction that is favourable for successful collective action.

Our findings possibly underestimate the potential of the participatory process. Due to time and resource constraints, we could only begin a participatory process. Insights into the effects of

an extended process of communication and deliberation about cooperative resource management are currently examined in our ongoing field research in the study area.

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Table 1: Number of participants in the first questionnaire

Community	Participants
Ilha de Antonio Cardoso	26
Fazenda Pernambuco	31
Novo Porto Castro Alves	26
Trapia/Mamona	42
Tupiacu /Timborinha	46
Xavante	26
Total	197

Table 2: Numbers of participants in each participation x opinion leader combination

	Participants in the communities with participation	Participants in the communities without participation
Information from opinion leader	33	36
No information from opinion leader	35	38

Table 3: Number of participants in the second questionnaire

Community	Participants	Percentage for whom the first questionnaire was also available
Tupiacu/Timborinha	29	0.59
Trapia/Mamona	31	0.74
Novo Porto Castro Alves	20	0.77
Fazenda Pernambuco	20	0.64
Ilha de Antonio Cardoso	21	0.81
Xavante	21	0.81
Total	142	

Table 4: Summary Statistics of Fishing Behaviour

	Mean	No. Obs.
<i>Fishing Behaviour</i>		
Catch fish and shrimp		147
Fish caught in kilogram/ week	11.45	
Shrimp caught in liter/ week	79.73	

Table 5: Willingness to denounce (Proposal 2)

Level of Misbehaviour	Never, irrespective of misbehaviour	Very high	High	Low	Very low
Observations	16	35	5	6	81
Percentage	11.20%	24.50%	3.50%	4.20%	56.60%

Table 6: Explanatory variables used in the models (SD indicates the Standard Deviation)

Variable	Description	Mean	S.D.
<i>Explanatory Variable</i>			
Participation	Communities where participatory research took place; 0 if there was not participation; and 1 if there was participation		
Opinion Leaders	Participant has been informed by the leader opinions; 0 if participants were not informed; and 1 if they were informed		
Community	Communities; 1 if Tupiacu and Timborinha; 2 if Fazenda Pernambuco; 3 if Ilha de Antonio Cardoso; 4 if Xavane; 5 if Trapia and Mamona; 6 if Fazenda Pernambuco		
Direction of Opinion Leader	The direction of the opinion of the leader; -1 if the leader has “lot of doubts”; 0 if there is “no opinion” or if the leader has “little doubt”; and 1 if he has “lot of doubt”		
Group	It refers to the interaction between the variables communities, opinion leader and direction of the opinion leader		
Age	Age of fishermen	36.470	13.350
Gender	0 if male; 1 if female	0.115	0.321
Education	Years spent in school	3.668	2.931
Religiosity	Religiosity of fishermen. 0 if “without religion”; 1 if “not religious”; 2 if “a little bit”; 3 if “a bit”; 4 if is “some”; and 5 if “a lot religious”	3.426	1.308
Caught Fish	Kilos caught per week	11.450	11.170
Number of Garrafas	Amount of plastic bottles in possession of fishermen	309.570	196.200
Belief Mesh Size other Communities	Beliefs about the mesh size fishermen form other communities use	7.386	1.376
Field Belief Proposal 1	Belief how many hours other fishermen would work on average for free in the “colonia”	6.154	3.068
Field Belief Proposal 2	Belief how many plastic bottles other fishermen would hand in if they receive materials to make 120 “cofos” related (Proposal 3)	221.600	198.500
Field Belief Proposal 3	How many out of 10 fishermen would denounce someone to the IBAMA selling small fish/shrimp	4.846	4.777
<i>Dependent Variable</i>			
Proposal 1	How many hours fishermen would work for free in the “colonia”	5.598	5.247
Proposal 2	Exactly when fishermen would denounce someone to the IBAMA. 0 if “I would not denounce”; 1 if he sells “a little bit” of small shrimp and fish; 2 if he sells “a bit” of small shrimp and fish; 3 if he sells “some” small shrimp and fish and 4 if he sells “a lot” of small shrimp and fish	2.706	1.587
Proposal 3	How many plastic bottles would fishermen hand in if they receive materials to make 120 “cofos (Proposal 3)	179.400	141.600

Table 7: Willingness to Volunteer in the Colonia (OLS)

Model	1	2	3	4
Participation	0.120 (0.899)	0.105 (0.886)	0.319 (0.558)	0.530 (0.879)
Opinion Leader	-0.770 (2.940)	-1.146 (0.829)	-0.478 (0.559)	-1.067 (0.879)
Direction of the Opinion Leader	-0.390 (2.960)			
Field Belief	0.885*** (0.085)	0.883 (0.084)	0.848*** (0.059)	
Education	-0.096 (0.189)	-0.090 (0.183)		
Age	-0.071* (0.042)	-0.070* (0.041)		
Gender	1.10 (1.220)	1.080 (1.210)		
Religiosity	0.807** (0.356)	0.081** (0.354)		
Catch	-0.020 (0.038)	-0.021 (0.038)		
Number of Garrafas	0.001 (0.002)	0.001 (0.002)		
N	94	94	143	143
R squared	0.599	0.599	0.605	0.013
Adj. R squared	0.551	0.556	0.597	*
AIC	691	689	1058	1187
BIC	719	714	1070	1196

Notes: *** 99-percent significance, ** 95-percent significance; * 90-percent significance; Standard error in parentheses

Table 8: Willingness to Denounce Misbehaviour (OrderedLogit)

Model	1	2	3	4	5
Participation	0.936 (0.584)	0.922* (0.548)	0.887* (0.524)	0.792 (0.517)	0.804 (0.514)
Opinion Leader	-0.400 (1.080)	-0.335 (0.533)	-0.389 (0.516)	-0.359 (0.511)	-0.450 (0.507)
Direction of the Opinion Leader	0.080 (1.110)				
Field Belief Proposal 2	0.213** (0.093)	0.214 ** (0.092)	0.214** (0.086)	0.215** (0.086)	
Education	0.054 (0.113)	0.054 (0.112)			
Age	0.030 (0.026)	0.030 (0.026)			
Gender	-0.607 (0.776)	-0.601 (0.766)			
Religiosity	-0.146 (0.234)	-0.146 (0.232)			
Belief Mesh Size other Communities	0.191 (0.209)	0.194 (0.206)	0.148 (0.194)		
N	135	135	139	140	140
R squared	0.082	0.082	0.074	0.066	0.023
Adj. R squared	0.016	0.024	0.047	0.045	0.009

See notes in table 7

Table 9: Willingness to Exchange Garrafas (OLS)

Model	1	2	3	4
Participation	23.100 (26.300)	8.800 (24.000)	-33.600 (23.300)	-36.200 (25.300)
Opinion Leader	53.300 (56.700)	54.900** (22.400)	55.000** (23.700)	37.000 (25.400)
Direction of the Opinion Leader	-30.400 (58.400)			
Field Belief	0.296*** (0.056)	0.291*** (0.056)	0.278*** (0.059)	
Education	-6.280 (5.050)	-5.290 (4.980)		
Age	0.660 (1.110)	0.460 (1.100)		
Gender	4.700 (33.000)	2.100 (32.900)		
Religiosity	-5.500 (9.180)	-6.230 (9.210)		
Number of Garrafas	0.345*** (0.064)	0.357*** (0.063)		
N	115	115	123	123
R squared	0.426	0.490	0.187	0.033
Adj. R squared	0.371	0.364	0.167	0.017
AIC	1647	1646	1792	1811
BIC	1677	1671	1803	1820

See notes in table 7

Table 10: Field Beliefs (OLS)

Dependent Variable	Field Belief Proposal 1	Field Belief Proposal 2	Field Belief Proposal 3
Education	0.240 (0.171)	-0.101 (0.107)	-3.700 (7.560)
Age	0.053 (0.037)	-0.036 (0.023)	-1.360 (1.610)
Gender	-0.120 (1.210)	-0.938 (0.761)	-86.400* (51.000)
Religiosity	-0.189 (0.349)	0.256 (0.219)	28.600* (14.600)
N	139	139	128
R squared	0.021	0.036	0.057
Adj. R squared	*	0.007	0.026
AIC	1129	1000	1977
BIC	1144	1014	1992

See notes in table 7

Figure 1: Overview of the experimental design (B, WTC, MC and Q refer to beliefs, willingness to contribute, Management Council and questionnaire, respectively)

Experimental design

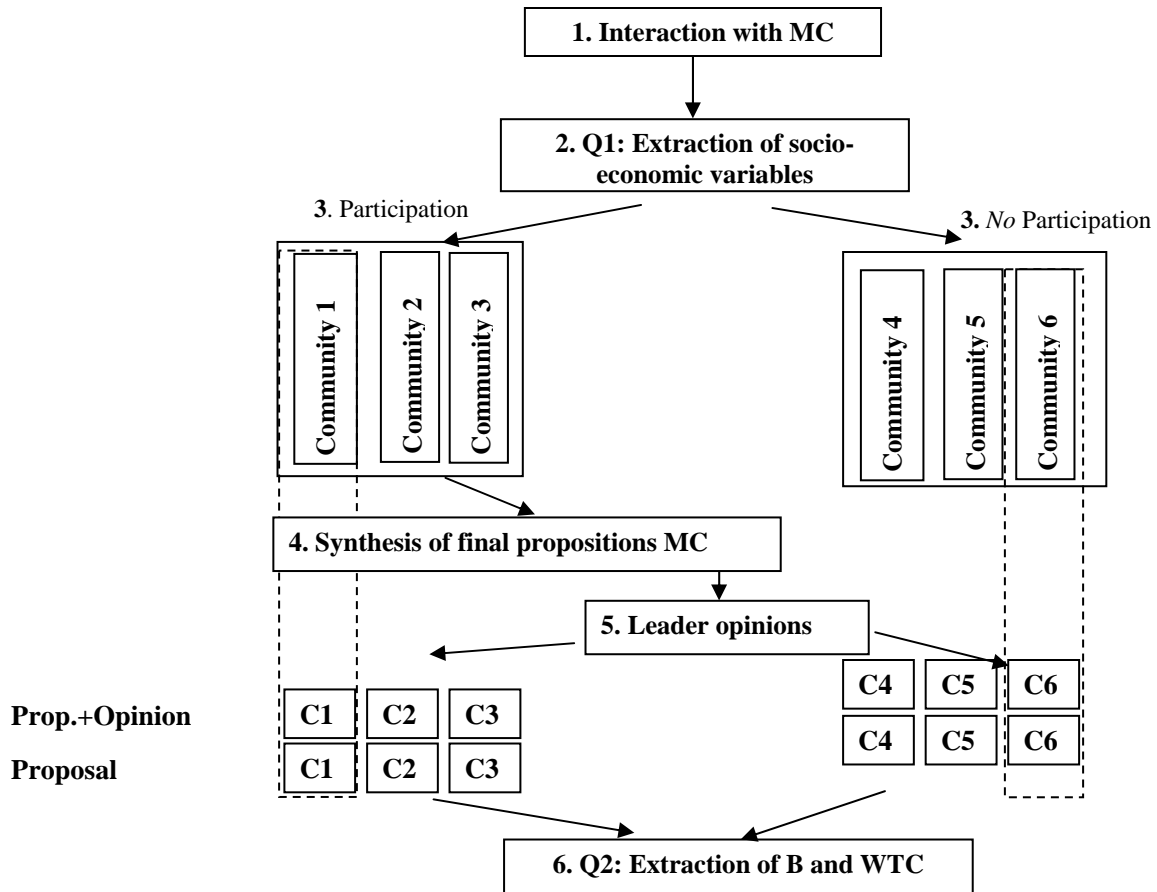


Figure 2: Willingness to work for Colonia

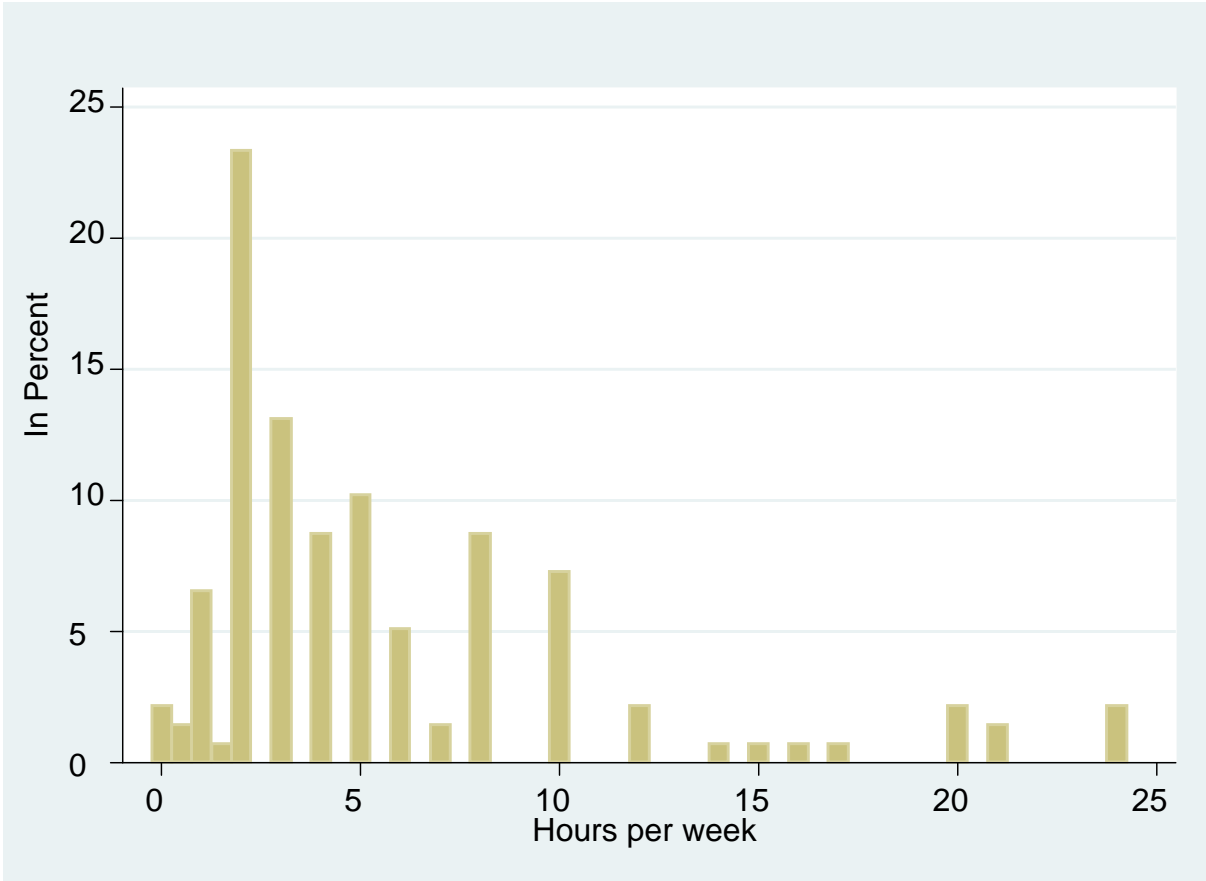
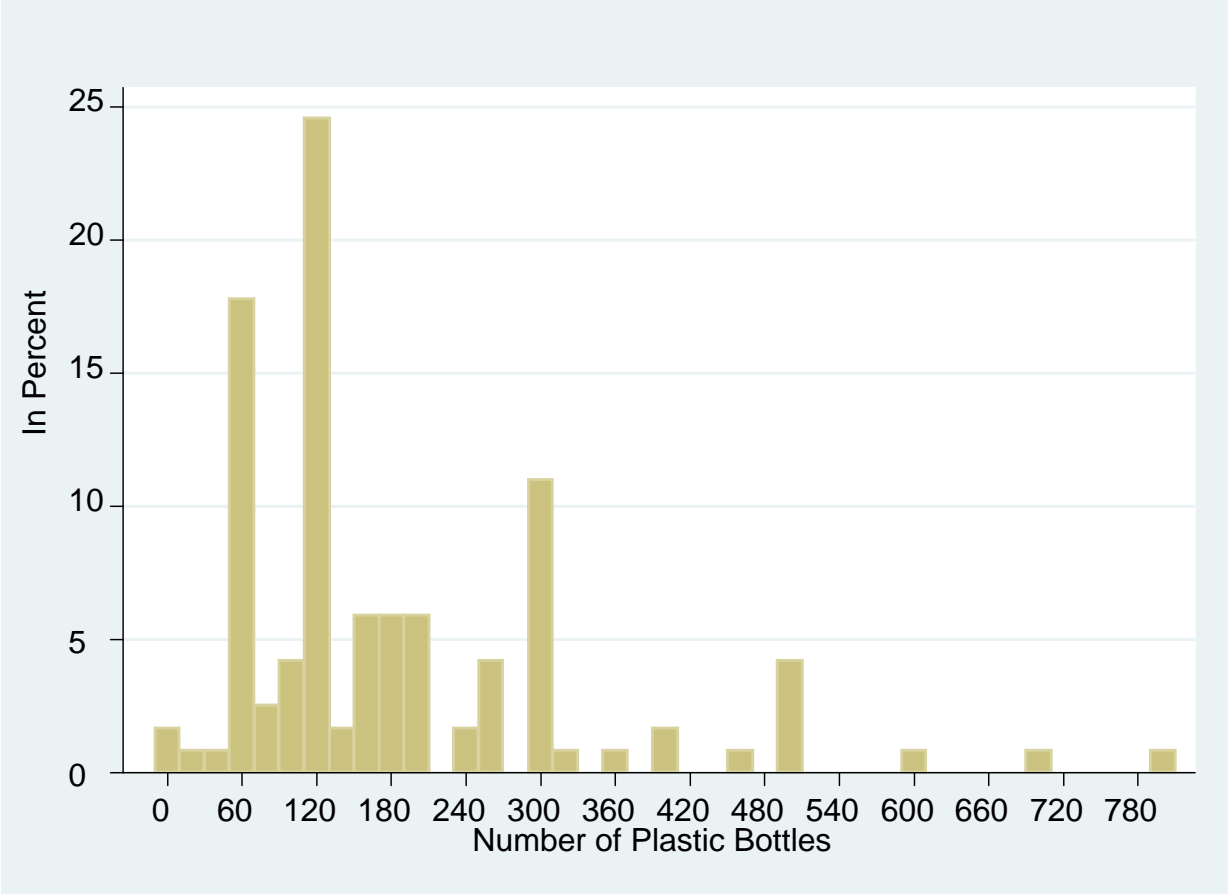


Figure 3: Willingness to Exchange Plastic Bottles



APPENDIX

Table 11: Willingness to denounce misbehaviour (= proposal 2)

Variable	With socioeconomic variables			Without socioeconomic variables		
	DF	SS	F pr.	Df	SS	F pr.
Education	1	0.323	0.716			
Age	1	0.46	0.664			
Gender	1	2.097	0.354			
Religiosity	1	0.265	0.741			
Catch	1	0.269	0.74			
Number of Garrafas	1	0.096	0.843			
Belief	1	10.9	0.037	1	34.09	0
Proposal 2						
Participation	1	9.708	0.137*	1	14.669	0.073
Community	4	11.24	0.521	4	10.058	0.617
Leader	1	3.065	0.264	1	2.24	0.312
Opinion						
Supportiveness of Leader	1	1.397	0.449	1	0.079	0.849
Opinion						
Leader	4	11.899	0.305	4	13.811	0.181
Opinion x Community						
Residual	75	181.091		130	282.716	

* Tested against variation between communities (line below) because all participants within a community either had or did not have participation.

Table 12: Willingness to exchange unsustainable traps (= proposal 3)

Variables	With socioeconomic variables			Without socioeconomic variables		
	DF	SS	F pr.	DF	SS	F pr.
Education	1	99312	0.008			
Age	1	8272	0.433			
Gender	1	55462	0.044			
Religiosity	1	1555	0.733			
Number of Garrafas	1	421467	0			
Belief	1	307541	0	1	333614	0
Proposal 3						
Participation	1	1515	0.518*	1	34232	0.289
Community	4	12075	0.921	4	91763	0.42
Leader	1	80115	0.016	1	91763	0.035
Opinion						
Supportiveness of Leader	2	61090	0.107	2	35880	0.341
Opinion						
Leader	4	57813	0.369	4	73927	0.352
Opinion x Community						
Residual	96	1279788		109	1801573	

*See table 11

Table 13: Willingness to work in the Colonia for free (= proposal 1)

Variables	With socioeconomic variables			Without socioeconomic variables		
	DF	SS	F pr.	DF	SS	F pr.
Education	1	0.49	0.857			
Age	1	7.97	0.469			
Gender	1	0	1			
Religiosity	1	41.56	0.101			
Catch	1	44.68	0.089			
Number of Garrafas	1	15.42	0.315			
Belief	1	1704.31	0	1	2355.19	0
Proposal 1						
Participation	1	0	1.000*	1	3.69	0.569
Community	4	49.06	0.463	4	38.43	0.74
Leader	1	37.53	0.119	1	9.73	0.346
Opinion						
Supportiveness of Leader	1	3.18	0.647	1	4.2	0.535
Opinion						
Leader	5	57.97	0.574	5	96.37	0.123
Opinion x Community						
Residual	74	1113.62		129	1402.02	

* See table 11