The Creation of Social Norms under Weak Institutions

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Abstract: Formal regulations often fail to ensure sustainable management of natural resources. An alternative approach could rely on the interaction of norm-based interventions and social sanctions. Our lab-in-the-field experiment with fishermen at Lake Victoria studies how a norm-based intervention, namely, social information about high or low levels of previous cooperation, affects behavior and beliefs in a prisoner's dilemma game with or without weak social sanctioning. Providing different social information succeeds in creating different norms of cooperation, but only if sanctioning is possible: cooperation rates start at a high level and stay at a high level when social information emphasizes cooperation but start at a low level and stay at a low level when social information emphasizes defection. Without social sanctioning, cooperation rates decline, irrespective of the social information. Particularly participants with close connection to others in their experimental session conform to the behavior that is emphasized by the social information message under sanctioning.

JEL Codes: C72, C93, D7, Q22

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MANAGING COMMON-POOL RESOURCES is challenging, in particular under limited state capacity. Lack of political will, low enforcement power, and corruption are reasons why governments fail to address problems of pollution, deforestation, or overfishing

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(Ostrom 2008; Barrett 2018). A prototype of such a common-pool resource system is Lake Victoria in East Africa. Fisheries from Lake Victoria support the livelihood of 4 million people, contributing annually about €700 million to one of the poorest regions in the world (Mkumbo and Marshall 2015; LVFO 2017). Preventing further depletion of the lake's resources is vital for the region, but efforts to combat overfishing are insufficient (Eggert and Lokina 2010). In the absence of formal enforcement, resource users have to rely on self-management (Baland and Platteau 1996; Ostrom 2008), and activating social norms of cooperation may be a promising policy tool (Ostrom 1990; Nyborg et al. 2016). Because social norms are sustained by sanctions (Elster 2007), norm-based interventions should be analyzed jointly with the use of sanctioning mechanisms.

However, researchers face the difficulty that "without a clean empirical identification . . . almost every behavior can be rationalized as norm driven" (Fehr and Schurtenberger 2018a, 458). Behavioral experiments allow causal inference and are thus powerful instruments to study the effect of social norms as policy tools. In this paper, we ask how a norm-based intervention affects behavior and beliefs in a three-player prisoner's dilemma. The study is conducted with fishermen at Lake Victoria, Tanzania. The norm-based intervention is the provision of social information, that is, information on peer behavior. We use social information to suggest either low cooperation rates or high cooperation rates. Additionally, we vary whether participants can use a weak social sanctioning institution where participants can vote to exclude defectors or cooperators from receiving a small financial bonus. Our weak social sanctioning institution differs from the celebrated altruistic punishment institution (see Ostrom et al. 1992; Fehr and Gächter 2000, 2002) but mimics social enforcement in the field (see the discussion in Guala [2012]). In sum, we have a 2×2 design: social information suggests either low or high cooperation rates and participants can or cannot use the weak social sanctioning institution. The experiment is repeated for seven rounds (perfect-stranger matching) to test whether different social norms are created in the four different treatment conditions. Moreover, we relate behavior and expectations in the experiment to participants' social proximity to other fishermen in their reference network.

Although social norms are frequently used as an explanation for behavior in social interactions (see, e.g., Bernhard et al. 2006; Schram and Charness 2015), no generally accepted definition of social norms has emerged in the economic literature. We draw on influential contributions (see, e.g., Cialdini et al. 1990; Ostrom 2000; Elster 2007; Bicchieri 2017) and use a definition that illustrates how social norms can be measured:

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a social norm is a stable pattern of behavior that is supported by a consistent set of beliefs about others. This definition has three implications. First, it means that "social norms cannot be identified just with observable behavior, nor can they merely be equated with normative beliefs" (Bicchieri et al. 2018). Second, Elster (1989, 99) highlights the social element and distinguishes social norms from moral norms: "For norms to be social, they must be shared by other people and partly sustained by their approval and disapproval." Third, it means that repetition is important: a social norm is a dynamic concept (Sethi and Somanathan 1996; Binmore 2010; Young 2015) that not only describes a static equilibrium in the sense that each individual prefers a given action conditional on her beliefs, but also an equilibrium in the dynamic sense that behavior and beliefs are stable and do not change over time. To account for all three implications in our empirical approach, we elicit normative beliefs (what is considered appropriate) and track participants' empirical expectations (what participants believe others do) and behavior over the course of repeated one-shot interactions. The successful creation of social norms in our experiment would then show as a stable pattern of cooperation and a corresponding pattern of beliefs.

The literature on norm-based interventions suggests that providing social information can induce behavioral change (e.g., Frey and Meier 2004; Shang and Croson 2009; Farrow et al. 2017; Goeschl et al. 2018; Bicchieri and Dimant 2019). For example, social information is found to be an effective policy tool in promoting voting behavior (Gerber and Rogers 2009), retirement savings (Duflo and Saez 2003), and tax compliance (Hallsworth et al. 2017). Importantly, Allcott (2011) and Allcott and Rogers (2014) demonstrate the cost-effectiveness and simple implementation of norm-based interventions on a large scale.[1] Several lab experiments focus on the underlying mechanism of how social information influences behavior. Building on theories of norm conformity (Bénabou and Tirole 2006; Kimbrough and Vostroknutov 2016), the findings so far suggest that social information successfully changes normative or empirical expectations and induces behavioral change since individuals condition their actions on those beliefs (Croson et al. 2009; Goeschl et al. 2018).

As conformity depends on the behavior and opinion of others (Elster 1989), we combine social information with a social sanctioning institution. That is, we experimentally vary whether participants have the opportunity to show (and receive) disapproval about others' (their) behavior. In particular, the social sanctioning institution is implemented by giving participants the option to vote on which strategy should be excluded from receiving a small financial bonus. Crucially, the financial bonus is small enough to leave the Nash

1. The Opower Home Energy Report intervention studied by Allcott (2011) and Allcott and Rogers (2014) provides households with empirical information about energy consumption in their neighborhood. Motivation to conduct a large-scale norm-based intervention on energy conservation originates from a small set of field studies by Schultz et al. (2007), Goldstein et al. (2008), and Nolan et al. (2008).

equilibrium in the game unchanged, so that our study ties into the literature on weak sanctioning (Masclet et al. 2003; Tyran and Feld 2006) and mimics informal ways of norm enforcement at Lake Victoria.[2]

In the last decades, many mechanisms to induce and maintain cooperation have been tested. A number of lab-in-the-field experiments show that free riding is reduced when cooperation can be socially enforced (Carpenter et al. 2004; Alpizar et al. 2008; Janssen et al. 2010; Rustagi et al. 2010; Hayo and Vollan 2012). In particular, the studies by Cárdenas (2011) and Lopez et al. (2012) with villagers and fishermen from Colombia find that shame (i.e., publicly revealing a participant's contribution) is effective in increasing cooperation. The social sanctioning institution in our experiment is anonymous, and it induces a payoff reduction so that the possible effect of social sanctions is monetarily defined.[3] Participants can sanction both defection and cooperation in our experiment. In other words, our focus is not so much on increasing cooperation in the experiment per se, but on the question whether social information (alone, or in combination with social sanctioning) creates different social norms of cooperation.

The only study that investigates the relationship between a social information message and a form of social enforcement in a repeated setting is Fehr and Schurtenberger (2018b), who (parallel and unbeknownst to us) conducted a novel lab experiment on social norms of cooperation.[4] They use a public goods game and employ a 2 × 2 design

2. Ostrom (2000, 149) writes: "a frequent finding is that when the users of a common-pool resource organize themselves to devise and enforce some of their own basic rules, they tend to manage local resources more sustainably than when rules are externally imposed on them," and further (on 151), "sanctions that are imposed are often so low as to have no impact on an expected benefit-cost ratio of breaking local rules (given the substantial temptations frequently involved)." While peer-to-peer punishment is found to be cooperation enhancing in the lab (Fehr and Gächter 2000, 2002), such a possibility of high impact punishment is not often observed in the field. Rather, some form of (not very strong) coordinated punishment is usually applied (Guala 2012). A concrete example could be the exclusion from playing pool, a popular leisure activity at the shores of Lake Victoria. For an anthropological account of the social ties that form an important part of many fishermen's lives, see Beuving (2010).

3. It is difficult to map the effect of "public shame" in monetary terms. Because of the out-of-lab consequences, it may be very large and, in particular, larger than the potential monetary gain from defection. Also, note that Cárdenas (2011) and Lopez et al. (2012) include a rich set of treatments with high/low external fines, face-to-face communication (in Cárdenas 2011), and also guilt and recommended play (in Lopez et al. 2012).

4. Bicchieri et al. (2022) present results from a one-shot trust game. They distinguish whether participants receive information about what others think the trustee ought to do, what a subset of trustees actually did, or no information under the presence or absence of an exogenous weak punishment institution. They find that normative information may raise the return to the trustor, but only under weak punishment, highlighting the moderating role of enforcement on norm-based interventions.

where they (i) either do or do not provide normative social information,[5] and (ii) either do or do not enable altruistic peer punishment with a counterpunishment possibility (as in Nikiforakis 2008). They find that without punishment and irrespective of normative priming, cooperation deteriorates over time. However, when punishment and counterpunishment are allowed, cooperation is stabilized in both treatments (but with a higher cooperation level when priming was provided; see also Fehr and Schurtenberger 2018a, fig. 3).

Our results are strikingly similar to those of Fehr and Schurtenberger (2018b), albeit with a participant pool of actual resource users instead of students and a different enforcement mechanism. First, we observe that the social information message has no effect on cooperation without social sanctioning. Cooperation rates decline over time, independent of whether social information emphasizes cooperation. Second, weak social sanctioning stabilizes cooperation. What is more, the social information message affects behavior under sanctioning: when cooperation is emphasized, cooperation rates start at a high level and stay at a high level (on average 54%). When defection is emphasized, cooperation rates start at a relatively lower level and remain at this lower level (on average 42%).

Moreover, we elicit beliefs, revealing that the differences in behavior between the treatments are accompanied by parallel differences in empirical expectations. In the social sanctioning treatment where cooperation is emphasized, cooperation rates are high and the majority expects others to cooperate. In contrast, in the social sanctioning treatment where defection is emphasized, cooperation rates are low and the majority expects others to defect. Without social sanctioning, emphasizing cooperation or defection does not produce significant differences in beliefs. Thus, the social sanctioning institution appears as a necessary condition for a stable pattern of behavior. Different information then leads to a self-enforcing alignment of beliefs and behavior—different social norms are created.

Finally, research in economics, sociology, and psychology has highlighted the role of the reference network and social proximity to explain conformity with social norms (Elster 2007; Dimant 2019; Bicchieri et al. 2021). The beliefs and behavior of others matter more for individual actions when "others" refers to a group that is relevant to the respective actor.[6] With reference to the literature on natural resource use that

5. In Fehr and Schurtenberger (2018b), the social information is endogenously determined and based on a norm formation opportunity stage where participants are asked how many tokens each group member should contribute to the public good.

6. The concept of social proximity strongly relates to social identity and group affiliation. The discussion of social identity and group affiliation in economics goes back to influential work by Tajfel and Turner (1979) and Akerlof and Kranton (2000). Further findings imply that conformity to shared norms of behavior is greater with high levels of social affiliation (Platteau 2006). Not only do close-knit communities share an understanding through their common identity, but strong social affiliation may be a consequence of existing group norms that govern

connects the lab and the field (e.g., Carpenter and Seki 2011; Fehr and Leibbrandt 2011; Kosfeld and Rustagi 2015) we use the random treatment assignment across individual characteristics to study an individual's social proximity to others as an additional social dimension that may facilitate the creation of social norms. In particular, we measure a participant's social proximity to the others in a session by eliciting whether a fisherman belongs to the session's majority with respect to gear type (target species) and region of origin (ethnicity), two defining features of the social structure in fishing communities at Lake Victoria (Nunan et al. 2018). We find that those participants with close social proximity to the others in their session drive the social information treatment effect: they cooperate more when social information emphasizes cooperation and cooperate less when social information emphasizes defection.

1. LAKE VICTORIA FISHERIES

Lake Victoria (see fig. 1) is the largest lake in Africa, and its resources are shared among three nations (Kenya, Tanzania, and Uganda). Despite the existence of intergovernmental structures such as the Lake Victoria Fisheries Organization, national strategic incentives limit coordinated and effective measures to curb overfishing. Within each country, limited state capacity hampers monitoring and enforcement of the fishing regulations that aim to promote sustainable resource use, and thus noncompliance is common (Eggert and Lokina 2010). Therefore, regulators should focus on enhancing compliance. Promoting resource users' own cooperative efforts and community management is key to overcome the social dilemma that characterizes the use of the lake's resources.

In order to prevent further depletion of the fish stock and to encourage community participation, the Tanzanian government established local comanagement structures known as beach management units (BMU). BMUs were introduced in 1998 and have been helpful in reducing the use of poison and dynamite, but their overall effectiveness is unclear (Eggert and Lokina 2010; Nunan and Onyango 2017). Corruption and kinship ties between BMU officials and fishermen make effective monitoring and enforcement difficult. Yet, BMUs are a forum for exchange and feedback at the landing site level (Luomba 2013). This offers a potential springboard for policies that aim at changing social norms of cooperation in an environment where states' governance capacities are limited.

Moreover, the social structure in a community plays an important role for successful management of common pool resources (Mosimane et al. 2012). Crona and Bodin (2006), Barnes et al. (2016), and Nunan et al. (2018) identify specific determinants of social cohesion in fishing communities. Two features that are particularly relevant at Lake Victoria are (1) differences in the region of origin, which partly reflect ethnic differences,

beliefs and attitudes of community members (Mason 2006). This does not imply that social proximity necessarily increases cooperation. Rather, social proximity enhances the pressure to conform to whatever the social norm is.

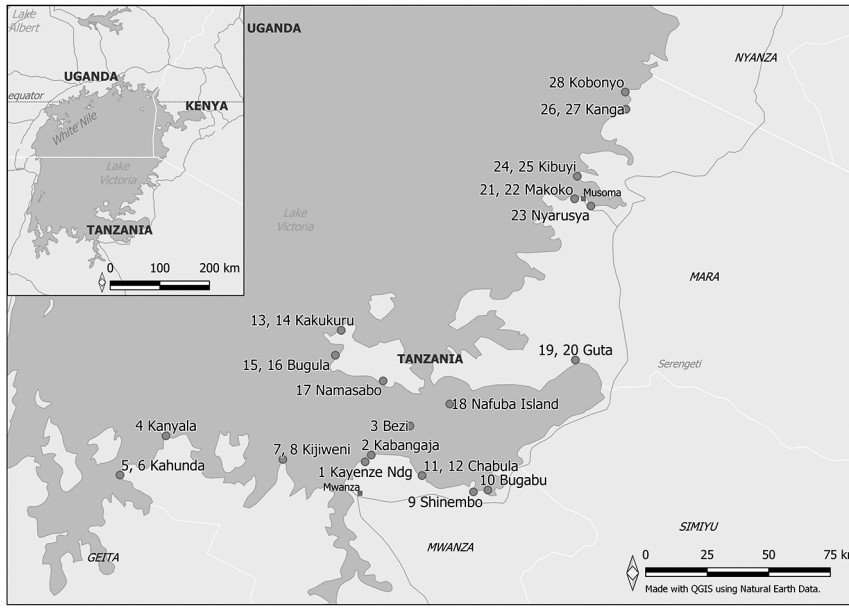

Figure 1. Map of field research sites, Lake Victoria, Tanzania. Color version available as an online enhancement.

and (2) a fisherman's main target species, which essentially splits fishermen into different life and work routines. Dagaa fishermen work at night and use solar or kerosene powered lights and small meshed seine nets, while Nile perch and tilapia fishermen use hooks or large meshed nets to fish during the day. Moreover, dagaa is mainly sold to local and regional markets while Nile perch are collected by processing plants and exported to the world market.[7]

2. EXPERIMENTAL DESIGN AND PROCEDURE

In the following, we describe an experiment designed to test whether a social information message can create different social norms of cooperation with or without a weak social sanctioning institution. In particular, we use a factorial design where one factor is a message providing information on either high or low cooperation rates of previous participants in a similar setting. The other factor is a sanctioning institution, implemented as the opportunity to vote on what type of behavior should be excluded from receiving a small financial bonus.

7. Interestingly, Jang and Lynham (2015) show that differences in the typical contractual sharing agreements between boat owners and crews in the dagaa and Nile perch fisheries in Kenya translate into differences in sharing behavior in the ultimatum game.

We refer to the treatment where the sanctioning institution is available and the social information message emphasizes high cooperation as *hi-S* treatment. The corresponding social information treatment without a sanctioning institution is referred to as *hi-noS* treatment. In parallel, *low-S* and *low-noS* refer to the treatments with and without social sanctioning when the social information message emphasizes low cooperation.

2.1. The Social Dilemma Game

Our vehicle to model the social dilemma is a three-player prisoner's dilemma. It is a simultaneous-move game such that participants cannot condition their action on the observed behavior of others. The game is played for a total of seven rounds with a perfect-stranger matching protocol. The protocol prevents directly reciprocating past behavior and precludes forward-looking motivations for specific actions.[8]

Participants are randomly divided into groups of three. Each participant receives an endowment of four points that she can either allocate to a private account (hereafter "defect") or to a group account (hereafter "cooperate"). Only the full endowment can be transferred to either account. For every group account contribution, all three group members earn two points. Table 1 shows the individual payoff matrix.

We opt for the prisoner's dilemma game, arguably the simplest cooperation game. Because the game has only two pure strategies, payoff consequences are easy to explain. This is an important consideration when participants have little formal education. Furthermore, we choose not to frame the game in the resource extraction context of our field. Using an abstract game reduces the concern that any experimenter-induced context overwrites the incentive structure of the game; see Zizzo (2010) for a discussion.[9] That said, the binary decision set in the experiment is a good proxy for crucial cooperation decisions in the weakly regulated fisheries at Lake Victoria. For example, the choice between using legal or illegal fishing gear is an important compliance decision that affects sustainable resource use (Eggert and Lokina 2010).

2.2. Social Information Message and Belief Elicitation

Prior to the allocation decision in the three-player prisoner's dilemma game (but after participants are fully informed about the rules), we elicit the participants' normative

8. Seven rounds is the maximum number of repetitions that still allows a perfect-stranger matching in groups of three when there are a total of 15 participants in the pool. We chose this threshold because we did not know ex ante that we would be successful in recruiting 21 participants in every session.

9. Zizzo (2010) cautions that experiments may be prone to "purely cognitive experimenter demand effect (EDE)" when context is given. He writes: "Context may distract subjects and allow them to carry over unrealistic scripts and expectations to the task; it may reduce the generality of the experiment; it may induce EDE. The implied trade-off between helping subjects' understanding (by providing contextual cues) and reducing the likelihood of EDE (by having more abstract instructions) is one that experimentalists need to face on a regular basis" (Zizzo 2010, 82).

Table 1. Individual Payoff Matrix

		Number of Other Cooperators		
		0	1	2
Own decision	Cooperate	2 pt	4 pt	6 pt
	Defect	4 pt	6 pt	8 pt

beliefs, normative expectations, and empirical expectations (Bicchieri 2017). Before the belief elicitation, participants receive a verbal social information message; see table 2.

Our message is designed to affect empirical expectations in the direction of either cooperative (high) or defective (low) behavior. The phrasing utilizes the word "many," making our social information manipulation very subtle.[10] Moreover, we deliberately do not want to persuade participants that one or the other action is better. That is, we address descriptive norms (what do most others do) instead of injunctive norms (a prescription of what one ought to do; see Cialdini et al. 1990).

In practice, descriptive and injunctive norms may not be fully separable. For example, participants could take the social information message as a signal of what is the right action in the eyes of others and reevaluate their own moral belief. Therefore, we ask participants what they think one ought to do in this situation, that is, their personal normative beliefs. Participants can choose from a menu of three options. They can either state that one ought to (i) "put the points to the private account," (ii) "put the points to the group account," or (iii) "do what others do." Moreover, we ask participants what they think most others think one ought to do, that is, their normative expectations. Next, we repeat the social information message and ask participants what they think others

10. Note that we did not lie to the participants. We had visited the communities in this study about a year before and conducted a survey that included the incentivized decision to put points in a private or group account. Across the whole study, many participants had put the points in the group account, and many participants had put the points in their private account. More specifically, in some communities, the majority of participants cooperated, and in other communities the majority did not cooperate. Since participants were resampled with a similar experimental setup (using the same tablets, logos, etc.) and the same research team, it was evident that the term "in a (the) previous survey" (the Swahili "Katika utafiti uliopita" could be both translated as specific or unspecific) referred to our last visit. Acknowledging that there are different perspectives on where to draw the line with respect to deception and manipulation in experimental economics (see Barrera and Simpson [2012] and Rousu et al. [2015] for insights into the debate), we argue that our attempt to shift empirical expectations by providing selective information is acceptable. Indeed, the crux of manipulating beliefs to study their causal effect on behavior is most commonly overcome by providing a factually accurate, but not necessarily representative, statement about a previous sample; see e.g., Frey and Meier (2004), Bicchieri and Xiao (2009), or Fehr and Schurtenberger (2018b).

Table 2. Social Information Treatments

Treatment	Message
High	In a previous survey, it was found that many participants chose to put the points to the group account and not to put them to their private account.
Low	In a previous survey, it was found that many participants chose to put the points to their private account and not to put them to the group account.

would actually do, that is, their empirical expectation. Here participants can reply that (i) most other participants will allocate the endowment to the private account or (ii) most other participants will allocate it to the group account. Both normative expectations and empirical expectations are incentivized by offering an extra point for correct prediction.[11]

2.3. Weak Social Sanctioning

To model social norm enforcement, we design a mechanism that reflects the informal institutions available to local communities. Specifically, each participant in a group may receive a bonus of one point. Prior to that, each participant casts a vote that either (i) those who allocated their endowments to their private account shall be excluded from receiving the bonus, (ii) those who allocated their points to the group account shall be excluded, or (iii) that no one shall be excluded from receiving the bonus. The exclusion rule is determined by majority, that is, the rule receiving two or three votes within a group is applied. If each alternative receives exactly one vote (no majority is reached), no member is excluded from receiving the extra point.

There are two notable features of the sanctioning institution: First, being based on the exclusion of group members from a financial bonus of one point, our sanctioning institution simulates the kind of mild ostracism observed in the field (Beuving 2010; Guala 2012). Second, the sanctioning institution has the character of giving a general comment on the behavior of others instead of a directed personal punishment. Participants vote on which strategy should be excluded from receiving the bonus point, and participants vote before they know the contribution decisions of their group members.

In the treatments with social sanctioning, participants are informed about the voting mechanism after beliefs are elicited but before they make their first contribution decision. The voting procedure itself takes place after contribution decisions are made but before the actual choices of the group members are revealed. After voting, participants are informed about the allocation decisions by the three group members, the exclusion rule that

11. Incentivizing a participant's empirical expectations requires comparing the former to the actual cooperation decisions in the session. To incentivize a participant's normative expectation we reward participants when their normative expectations are correct, that is, if their expressed belief corresponds to the modal personal normative belief in the session.

was selected, and who was excluded from receiving the bonus. In the treatments without social sanctioning, the voting mechanism is not mentioned at any point during the game. After their allocation decision, participants see a report on the allocation decisions of all group members and the total points earned by themselves. An English translation of the instructions, a time line of the game's procedure, and screenshots of the choice situations are available online.

2.4. Repetition

After participants finish the (one-shot) procedure explained above they are informed that the experiment will continue for six additional rounds. We employ a perfect-stranger matching, highlighting that "you will be matched with two other participants from this session that have never been in your group before and will never be in your group again." The perfect-stranger protocol is easy to communicate. Importantly, it neutralizes direct reciprocity and forward-looking motivations that participants may have for choosing a specific action. Moreover, before the allocation decision in each of the additional six rounds, we elicit participants' empirical expectations. We do not repeat the social information message because once participants gain experience in the game itself, further messages may contradict observed behavior and jeopardize the message's credibility.

2.5. Implementation

The experiment was conducted in 20 villages with a total of 28 sessions in the Lake Victoria region of Tanzania between February and March 2018 (see fig. 1). The sample is balanced with seven sessions per treatment. Each session comprised 21 participants such that the total number of participants is $N = 588$.[12]

The experiment took place in a community center in the village or directly at the landing site. To begin, the general rules of the session were explained, and we obtained informed consent. Afterward, tablets were distributed and participants familiarized themselves with the device by completing brief handling exercises. Participants were guided through the social dilemma game step by step, using posters for visualization and requisites for illustration of the game's mechanics. In particular, it was explained that decisions during the game would translate to real money dependent on own

12. The current experiment is the second field trip to these communities as part of a longer project. During the first field trip to the same landing sites in 2017, participants were invited based on a random draw from the lists of registered fishermen at the respective landing site. Crew members, boat owners, or fishing agents were all eligible to participate in the experiment. If a list of registered fishermen was not available we overinvited a convenience sample and randomly retained 21 participants. In the current experiment, we had the aim of resampling participants from the first field trip (we achieved a resampling rate of of just under 50%) and then used above procedure to complete sessions. See table A-10 in the online appendix for an overview of the number of participants per treatment.

choices and choices of other group members. All decisions were made anonymously, and no communication between participants was allowed during the session. Carton shields ensured privacy. Participants were not able to identify their group members, neither during the experiment nor afterward. Comprehension of the game's rules was tested with the help of four different scenarios that asked participants to name the correct payoffs after specific decisions were made by all group members. We control for participant's comprehension in the analysis.

Upon completion of the experiment, a volunteer was asked to roll a die in order to determine which of the six repeated rounds would be paid out in addition to the one-shot round. Subsequently, we used the incentivized lottery-choice task by Gneezy and Potters (1997) to measure participants' risk aversion. Participants were endowed with 6 points and selected how much to invest in a risky option with a 50% chance to lose their money and a 50% chance to triple the amount.[13] Participants then filled out a short questionnaire on demographics, compliance to fishing regulations, official management of the landing site, and socioeconomic background. After an average of two hours, sessions ended with a private payout.[14]

2.6. Participant Characteristics

Table 3 provides an overview of the demographic characteristics of the participants. Among all 588 participants, there are only 12 women, illustrating that the fishing sector at Lake Victoria is heavily dominated by men. The fishermen in our experiment are, on average, about 38 years old, and 72% see themselves still being a fisherman in two years time. Daily earnings are low, with about 45% of all participants reporting an income below 5,000 TZS (approximately US$2.20) per day. Over 60% of participants state that they have always lived at the respective landing site. The average crew size in our sample is 3.79 with a median value of 4. Approximately 60% of the participants work as crew members and 23% report being a boat owner. Thirty-nine percent of the participants target dagaa, while 22% use gillnets and 35% use hooks to target Nile perch or tilapia.

2.7. Social Proximity Measure

Scholars who study the role of social norms emphasize the importance of the reference network for conformity (Elster 2007; Bicchieri 2017). We draw from the sociological and anthropological literature on social structures in fishing communities (Crona and

13. Although communicated and played as an independent task, the risk aversion measure may have been contaminated by the social information treatment. Indeed, we find a significant difference in risk preferences between low and high social information ($p < .01$ in a two-sided t-test). Hence, we do not use it as a control variable in the regression analyses.

14. The average payout was just above 5,000 TZS (approximately US$2.20), which is the median daily income in our sample. The minimum payout was set to 2,500 TZS.

Table 3. Participants' Characteristics

Variable	Mean	SD	Min	Max
Age	37.95	12.03	18	93
Female	.02	. . .	0	1
0–5,000 TZS daily earnings	.45	. . .	0	1
Never moved	.61	. . .	0	1
Crew size	3.79	.84	1	6
Main gear: dagaa net	.39	. . .	0	1

Bodin 2006; Barnes et al. 2016; Nunan et al. 2018) to construct a measure of a participant's social proximity to the other participants in a given experimental session. While the prisoner's dilemma game is played with full anonymity, the set of 21 participants in one session live in the same community and know each other. Hence, the individual participant is able to infer how socially close she is to all the other participants that may be matched with her during the game. Specifically, we consider a participant to be "close" to the others in the session when she (i) targets the same species and (ii) comes from the same region as the majority of participants in a given session. These two dimensions do not fully encompass the rich structure that defines communities at Lake Victoria, but it reflects important dimensions of a fisherman's social network: tribal and kinship culture as well as knowledge sharing with respect to resource use.

Based on these two questions, we construct an index that measures how close a given individual is to the typical participant in the session (social proximity, SP_i). The index can take three values: If the participant is active in the same fishery as the majority of other participants in the session and comes from the same region as the majority of others in the session, we set $SP_i = 1$. If the participant is active in a different fishery and comes from a different region than the majority of others in the session, we set $SP_i = 0$. Finally, if either the participant is active in the same fishery or comes from the same region as the majority of others (but not both), we set $SP_i = 0.5$. We plot the distribution of the underlying data and provide an extended discussion of the social proximity measure in appendix A-2 (appendix is available online).

3. HYPOTHESES

To derive hypotheses, we first discuss standard preferences and then proceed to norm-based preferences. The individual payoff matrix (table 1) illustrates that defection is the dominant strategy. Under standard preferences, the dominant strategy is changed neither by the social information message nor by the social sanctioning institution or one's social proximity to others. First, defection maximizes own payoff irrespective of the (induced) beliefs about others' behavior or considerations on who the others are. Second, our social sanctioning institution is "weak" (see, e.g., Tyran and Feld 2006; Bicchieri et al. 2022): the gain from defection is two points, while the bonus is only one point so

that the dominant strategy is still to defect, even when an individual expects to be sanctioned with certainty. Hence, standard neoclassical theory predicts that individuals will put their points to the private account in all treatments.

An alternative is to draw predictions from theories that describe how social norms affect utility. Such theories often postulate that individuals experience disutility or discomfort when deviating from the norm (see, e.g., Kimbrough and Vostroknutov 2016; Michaeli and Spiro 2017; Fehr and Schurtenberger 2018a). Equation (1) illustrates the mechanism.

$$u = \pi(x_i, x_{-i}) - [d_1(x_i - \text{pnb}_i)^2 + d_2(x_i - \text{ne}_i)^2 + d_3(x_i - \text{ee}_i)^2] + s(x_i, v_i, v_{-i}). \quad (1)$$

Utility u depends on three components that we—for simplicity—assume to be additive and separable: First, there is a monetary component π that depends on the individuals' own action x_i and on the action of the others x_{-i}. Second, there is a nonmonetary component that depends on the individual's discomfort from deviating from (1) her personal normative belief (what she thinks is the morally right thing to do, pnb_i), (2) her normative expectation (what she believes most others think is the right thing to do, ne_i), and (3) her empirical expectation (what she beliefs most others will actually do, ee_i). We assume quadratic discomfort functions and positive sensitivity parameters $d_1, d_2, d_3 \geq 0$ that capture how sensitive a given individual is to the respective deviation. The third component is the sanctioning function $s(x_i, v_i, v_{-i})$. It is only present in the sanctioning treatments. This function captures both monetary and nonmonetary elements from receiving sanctions and depends on the individuals' own action x_i, her own vote, v_i, and the votes of the others, v_{-i}, on which action shall be excluded from receiving the bonus points. We return to sanctioning after discussing how our social information treatments affect behavior.

Think of actions and beliefs as continuous variables defined on [0, 1], measuring the propensity to cooperate, the belief that others cooperate, or the intensity with which cooperating is considered to be the right thing to do. While monetary payoffs π are strictly decreasing in x_i, a higher personal normative belief (pnb_i) that one ought to cooperate induces cooperation. A participant who expects others to have high personal normative beliefs has high normative expectations (ne_i), which increases her propensity to cooperate. Finally, a participant who has high empirical expectations (e.g., because she thinks that others are like her and have high pnb_i and ne_i) is more likely to cooperate as well.[15]

15. Our theoretical model is deliberately simple. For example, there is a nuanced difference between the agent's belief about what others expect agents in general to do and what others expect the specific agent to do (Hauge 2016) that our model does not pick up. Further, there may be interactions between the different components. Hauge (2015), for example, shows that personal normative beliefs may depend on the behavior of others.

Assuming that one point in the experiment (table 1) is equivalent to one unit of utility, equation (1) takes the following form in the treatments without sanctioning:

$$u = 4 + 4x_{-i} - 2x_i - [d_1(x_i - \text{pnb}_i)^2 + d_2(x_i - \text{ne}_i)^2 + d_3(x_i - \text{ee}_i)^2].$$

Consequently, we can explicitly state the interior solution to the first-order condition:

$$x_i^* = \frac{d_1}{d_1 + d_2 + d_3}\text{pnb}_i + \frac{d_2}{d_1 + d_2 + d_3}\text{ne}_i + \frac{d_3}{d_1 + d_2 + d_3}\text{ee}_i - \frac{1}{d_1 + d_2 + d_3}. \quad (2)$$

Note that the model allows for multiple equilibria that, in case the sensitivity parameters d_1, d_2, and d_3 are sufficiently large, depend on the social norm. That is, individuals who have high empirical expectations cooperate and confirm high empirical expectations, while individuals with low empirical expectations do not cooperate and confirm low empirical expectations.[16]

The social information message is designed to affect empirical expectations and we expect individuals to form their expectations accordingly.[17]

Hypothesis 1a: Initial empirical expectations about cooperation rates are higher in the *hi-* treatments than in the *low-* treatments.

As the first-order condition (2) illustrates, individuals who expect others to cooperate (higher ee_i) are more likely to cooperate themselves to avoid the discomfort of nonconformity.[18]

Hypothesis 1b: Average cooperation rates are higher in the *hi-* treatments than in the *low-* treatments.

We now turn to the sanctioning institution. At the outset, the participants in the respective treatments receive a bonus point. However, they can vote to exclude everyone in their group who defects (or everyone who cooperates) from receiving this bonus point. The sanctioning institution thus forces the participants to think about whether defection

16. Clearly, if individuals are not sensitive to the deviations from the norm (d_1, d_2, and d_3 are very small), the last term in (2) is large and there is no interior solution; the individuals' optimal action is to defect, regardless of their normative beliefs and empirical expectations.

17. The social information message may also affect normative expectations as it is plausible that participants deduce that others also think that one ought to cooperate when they hear that others cooperate; see Bicchieri and Xiao (2009). While we test for it, we do not form an explicit hypothesis about such a spillover effect.

18. To the extent that the social information indeed affects normative expectations, we expect such an effect to also increase cooperation in the *hi-* treatments relative to the *low-* treatments.

or cooperation shall be sanctioned and the effects of being sanctioned. One simplifying assumption of equation (1) is that participants do not derive utility from voting to sanction others. While we model only the disutility from being sanctioned, the power of social norms may come from the combination of sanctioning and (fear of) being sanctioned.

With respect to the act of voting, individuals are pivotal in three out of six cases, namely, when the other two members of their group do not agree on an exclusion rule. If individuals expect to be pivotal, they can use their vote to ensure that they can retain their bonus. Moreover, if individuals expect that one other member disapproves of the same action as themselves, they can ensure that the action that they disapprove is sanctioned. This act of voting can even play a role when individuals do not expect that they are pivotal because they can use their vote to express disapproval of defection or cooperation. While we are agnostic about whether individuals use the sanctioning institution for this purpose, we do assume that individuals do not vote to sanction their own behavior.

With respect to the effects of being sanctioned, a shared belief that no individual votes to sanction their own behavior implies that individuals can ensure to retain their bonus point by adapting their action to conform to their empirical expectations. Hence, the sanctioning function s effectively depends on the individual's empirical expectation ee_i and her action x_i. One particular form of the sanctioning function that captures this aspect is equation (3). Here the parameter $p > 0$ captures the probability-weighted utility cost of being sanctioned. The corresponding first-order condition is then given by (4).

$$s = 1 - p(x_i - \mathrm{ee}_i)^2, \tag{3}$$

$$\begin{aligned} x_i^* = {} & \frac{d_1}{d_1 + d_2 + d_3 + p}\,\mathrm{pnb}_i + \frac{d_2}{d_1 + d_2 + d_3 + p}\,\mathrm{ne}_i \\ & + \frac{d_3 + p}{d_1 + d_2 + d_3 + p}\,\mathrm{ee}_i - \frac{1}{d_1 + d_2 + d_3 + p}. \end{aligned} \tag{4}$$

Intuitively, the sanctioning institution increases the weight on the penalty from deviating from empirical expectations and decreases the weight of the other elements in the utility function. In other words, the sanctioning institution amplifies the effect of empirical expectations on individuals' own action. When the social information message emphasizes cooperation, and if it affects empirical expectations accordingly, we expect that individuals cooperate more in the *hi-S* treatment than in the *hi-noS* treatment. Conversely, when the social information message emphasizes defection, and if it affects empirical expectations accordingly, we expect less cooperation in the *low-S* treatment than in the *low-noS* treatment. In other words, the effect of the sanctioning institution on cooperation depends on the respective social information message.

Hypothesis 2: The average cooperation rate is higher in the *hi-S* treatment than in the *hi-noS* treatment and lower in the *low-S* treatment than in the *low-noS* treatment.

Note that hypothesis 2 stands in contrast to predictions that are based on social preference theories. Individuals who value cooperation more than conformity with empirical expectations would vote to exclude defectors and thereby use the sanctioning institution to increase cooperation also in the *low-S* treatment, yielding lower cooperation rates in the *low-noS* treatment than in the *low-S* treatment.

We operationalize our definition of a social norm by requiring (i) a stable pattern of behavior, and (ii) a corresponding pattern of beliefs. By studying the evolution of both cooperation and empirical expectations in the repeated game, we can reject social norms as an explanation for behavior when conditions (i) and (ii) are not met. Without social sanctioning, there are only internal consequences (e.g., guilt) for nonconformity. However, when there is a sanctioning institution, individuals perceive a social consequence to nonconformity. Participants have to consider which action they want to sanction and which actions are likely to be sanctioned. The message introduces a social behavior that one can conform to, and we expect that the initial cooperation rate aligns with individuals' empirical expectations. Consequently, individuals see their empirical expectations confirmed and act accordingly in the next round of the game: a self-fulfilling prophecy of either high or low cooperation.

In sum, we predict that conditions (i) and (ii) are met in the two treatments with social sanctioning. The variation in the social information treatment induces social norms at two different levels.

> **Hypothesis 3**: Behavior and beliefs are stable and align in the *-S* treatments: different social norms are created.

The sanctioning institution amplifies the negative consequences of not conforming to the social norm. Moreover, participants are matched with and potentially sanctioned by some of their close peers. Hence, we expect that the discomfort of nonconformity and anticipated sanctions increases with the social proximity to others in the session. In terms of the model described in (1), this means that sensitivity to the social norm and the effect of sanctioning for a participant who is in a session with close peers is larger than for a participant who is in a session without close peers.

> **Hypothesis 4**: Closer social proximity is associated with more cooperation and higher expectations in the *hi-S* treatment. In contrast, closer social proximity is associated with less cooperation and lower expectations in the *low-S* treatment.

Beyond anticipated sanctions and social proximity, the discomfort from not conforming with the expected actions of others may depend on several other motivations. Those include a preference for conformity as such, an intrinsic motivation for fairness, the guilt of disappointing or harming others, or a preference for reciprocity. While

each of these motivations may be at work to some extent, we do not aim to isolate their effect.

4. EXPERIMENTAL RESULTS

We present our results in three steps. First, we study behavior and beliefs over the course of the experiment (sec. 4.1). Second, we turn to the use of the social sanctioning institution (sec. 4.2). Third, we explore the role of the participant's social proximity to their reference network (sec. 4.3).[19]

4.1. The Evolution of Cooperation

Figure 2 shows cooperation rates over time in the four treatments. Without sanctioning, the social information message appears to have no effect. Irrespective of which behavior is emphasized (*hi-noS* or *low-noS*), cooperation rates decline over the course of the repeated game. With social sanctioning, stable cooperation rates are maintained. Cooperation rates start high and stay high when the message emphasizes cooperation (*hi-S*), and cooperation rates start low and stay low when the message emphasizes defection (*low-S*).

To support the descriptive findings, we regress cooperation decisions on the treatment variation, a time trend, and a set of session fixed effects, using a linear probability model. The coefficient estimates are shown in column 1 of table 4, whereas column 2 shows the results of regressing cooperation on an additional set of individual control variables. The *hi-S* treatment serves as the baseline treatment. We find significantly less cooperation in the *low-S* treatment than in the *hi-S* treatment. Conditional on social sanctioning, the cooperation rate is on average 21 percentage points lower with low social information than with high social information. Moreover, both treatments without social sanctioning exhibit a significant round effect; on average, cooperation erodes by about 3 percentage points with each repetition of the social dilemma game, indicating a decrease of about 18 percentage points over the full experiment. This unraveling of cooperation is not observed in the sanctioning treatments; cooperation rates are essentially stable over rounds.[20] Results are in line with nonparametric tests that compare cooperation rates between treatments in each round (see app. A-1.2) and robust to the exclusion of the last round, exclusion of the first one-shot procedure (first round), to dropping participants that failed the comprehension tests, controlling for prior experience with lab-in-the-field experiments, and to choosing a nonlinear probit model instead of the linear model (see app. A-1.3).

19. In a companion paper, Eymess (2021) analyzes the data from the first round of the experiment in isolation. Aiming to make a methodological contribution to the field of norm-nudging research, the behavioral mechanism of the norm-based intervention and social sanctioning is studied with a conditional process analysis.

20. The coefficient on the round trend is weakly significant in the *hi-S* treatment, but the effect is negligible; it amounts to a decrease of about 3 percentage points over the full range of the seven one-shot repetitions.

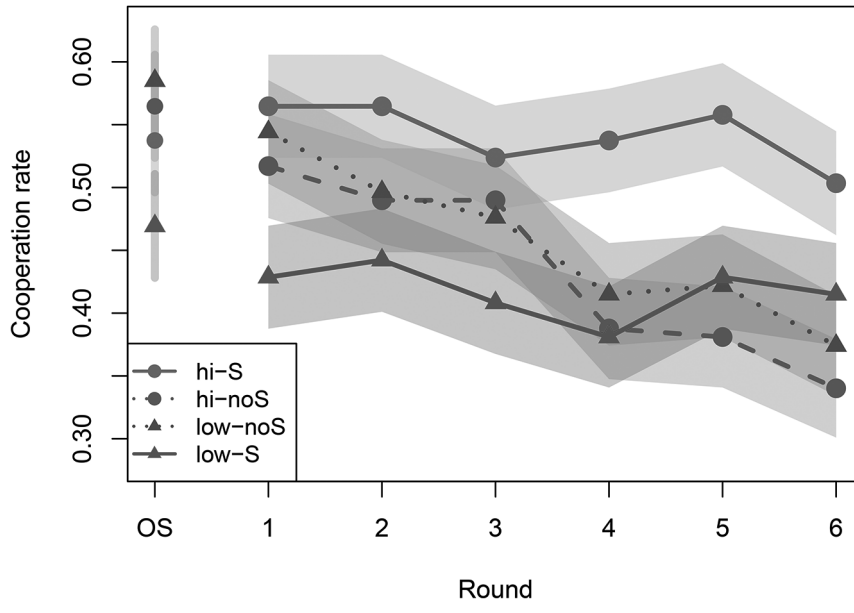

Figure 2. Cooperation rates (averaged on the treatment level) over the game. The one-shot game is indicated by OS and repeated rounds by their number. The shaded area indicates ±1 SE. Color version available as an online enhancement.

In sum, we find partial support for hypothesis 1b: while average cooperation is higher in the *hi-S* treatment than in the *low-S* treatment, there is no difference between the cooperation rates in the *hi-noS* and the *low-noS* treatment. Similarly, we find partial support for hypothesis 2: while starting from the same level, the average cooperation rate in the last rounds is higher in the *hi-S* treatment than in the *hi-noS* treatment and the average cooperation rate in the *low-S* treatment is lower than in the *low-noS* treatment in the early rounds, but ends at about the same level.

Next, we study participants' belief structure and analyze personal normative beliefs, normative expectations, and initial empirical expectations. Recall that the belief elicitation is conducted after the provision of social information but before the one-shot game. Moreover, participants are not yet informed about the voting mechanism in the *low-S* and *hi-S* treatments when stating their initial beliefs. Hence, we only distinguish between the low and high social information treatment.

The left panel of figure 3 shows the distribution of personal normative beliefs. Each of the options, to "put the points to the private account," to "do what others do," and to "put the points to the group account" is chosen by about one-third of the participants for both social information messages. This pattern suggests that participants do not perceive a clear moral difference between contributing to the private or the group account.

Table 4. Behavior and Beliefs: Individual Level

	Cooperation		Empirical Expectation	
	(1)	(2)	(3)	(4)
low-noS	.015	−.012	−.120	−.136
	(.110)	(.114)	(.113)	(.117)
low-S	−.213**	−.217**	−.221**	−.218*
	(.106)	(.107)	(.111)	(.115)
hi-noS	−.068	−.088	−.068	−.076
	(.115)	(.119)	(.123)	(.128)
Round	−.005*	−.005*	−.005***	−.005***
	(.003)	(.003)	(.001)	(.001)
low-noS × round	−.029***	−.029***	−.004**	−.004**
	(.003)	(.004)	(.002)	(.002)
low-S × round	−.003	−.003	.004***	.004**
	(.004)	(.004)	(.001)	(.002)
hi-noS × round	−.032***	−.032***	−.014***	−.014***
	(.003)	(.003)	(.001)	(.002)
Constant	.592***	.465**	.543***	.472**
	(.085)	(.190)	(.090)	(.188)
Session fixed effects	Yes	Yes	Yes	Yes
Individual controls	No	Yes	No	Yes
R^2	.057	.077	.044	.060
N	4,116	4,116	4,116	4,116

Note. The table reports individual-level estimates from a linear probability model. The baseline is set to the *hi-S* treatment. The model includes all seven repeated one-shot interactions. Individual controls include age, age squared, an indicator variable for comprehension, an indicator variable for whether the participant is a dagaa fisher, and crew size. Standard errors (in parentheses) are clustered in two ways, at the round level within a session and at the individual level.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

The middle panel in figure 3 shows the distribution of normative expectations. Similar to personal normative beliefs, each option is chosen by about one-third of the participants. This suggests that the provision of social information did not affect injunctive norms, at least not strongly.

The right panel in figure 3 shows the distribution of initial empirical expectations. We observe a marginally significant difference in empirical expectations between the high- and low social information treatments ($p = .08$, one-sided test of proportions, $N_{\text{low}} = N_{\text{high}} = 294$). In particular, 54% of our participants expect others to cooperate in the high information treatment, while this proportion is 48% with low social

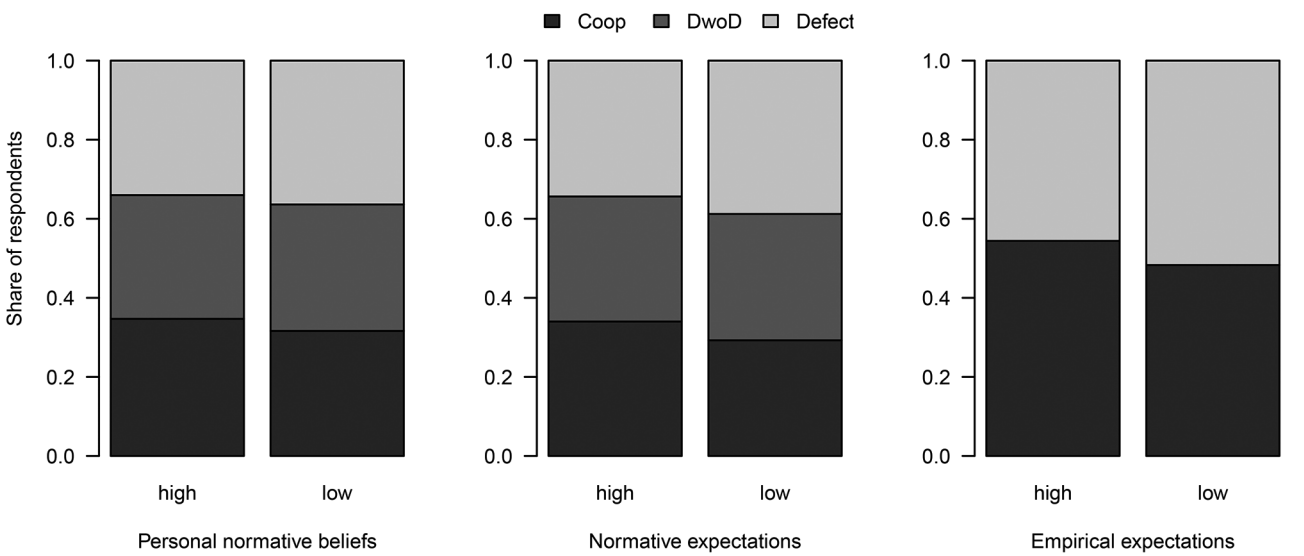

Figure 3. Elicited beliefs by information treatment. The left panel shows personal normative beliefs after the high and low social information message. The middle panel shows normative expectations, and the right panel shows empirical expectations (where "do what others do" was not an option). The dark gray area shows the share of fishermen who think the right thing to do is to "put the points in the group account" (Coop). The medium gray area shows the share of fishermen who think the right thing is to "do what others do" (DwoD). The light gray area shows the share of fishermen who think the right thing is to "put the points in the private account" (Defect).

information. Note that although the effect appears to be a small, it changes the expectation of the majority.

With respect to hypothesis 1a, we find suggestive evidence that initial empirical expectations about cooperation are lower in the *low-* treatments than in the *hi-* treatments. Considering the clear differences in cooperation behavior, the small difference of initial beliefs is remarkable. It suggests that if different social norms emerge over the course of the experiment, these norms were created by the intervention and not imported into the lab. We turn to the evidence on the emergence of different social norms next.

To study the creation of social norms, we focus on the operationalization stated in section 3. A social norm requires (i) a stable pattern of behavior and (ii) a corresponding pattern of beliefs. Cooperation declines over time in both *-noS* treatments, violating condition (i). No social norm is created. In the two *-S* treatments, we do observe a stable pattern of behavior (condition i). The question is whether we also observe a corresponding pattern of beliefs (condition ii).

Figure 4 plots average cooperation and empirical expectations over the course of the experiment for all four treatments. First, we find a marked difference in the levels of empirical expectations between the *hi-S* and *low-S* treatment. In particular, the majority of participants in the *hi-S* treatment expect others to cooperate, while the majority in the *low-S* treatment expect others to defect. Second, we find that, similar to the average cooperation rate, the average empirical expectation is relatively stable in the two *-S* treatments. In the two *-noS* treatments, the average cooperation rate declines, and a gap to average empirical expectation opens up. Accordingly, we observe that participants' empirical expectations in rounds 4–6 of the *-noS* treatments are less accurate than the empirical expectations of participants in the *-S* treatments ($p < .01$).[21]

We use a linear probability model to formally establish that empirical expectations follow the same pattern as cooperation behavior. In particular, we regress empirical expectations on the treatment variation, a time trend, and a set of session fixed effects; see column 3 of table 4. In column 4, we use an additional set of individual-level covariates as regressors (following the same approach as for cooperation; see cols. 1 and 2 of table 4). The difference in cooperation behavior between the *low-S* and *hi-S* treatment appears to be accompanied by parallel differences in empirical expectations. The regression results indicate that participants have lower empirical expectations in the *low-S* treatment ($p = .06$). Similar to cooperation behavior, the round trend for empirical expectations is significant but negligible in size for the sanctioning treatments.

In sum, we confirm hypothesis 3: behavior and beliefs are stable in the treatments with a social sanctioning institution. This is not the case in the treatments without social

21. While 55% and 56% of the participants' empirical expectations are accurate in rounds 1–3 and rounds 4–6 of the *-S* treatments, accuracy drops from 54% in rounds 1–3 to 44% in rounds 4–6 in the *-noS* treatments.

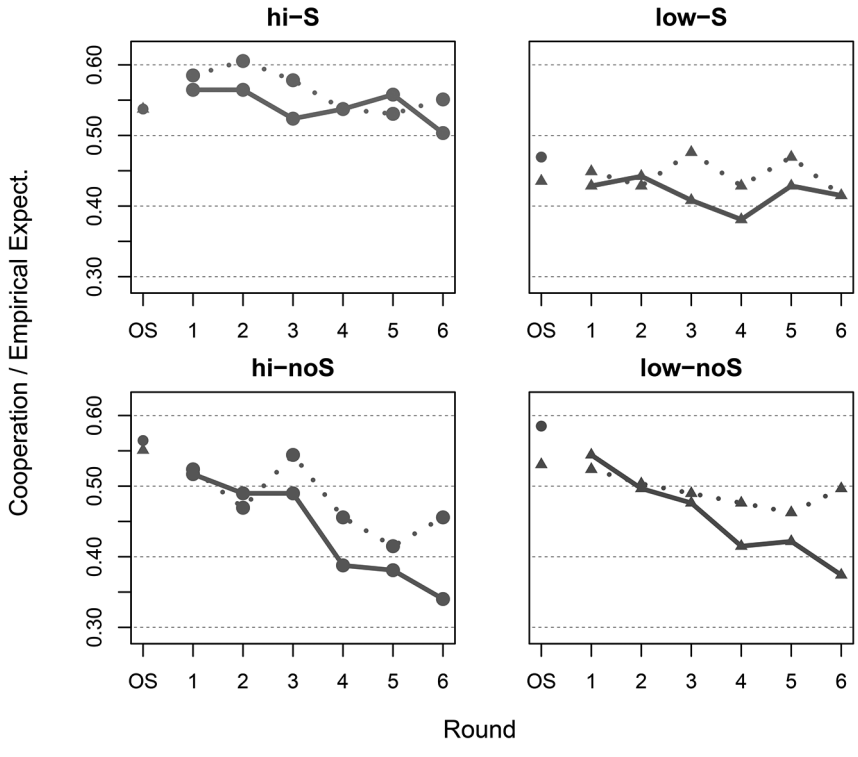

Figure 4. Evolution of empirical expectations. Dotted lines show average empirical expectations, solid lines average cooperation rates. The one-shot game is indicated by OS, repeated rounds by their number. Color version available as an online enhancement.

sanctioning. In other words, a norm-based intervention that relies on the provision of social information alone is not sufficient: a social sanctioning institution is necessary for the creation of different social norms.

4.2. The Role of the Sanctioning Institution

To understand the role that weak social sanctioning plays in creating social norms, we first investigate whether participants choose to use their exclusion vote or rather opt to exclude no one. Then we study votes to exclude defectors and, finally, how exclusion affects subsequent cooperation.

The sanctioning institution is sparsely used. In the *low-S* treatment, more than 50% of the participants vote to exclude no one in each of the repeated rounds. In the *hi-S* treatment, about 40% of the participants vote to exclude no one. With that many votes being cast on excluding no one, the likelihood to be excluded from the bonus with a majority

vote is rather low.[22] Note that it is reasonable that punishment is rare in equilibrium (Gächter 2012): after all, when the norm is followed, there is no need for exclusion.

Next, we focus on those votes that are cast to exclude defectors. We expect that participants vote for the exclusion of defectors more frequently in the *hi-S* treatment if the established norm of cooperation is higher than the norm in the *low-S* treatment. To this end, we fit a linear probability model of how the social information treatment affects whether participants vote to exclude defectors; see column 1 of table 5. We find suggestive evidence that there is less voting to exclude defectors in the *low-S* than *hi-S* treatment. This is remarkable because there is more defection in the *low-S* treatment. The fact that there is less voting to sanction defection corroborates that indeed different social norms have formed in the two treatments.

The regression model also includes covariates on whether a participant was excluded for defection or cooperation in the preceding round, a round trend, and whether a participant has cooperated in the interaction that is subject to the exclusion vote. Being excluded from the bonus after defecting leads to a higher probability to vote for excluding defectors in the next round. Also, the positive and highly significant coefficient for the variable that indicates whether a participant cooperated in the current round shows an additional, subtle function of the sanctioning institution: it may work as a self-signaling device, reinforcing that the action one has just chosen was indeed the right thing to do.

Further, we are interested in the influence of being excluded on cooperation and empirical expectation in the next round. In other words, do participants change their behavior or their beliefs in subsequent rounds when they are excluded from an extra point? Recall that participants cannot vote to exclude specific group members, but they can give feedback on strategies. The estimates of the linear models presented in columns 2 and 3 of table 5 show that being excluded for defection in the previous round is associated with more cooperation in the current round, but it is not associated with higher empirical expectations. Similarly, we find that those participants who were excluded for cooperation in the previous round are less likely to cooperate in the current round. Again, the effect for empirical expectations points in the same direction but is not significant. Overall, the magnitude of the effects is smaller than the treatment effect and much smaller than the persistence of cooperation (a participant who has cooperated in the last period is 64% more likely to cooperate in the current period than a participant who has defected in the last period).

Our findings that (*a*) many participants vote to exclude no one, (*b*) defectors are excluded less often in the *low-S* treatment despite the fact that there is more defection in

22. The probability ranges from 10% to 25% for being excluded after defecting in a given round in both the *hi-S* treatment and *low-S* treatment and between 10% and 30% for being excluded after cooperating in a given round in the *hi-S* treatment and respectively between 3% and 25% in the *low-S* treatment.

Table 5. The Use and Effect of Weak Social Sanctioning

	Vote Exclude Defectors (1)	Cooperation (2)	Empirical Expectation (3)
low-S	−.181*	−.133**	−.111
	(.105)	(.058)	(.086)
Excluded (def in $t-1$)	.280***	.094**	.068
	(.047)	(.046)	(.058)
Excluded (def in $t-1$) × *low-S*	−.038	−.033	.064
	(.084)	(.077)	(.088)
Excluded (coop in $t-1$)	−.059	−.110**	−.059
	(.054)	(.044)	(.050)
Excluded (coop in $t-1$) × *low-S*	.121	−.018	−.099
	(.095)	(.093)	(.088)
Coop in t	.107***		
	(.036)		
Coop in $t-1$		.638***	.549***
		(.030)	(.038)
Round trend	Yes	Yes	Yes
Session fixed effects	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
R^2	.07	.42	.33
N	1,764	1,764	1,764

Note. The table reports individual-level estimates from linear probability models. The analysis is limited to the sanctioning treatment with the baseline set to the *hi-S* treatment. The model includes all seven repeated one-shot interactions. Individual controls include age, age squared, an indicator variable for comprehension, an indicator variable for whether the participant is a dagaa fisher, and crew size. Standard errors (in parentheses) are clustered in two ways, at the round level within a session and at the individual level.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

that treatment, and (*c*) behavior and beliefs are not very responsive to being excluded indicate that it is the option to comment on which behavior should be excluded rather than the exclusion itself that stabilizes cooperation.

4.3. "Norms in the Wild"

We find that providing social information only leads to stable cooperation rates when the message is combined with a sanctioning institution. The policy implication for using social norms as a tool to improve governance under limited state capacity is clear: local fora for feedback and discussion need to be established and supported to accompany norm-based interventions. The existing BMUs could be such a forum at Lake

Victoria. Policy makers should strengthen these institutions when using a norm-based intervention to create "norms in the wild" (after Bicchieri 2017).

An additional policy-relevant question is whether the effect of a norm-based intervention can be amplified by the existing social structure in the targeted communities.[23] Norm-based theories make a clear prediction: the more relevant a fisherman perceives the reference group, the more weight will be attached to the social information message and the more forceful will be the threat of social sanctioning.

To study how a participant's social proximity to others affects norm conformity, we work with the natural heterogeneity of fishing communities at Lake Victoria and construct a social proximity measure that is based on two observable characteristics: main target species and region of origin. Put simply, we ask whether, for example, a dagaa fisherman from Ukerewe Island is more strongly affected by the social information message when he is in a session where most others are from Ukerewe and fish dagaa or when he is in a session where most others are from Rorya and fish Nile perch. Figure 5 shows predictive margins for the interaction between our proximity measure and the treatment variation on individual cooperation (left panel) and empirical expectations (right panel) in the repeated game. The full linear regression results are shown in table A-6 (tables A-1–A-10 are available online).

We find that, on average, an increase in the proximity of a fisherman to his peers in a session leads to more cooperation in the *hi-S* treatment but less cooperation in the *low-S* treatment. In other words, fishermen with a strong reference network in the session conform to the behavior that is emphasized by the social information message. Fishermen with few social ties to the others in their session, however, appear unaffected by the social information message and do not conform to it. In contrast, social proximity has no effect on cooperation in the *-noS* treatments. This is not surprising since without a sanctioning institution, different social norms of cooperation are not created.

For empirical expectations, we document even stronger effects: fishermen with close social proximity to other participants expect their peers to cooperate more in the *hi-S* treatment and less in the *low-S* treatment. We thus confirm hypothesis 4. In contrast, fishermen that differ with respect to both dimensions of target species and ethnicity expect the others in the session to defect when the social information message emphasizes cooperation. As expected, social proximity has no effect on empirical expectations when no social norm is created in the two *-noS* treatments.

23. For example, Loock et al. (2012) find that in their social comparison study on energy conservation, reference groups with close social proximity are more effective in inducing behavioral change. Similarly, Costa and Kahn (2013) test whether political orientation can predict the effectiveness of their intervention. Close to the current application, Barnes et al. (2016) highlight the importance of ethnic networks among fishermen in sharing information on shark bycatch.

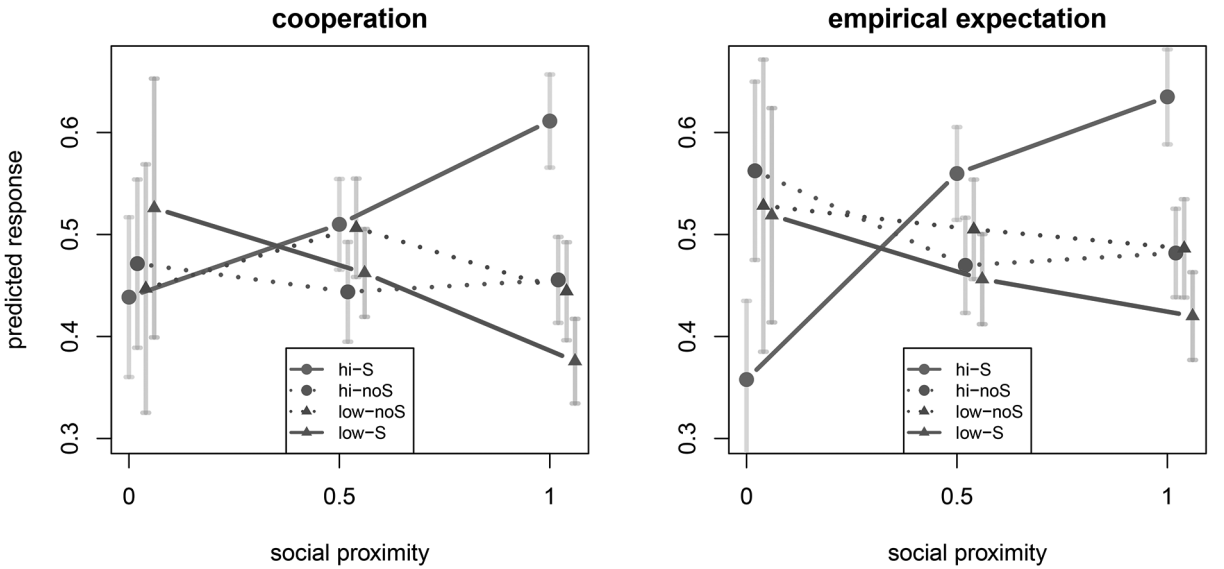

Figure 5. Predictive margins for the effect of social proximity on cooperation (*left panel*) and empirical expectation (*right panel*) for the four different treatments. Whiskers indicate ±1 SE. The solid line with round markers shows that participants in the *hi-S* treatment are less likely to cooperate and have low empirical expectations when they differ from the session majority with respect to target fishery and region of origin ($SP_i = 0$) and more likely to cooperate and have high empirical expectations when they have high social proximity ($SP_i = 1$). Conversely, the solid line with triangle markers shows that participants in the *low-S* treatment are more likely to cooperate and have high empirical expectations when they have low social proximity and less likely to cooperate and have low empirical expectations when they have high social proximity. Color version available as an online enhancement.

5. DISCUSSION

Reducing excessive fishing pressure at Lake Victoria is a prototypical situation where state capacity is limited and norm-based interventions may be a promising tool to enhance cooperation and support communal self-management. In this setting, we study the moderating role of a social sanctioning institution when information on the behavior of others aims to create different social norms of cooperation. The design of our social-dilemma experiment includes repeated observation of both actions and empirical expectations and is thereby able to detect or reject the pattern of behavior and beliefs that characterizes a social norm.

We show that the provision of social information can lead to the creation of different cooperation norms conditional on the presence of a social sanctioning institution. Without sanctioning, cooperation rates decline. With sanctioning, cooperation rates start high and stay high when social information emphasizes cooperation. In contrast, cooperation rates start low and stay low when social information emphasizes defection. The dynamic pattern of behavior is mirrored by a parallel pattern of empirical expectations. Our results are well explained by norm-based theories where individuals prefer to conform with what they expect others in their reference network to do.

One could object to a norm-based explanation by arguing that the social sanctioning institution has changed the game from a social dilemma game to a coordination game where the social information provides the focal point. While we deliberately designed our weak social sanctioning institution in a way that does not change the Nash equilibrium in terms of material payoffs, the game may have changed in participants' utility space (Ostrom 1998; Cárdenas and Ostrom 2004). Without knowing the nonmonetary component of participants' utility function, the argument that social sanctioning changes the game form in utility space is impossible to refute. That said, a view where social sanctioning transforms a social dilemma from a cooperation to a coordination problem and social information provides a focal point exactly accords to what some, for example, Binmore (2010), call a social norm.

The only other experiment that interacts a social information intervention with sanctioning that we are aware of is Fehr and Schurtenberger (2018b). Their lab experiment also documents stable cooperation rates when a norm-based intervention is combined with a sanctioning institution but declining cooperation rates without a sanctioning institution. The design of Fehr and Schurtenberger (2018b) is sufficiently similar to ours so that the two studies can be seen as conceptual replications of each other.[24]

24. Despite their similarity, there are several differences in the design of the two studies, most notably: (i) Fehr and Schurtenberger (2018b) attempt to affect participant's normative expectations while we attempt to affect participant's empirical expectations. (ii) The studies have different participant pools: students from Nottingham vs. fishermen from Lake Victoria. (iii) Both sanctioning institutions are "weak" but in different manners: Fehr and Schurtenberger (2018b) weaken their peer punishment institution (Fehr and Gächter 2000, 2002) by allowing

We believe that three lessons can be learned from the comparison of the two studies. First, while our sanctioning institution consists of three components: (i) giving/receiving feedback on others'/own behavior, (ii) a financial loss from being sanctioned, and (iii) a voting stage that could induce or reinforce consistency of (expressed) opinions, the sanctioning institution of Fehr and Schurtenberger (2018b) contains components i and ii. Thus, the two studies suggest that cooperation is affected by an attempt to activate social norms as long as there is a social enforcement institution that contains elements of feedback and sanctioning. Second, Fehr and Schurtenberger (2018b) observe stable cooperation rates with sanctioning and deteriorating rates without sanctioning over 15 rounds while we observe this pattern over seven rounds, indicating that our results may hold in a considerably longer experiment. Third, Fehr and Schurtenberger (2018b) attempt to activate the moral component of social norms, while our intervention is based on a descriptive message. The results suggest that both approaches work in a similar way.[25]

In practice, normative and empirical expectations may not always align. For example, resource users may have very positive views on cooperation and expect others to hold such normative beliefs as well, despite observing widespread defection empirically. An open question is how the combination of a sanctioning institution with a descriptive message that explicitly conflicts with normative expectations affects cooperation rates. Our results show that the sanctioning institution induces conformity with empirical expectations. But, could a sanctioning institution also induce conformity with normative expectations to lift a situation out of a bad equilibrium of low cooperation rates and low empirical expectations?

Our results highlight that sanctioning may also enforce a bad equilibrium of low cooperation rates. Thus, a sanctioning institution may backfire when it meets low empirical expectations. An important policy implication of this finding is that sanctioning alone does not necessarily translate into higher cooperation. Sanctioning must catalyze high empirical expectations to sustain high cooperation. A relevant policy question is therefore how to change empirical expectations in practice. Is it enough to increase the visibility of desirable behavior? Is it possible to decrease the visibility of undesirable behavior?

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for counterpunishment (Nikiforakis 2008), while we chose a punishment that is weak in that it does not change the Nash equilibrium. (iv) The punishment in Fehr and Schurtenberger (2018b) is decentralized and is directed toward participants, while our sanctioning is directed toward a strategy and only inflicted when coordinated through a majority rule. (v) Fehr and Schurtenberger (2018b) use partner matching for 15 rounds, while we use perfect-stranger matching for seven rounds.

25. A reason could be that a normative message contains information about the behavior that can be expected from others if these others often act in accordance with their normative beliefs. For the same reason, a descriptive message may also contain normative content (Bicchieri and Xiao 2009). However, the empirical equivalence of a descriptive and normative message should be further investigated in social dilemmas and other settings. Bicchieri et al. (2022), for example, do not find such equivalence in a one-shot trust game.

Our study also opens a number of avenues for theoretical and experimental research: for example, how do preferences for conformity with social norms differ from preferences for fairness, reciprocity, or guilt aversion? How does norm-activation and norm-compliance respond to changes in the structure of the underlying game or the sanctioning institution?

We choose a repeated prisoner's dilemma because of its simplicity and because it captures the essential cooperation problem for fishermen at Lake Victoria: compliance with official regulations under limited state capacity. Based on our findings, future work should study the creation of social norms in a more complicated extraction game with dynamic spillovers. Furthermore, it is important to study the implementation of norm-based interventions on actual conservation efforts. Understanding the effectiveness of "social norms as solutions" is imperative, particularly in settings where formal regulation of natural resource use is challenging (Nyborg et al. 2016).

In sum, our study provides strong evidence that norm-based interventions have the potential to enhance cooperation in social dilemma situations, but they require a social enforcement institution. We take a first step toward bridging the lab and the field and provide policy recommendations from the experimental test bed. To improve governance through norm-based interventions, they ought to be accompanied by the opportunity for social enforcement via supporting fora for feedback and discussion within relevant reference networks. In the context of Lake Victoria, existing comanagement structures such as the BMUs may facilitate social enforcement by holding regular community meetings that focus on issues of noncompliance or by adopting laws that mandate the exclusion of members who violate existing regulations. Our study highlights that there are two levers to pull. In addition to strengthening sanctioning institutions to enforce positive behavior, the positive behavior itself should be highlighted, for example by special life vests that allow fishers to signal their actions, or—corresponding to bumper stickers—by having stickers that fishermen can put on the bows of their boats. Finally, our finding that social information has a stronger effect for those participants who are closer to the others in their session suggests that targeting representative members as social multipliers and building community cohesion could be important auxiliary measures to improve governance.

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