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Changing collective action: Nudges and team decisions ☆

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ABSTRACT

Nudges are widely used and a broad literature documents that they successfully affect individual behavior. However, in most settings where nudges are needed to change collective action, teams – not individuals – determine outcomes. Because team decision making is pervasive, learning whether nudges work with teams in social dilemmas is important, especially when formal enforcement is difficult. Here, we show that a nudge increases team cooperation by 14 to 16 percentage points in a social dilemma among fishing crews at Lake Victoria, Tanzania. The nudge is particularly effective when team decisions are made by a team member with leadership experience. Our findings are a proof of concept that expands the toolkit of empirical researchers and policy makers that address social dilemmas among teams.

1. Introduction

Policy makers need alternative approaches to solve collective action problems when formal regulations are insufficient, unavailable, or cannot be enforced. One such alternative approach is nudging. Nudges induce desirable behavior by making subtle changes in the choice architecture using techniques such as setting defaults, providing reminders, or leveraging social comparisons (Benartzi et al., 2017; Bergquist et al., 2019). Nudges have become an established tool for governments that run behavioral science units to provide and optimize governmental services (DellaVigna and Linos, 2022).

By now, there is ample evidence that nudges can successfully change behavior. To name but a few of their many applications, nudges reduce water consumption (Ferraro and Price, 2013; Brent et al., 2015), help to save electricity (Allcott and Mullainathan, 2010; Allcott, 2011; Costa and Kahn, 2013), induce tax compliance (Hallsworth et al., 2017), and increase vaccination rates (Dai et al., 2021; Reñosa et al., 2021). For the most part, nudges have been studied when individuals (i) decide by themselves and (ii) do not directly interact with each other. An emerging experimental literature pushes the latter frontier, showing that nudges can change

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behavior when individuals strategically interact.[1] However, it is yet unclear whether nudges work when individuals do not decide by themselves but as part of a group or team.[2]

Team decision making is pervasive (Kotchen and Segerson, 2019), also in collective action problems. For example, executive boards decide whether to collude or compete with other firms, government teams participate in international negotiations to combat climate change, and fishing crews harvest natural resources. Policy makers must know whether nudges are an effective part of their toolbox when addressing collective action problems among teams. One may be inclined to think that nudges should work on teams if they are successful with individuals. But a long-standing literature in economics (Gillet et al., 2009; Kocher et al., 2020) and social psychology (Schopler and Insko, 1992) that compares individual and team behavior implies that this inference is not necessarily true. Because decision making for teams that interact with other teams fundamentally differs from decision making for individuals that interact with other individuals, individual decisions are not a good predictor of team decisions (Charness and Sutter, 2012).

To take a first step towards understanding whether a nudge can affect team behavior in a social dilemma, one has to overcome several obstacles. First, one needs sufficient experimental control to cleanly identify a treatment effect on cooperation. This involves a trade-off between allowing free within-team communication and using a formal process of decision-making that aggregates individual choices to determine team decisions. While the former is a natural element of reaching a joint decision, the latter allows the experimenter to study different decision-making processes such as majority voting or unanimity (see *e.g.*, Gillet et al., 2009). Second, one needs a decision situation that reflects a conflicting incentive structure: On the one hand, financial stakes must be sufficiently high so that defection is clearly payoff dominant. On the other hand, the context must be sufficiently rich and natural so that the behavior of others matters and a norm-nudge (a nudge that relies on social comparison) can have traction. Third, one needs to observe a large number of teams to have sufficient statistical power. Ideally, those teams are not artificially created for the field laboratory, but routinely interact with each other in real life.

We resolve these difficulties by conducting a lab-in-the-field experiment at Lake Victoria, Tanzania. The teams in our experiment are crews from different fishing firms who manage the social dilemma of common pool resource use in their daily lives. Fisheries at Lake Victoria are not only a natural but also a relevant setting to study whether norm-nudges can change collective action: Widespread illegal fishing practices threaten the income and food security of more than four million people while formal regulations that aim to increase sustainable resource use remain ineffective (Eggert and Lokina, 2010; Cepić and Nunan, 2017). There is an urgent need to find effective policies that balance the societal needs of both short-term resource exploitation and long-term conservation.

In our experiment, fishing crews interact in a repeated two-team prisoner's dilemma game with a binary choice set, framed as a decision to take (defect) or leave (cooperate) points in an account that is shared by two teams. Points that remain in the shared account are increased and then distributed equally, using a marginal per capita return of 0.75. Each team consists of three members that work together as a fishing crew in real life. While the team's composition is therefore fixed, a team is matched with a different team in each of the five iterations of the repeated game. To test whether a nudge can increase cooperation, we vary whether teams are informed about the cooperative behavior of other teams in a previous experimental session, *i.e.*, a norm-nudge.

Furthermore, we use a particular feature of our field setting to understand whether the effect of a norm-nudge depends on how teams reach a joint decision. Like most firms around the world, many fishing crews at Lake Victoria are managed hierarchically. About half of the fishing crews in our sample have a captain or owner who decides where to fish. The other half uses an egalitarian management structure. Here, the crew chooses the location for fishing. We mimic these management structures in our experiment. Similar to Gillet et al. (2009), we disallow communication between team members and impose two different formal requirements for the team-decision making process: A team's decision to cooperate or defect is either determined by the dictatorial decision of one team member (hierarchical management), or through majority voting (egalitarian management). Because the management structure is randomly assigned, some participants have real life experience with their role in a hierarchical or an egalitarian structure while others do not. This unique setup allows us to identify the effect of role experience (Gibbons and Waldman, 2004; Huckman et al., 2009) on the success of a norm-nudge.

We find that a norm-nudge increases cooperation of teams in a prisoner's dilemma. When the team's action is determined by majority voting, the provision of the nudge leads to an increase in average cooperation by 14 percentage points. When the team's action is determined by the dictatorial decision of one member, average cooperation increases by 16 percentage points. Yet, the behavioral change is accompanied by a change in empirical expectations (the belief about the behavior of other teams) only for team dictators. Interestingly, the treatment effect of the nudge under hierarchical management is driven by participants with role experience: fishermen with authority over other team members in real life. Our results demonstrate that nudges can be a promising policy tool also when decisions are taken by teams. This proof of concept has important policy implications and opens a number of avenues for future research that we discuss in section 7.

2. Related literature

We study whether information about the behavior of other teams affects team decisions in a social dilemma. Our study thereby links three previously unconnected strands of literature: research on the effect of norm-nudges on behavior (section 2.1), research on teams as decision makers (section 2.2), and research on the structure that teams use to make joint decisions (section 2.3).

[1] For example, nudges induce behavioral change in the trust game (Bicchieri et al., 2021) or in social dilemma experiments (Lopez et al., 2012; Fehr and Schurtenberger, 2018; Diekert et al., 2022a).

[2] We are aware of one study in the psychology literature that nudges teams of university students in a non-social lying task (Dunaiev and Khadjavi, 2021).

To guide the reader's thinking of how we relate to the literature, it may be helpful to make two comments on what we are *not* doing. First, we do not compare individual to team behavior since a shift from individuals to teams as economic agents is rarely a viable policy option. There is a large literature on this comparison, see *e.g.*, Gillet et al. (2009) for a seminal paper on cooperation in a common pool resource game. Instead, we tackle the relevant policy question whether norm-nudges can be used at all to induce a behavioral change when decisions are made by teams. Second, we do not measure social norms. Such an operationalization is beyond the scope of this paper as it requires an intricate analysis of behavior and beliefs over time, especially when norms within and across teams may be at play.[3] While we consider beliefs about other teams' behavior as a driving mechanism of a nudge's effect on team decisions, our study is designed to test (i) the existence of a treatment effect and (ii) whether it depends on the team's management structure. The identification of and discrimination between possible pathways of an effect will be the task of future work.

2.1. Behavioral change through norm-nudges

The behavior and opinion of others are powerful drivers of individual decision making. A large number of successful norm-nudges leverage this fact, see the reviews by Benartzi et al. (2017), Farrow et al. (2017), Bergquist et al. (2019), and DellaVigna and Linos (2022). The experiments by Croson et al. (2009) and Bicchieri and Xiao (2009) show how norm-nudges work: After individuals receive credible information about what others do or about what others consider to be appropriate, they update their expectations about others' beliefs and behavior.[4] Thereby, norm-nudges activate or change the perceived social norm. Nudges appear to be particularly effective when the underlying norm is vague and therefore still malleable (Dimant and Gesche, 2023). Naturally, they are less applicable in situations where agents are fully informed about others' behavior and beliefs.

A number of theoretical models formalize the intuition that violating social norms introduces discomfort (see *e.g.*, Kübler, 2001; Velez et al., 2009; Kimbrough and Vostroknutov, 2016; Michaeli and Spiro, 2017). Discomfort increases in the mismatch between own actions and the (expected) actions of others and is often reinforced by the prospect of punishment (Balafoutas and Nikiforakis, 2012; Fehr and Schurtenberger, 2018). In other words, individuals prefer to conform, especially if non-conformity may be sanctioned. A norm-nudge activates these preferences for conformity: It makes the desired behavior salient and – conditional on the individual's initial expectation – may change the perceived social norm.

The credibility of the nudging message, the observability of behavior, and the relevance of the reference group are important considerations for a successful design of interventions that target social norms (Miller and Prentice, 2016; Efferson et al., 2020; Bolton et al., 2021; Bicchieri and Dimant, 2022). Agents may disregard a message about others' behavior or beliefs if it (i) does not come from a trusted source, or (ii) does not draw a comparison to a relevant social group. For example, Diekert et al. (2022a) document that the effect of a norm-nudge increases with social proximity between agents in a social dilemma game.

2.2. Team decision making

While the neo-classical theory of self-interested, rational agents has difficulties to predict individual behavior – in particular in social dilemmas – it applies remarkably well to team decisions in general (Kugler et al., 2012; Charness and Sutter, 2012). Teams make patient, time-consistent choices (Shapiro, 2010; Denant-Boemont et al., 2017) and are good at earning high payoffs because they avoid miscoordination (Feri et al., 2010) and make less errors in reasoning (Charness and Sutter, 2012). Moreover, teams generally transfer little or nothing in non-strategic allocation tasks such as the dictator game (Luhan et al., 2009). The regularity of self-interested and rational team behavior holds in strategic settings. Experiments in economics (Kagel and McGee, 2016) and social psychology (Schopler and Insko, 1992) show that teams maximize own benefits over making socially optimal decisions in a social dilemma.[5]

There are three main motivations why teams are non-cooperative when they interact with other teams: (i) social support for self-interest, (ii) the fear of exploitation by other teams, and (iii) the diffusion of responsibility. First, teams defect in a social dilemma because team members' self-interest aligns with benefits to the in-group. While choosing a non-cooperative strategy hurts the out-group, it maximizes the in-group payoff. That is, defection can be rationalized as an act of shared self interest (Insko et al., 1990; Kugler et al., 2012) in which pro-social preferences towards other groups are crowded out by parochial altruism (Charness and Chen, 2020). Such altruism is consistent with a let-down aversion of one's own team (Charness and Holder, 2019) as cooperation is costly not only at the expense of own payoffs but also at the expense of the in-group.

Second, teams defect in a social dilemma because they fear the exploitation by other teams. Defection protects oneself and the in-group against a sucker payoff (Bornstein et al., 2004a). It can be rationalized as a defensive response when other teams are not trusted to cooperate (Kagel and McGee, 2016). Such a lack of trust in interactions between teams is documented in Kugler et al. (2007) and Song (2009), who find that teams expect other teams to act selfish.

[3] In a different norm-nudge experiment, Diekert et al. (2022a) measure social norms when fishers from Lake Victoria act as individual decision makers, not as teams.

[4] Belief formation is usually tracked through incentivized elicitation of empirical expectations and personal normative beliefs (Bicchieri, 2017). Yet, dependencies between stated beliefs and behavior complicate the identification of empirical expectations and personal beliefs as driving mechanisms of behavioral change. While some agents' behavior is driven by their beliefs, others may state a certain belief to justify their behavior (Andreoni and Sanchez, 2014).

[5] Teams show only limited pro-social behavior also in related strategic settings such as the ultimatum game (Bornstein and Yaniv, 1998), the trust game (Kugler et al., 2007), or in a gift-exchange game (Kocher and Sutter, 2007). The finding is called the "discontinuity effect" in the social psychology literature to describe that team decisions are less pro-social than suggested by the aggregate preferences of individual team members (Insko et al., 1988, 1990; Schopler and Insko, 1992; Schopler et al., 1995).

Third, teams defect in a social dilemma because responsibility is diffused. The individual within a team is often not identifiable and thus cannot be solely held accountable for a selfish choice (Schopler et al., 1995; Kugler et al., 2012). The diffusion of responsibility facilitates selfish behavior (Charness, 2000). Moreover, the lack of distinct identification allows team members to hide behind a "shield of anonymity". This increases the social distance between teams and is detrimental for cooperation (Bohnet and Frey, 1999).[6]

2.3. Hierarchical and egalitarian management structures

Can a norm-nudge increase cooperation in a social dilemma between teams? The answer to our research question may depend on the teams' management structure. Similar to the approach in Bornstein et al. (2004b), who either impose majority rule or a dictatorship and the approach in Gillet et al. (2009), who either impose majority rule or unanimity, we consider two different formal processes of team decision making while shutting down face-to-face discussions between team members. In a hierarchical structure, team decisions are determined by the choice of one team member, a team dictator. In contrast, in an egalitarian structure, every team member equally determines the team's decision through a majority vote.

Despite the fundamental nature of the question of how the team's structure affects economic outcomes,[7] there are surprisingly few experimental papers that directly compare hierarchical and egalitarian management structures. Bornstein et al. (2004b) and Heap et al. (2020) compare hierarchical and egalitarian teams in an inter-group chicken game and a price competition, respectively. Neither find significant differences in team behavior between the two structures. Frohlich et al. (1998) find that egalitarian teams (framed as employee-owned firms) perform better than hierarchical teams (framed as conventionally-owned firms) in a productivity task. Moreover, Ellman and Pezanis-Christou (2010) test whether differences in management structures lead to differences in ethical decision making (behavior that harms third parties). Their results suggest that egalitarian teams make more ethical decisions.

In the previous section we gave three explanations for why teams are self-interested and rational decision makers. While the motivations of shared self-interest and the fear of exploitation apply to team decisions in either management structure, the evasion of responsibility is not possible in hierarchical teams (Song, 2009). That is, the team's dictator is solely responsible for the team's decision. In a gift-exchange experiment, Charness (2000) finds that the opportunity to evade responsibility leads to more selfish choices. However, it is not clear whether this applies to teams because the existing evidence on the evasion of responsibility is based on comparisons between team and individual behavior (see Kugler et al., 2012). For example, Atanasov and Kunreuther (2016) show that team dictators are cautious decision makers that act tough as they worry about the impression they make with their team.

In summary, the evidence comparing hierarchical with egalitarian team structures is inconclusive. Yet, we note that the possibility to evade responsibility in egalitarian teams may interact with the effect of a norm-nudge that is designed to induce cooperation in a social dilemma. To inform policies and future research, it is therefore important to understand potential differences in the responsiveness of hierarchical and egalitarian teams to norm-nudge interventions. With a better understanding of their potential to change behavior in different underlying team management structures, norm-nudges may become a useful addition to the toolbox of policy makers that aim to improve outcomes in a multitude of settings characterized by team decision making.

3. Fishing at Lake Victoria

We conduct our lab-in-the-field experiment with a sample of fishing crews from the Lake Victoria fisheries. The Lake Victoria fisheries in East Africa are an important driver of local and regional economies in the three riparian countries Kenya, Tanzania, and Uganda (see Fig. 1). The income and food security of more than four million people is supported by a common pool resource system that is under pressure from overfishing, pollution, climate change, and rapid population growth. As the demand for resources and food from the lake is steadily increasing and formal regulatory structures continue to be dysfunctional, there is an urgent need to find effective policies that balance the societal needs of both short-term resource exploitation and long-term conservation (Aura et al., 2019).

3.1. The need for informal governance

Due to strategic incentives, limited state capacity, and dysfunctional formal institutions, the enforcement of fishing regulations at Lake Victoria is weak. All adjacent countries have passed laws to govern issues such as licensing, gear use, and the protection of breeding areas. Yet, violations are common and attempts to reduce illegal fishing practices are plagued by issues of corruption (Nunan et al., 2018). To help monitor and enforce regulations, landing site level co-management structures known as beach management units (BMU), *i.e.*, elected fisheries representatives, were introduced to the lake in the late 1990s. However, strong norms of kinship compromise the utilization of these co-management structures as enforcement mechanism (Etiegni et al., 2017). Simply devolving law enforcement from the national government to elected community representatives has not worked. Especially in situations of economic distress, fishing crews at Lake Victoria continue to break rules and regulations (Cepić and Nunan, 2017).

[6] Comparing the studies by Cason and Mui (1997) and Luhan et al. (2009), who study team decisions in a dictator game, highlights the implications of identifiability. While Luhan et al.'s (2009) finding of selfish allocations is in line with the large majority of the literature on team decisions, it contrasts with the results in Cason and Mui (1997), who observe more altruistic decisions. Among the differences between the two studies that may cause those higher transfers is the fact that Cason and Mui (1997) publicly identify single team members when teams are formed and thereby remove the shield of anonymity.

[7] See Garicano et al. (2013) for a review of the theoretical literature and Caliendo et al. (2020) for recent empirical evidence.

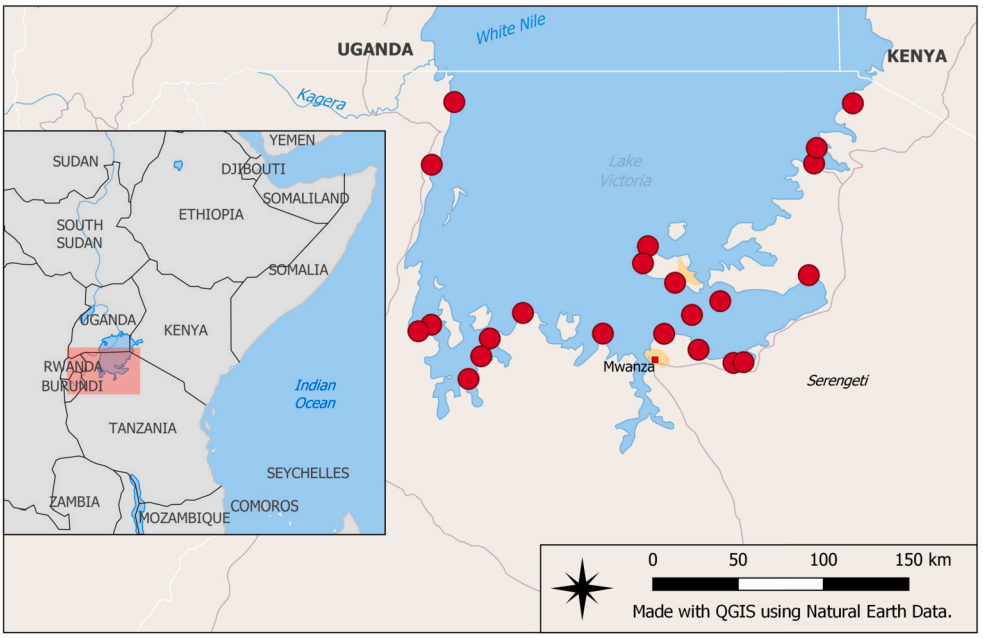

Fig. 1. Map of Lake Victoria and visited landing sites.

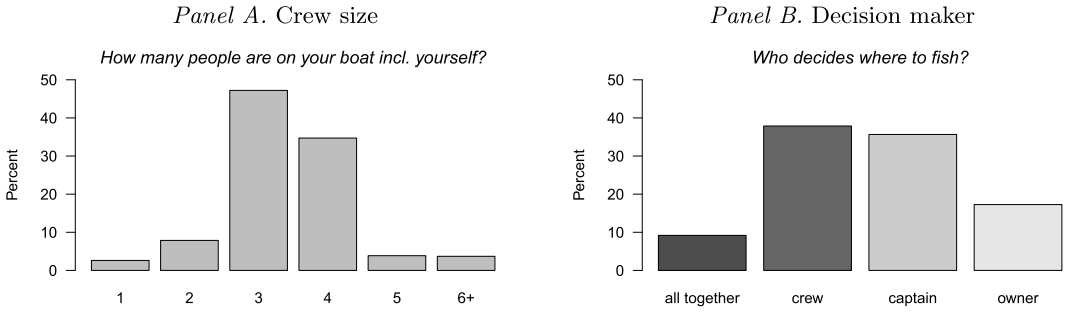

Fig. 2. Distribution of self-reported crew size and decision maker. *Notes:* Distribution of fishing crew sizes in our sample (N = 648) in Panel A as a response to the question "How many people are on your boat incl. yourself?" and distribution of decision maker for the location of fishing (N = 631) in Panel B as a response to the question "Who decides where to fish?".

The lake's resources are mostly contested on a local level since a large part of the fisheries rely on species that populate inshore areas (Taabu-Munyaho et al., 2013). When fishing crews choose to break regulations for their own economic benefit, they especially threaten the livelihoods of others in their own community or in neighboring communities. The social dilemma of common pool resource use can thus be broken down to the local level, generating important implications for policy makers that debate between top-down or bottom-up approaches to regulation. For a bottom-up intervention, social norms may be a promising tool to facilitate cooperation and self-management by resource users in local communities (Vollan and Ostrom, 2010; Nyborg et al., 2016). Stakeholders that aim to ensure the sustainable use of Lake Victoria's resources in the long-term without jeopardizing the livelihoods of fishermen and their families in the short-term, may therefore use norm-nudges (*e.g.*, emphasizing examples of cooperative fishing practices) to change collective action.

3.2. Fishing firms are organized in teams

Most fishermen at Lake Victoria work in teams. Panel A in Fig. 2 plots the distribution of crew size in our sample. Only about 3% of fishermen report to harvest on their own and 8% report to work in pairs. The fishery is dominated by firms that operate with crews of three (46%) and four (35%) members.

Fishing crews at Lake Victoria use varying management structures to reach joint decisions. An important daily decision that determines production is the location of fishing. Broadly speaking, the crew's fishing location is either decided by all crew members together or by the crew's captain or the firm's owner. Panel B in Fig. 2 shows the distribution of decision makers for the fishing location as measured by the individual participant's response to the question "Who decides where to fish?". The two darker colored

Table 1
Payoff matrix.

		Team B	
		leave points (*cooperate*)	take points (*defect*)
Team A	leave points (*cooperate*)	6,6	3,7
	take points (*defect*)	7,3	4,4

bars indicate what we categorize as egalitarian management in which the decision is either made by all fishermen together (including the owner who often stays ashore) or the crew that goes out for fishing. In contrast, the two lighter colored bars indicate what we categorize as hierarchical management in which the decision is either made by the captain or the firm's owner.

Following our categorization of individual responses, we observe an approximately equal distribution between the two forms of management (47% egalitarian to 53% hierarchical). In reality, the management structure may be more nuanced and variable than what our binary distinction between egalitarian and hierarchical management can capture and there may be disagreement between team members. While one team member may perceive to have decision power and respond accordingly, the others may perceive that they co-determine the fishing location, warranting a response that we categorize as egalitarian. In fact, out of 216 fishing crews in our experiment, there are 56 teams in which all three team members report the same management structure while in 153 teams, we observe a two-to-one split between egalitarian and hierarchical management. In the remaining seven teams, a categorization for the team is not possible due to missing individual responses. When excluding those seven teams and categorizing the management of a team with a two-to-one split as using the structure that is reported by the majority, we retain the approximately equal split between the two forms of management (47% egalitarian to 53% hierarchical).[8]

4. Experimental design and implementation

To model the social dilemma of common pool resource use between teams, we use a two-team prisoner's dilemma game with disapproval and incentivized belief elicitation. Three participants play together in a team. A team in the experiment comprises participants that work together in the same fishing firm and hence form a real team in their daily lives. Each team is paired with another team to share an account with eight points. Every team plays with a binary choice set, framed as a decision to take four points from the shared account (hereafter: *defect*) or leave the points in the shared account (hereafter: *cooperate*). Moves are made simultaneously. The points remaining in the shared account are increased and then distributed equally. For four points left in the shared account, both teams receive three points, *i.e.*, a marginal per capita return of 0.75. The game is incentivized. For each point received by the team, each team member is rewarded 500 Tanzanian Shilling (TZS).[9] The payoff matrix illustrates that defection is the payoff dominant strategy while mutual cooperation is the social optimum, see Table 1.

Management Structure and Role Experience

Participants privately and simultaneously choose whether they want their team to cooperate or defect. To determine the team decision, the choices of the three individual team members are aggregated according to an imposed management structure (randomized across sessions). In a given session, either an egalitarian or a hierarchical management structure is used. Direct communication or interaction within or across teams is not allowed.

The egalitarian management structure is implemented by majority voting. The choice that is preferred by at least two out of the three team members will be the team's decision. Hierarchical management is implemented by a dictatorial decision. That is, all team members indicate their choice, but only one is then randomly selected to determine the team's action.

We classify participants to have role experience based on two self-reported variables: the firm's management structure and the role of the participant within the firm. Participants in the majority voting mechanism that report to work in a firm with an egalitarian structure are familiar with the structure in the experiment and are therefore classified to have role experience. For the hierarchical structure, only those participants that report to work in firms with hierarchical management *and* actually have decision making power (*i.e.*, they report to be the captain or the firm's owner) are classified as having role experience. Note that once again, we use data on the management structure as reported by the individual participant, thereby allowing for conflicting responses within teams. However, here the classification needs to consider a more nuanced measure for hierarchical decisions. While we categorize firms as using a hierarchical structure when either the owner or the captain makes decisions (see section 3.2), role experience is assigned if the

[8] Alternatively, we categorize the management structure based on self-reported responses to the question on who determines the choice of gear, another crucial decision for fishing productivity. Unfortunately, we did not record any data on who determines the choice of gear for the first five experimental sessions such that we base our categorization on a total of N = 536 responses. 43% of all participants report that the decision is made jointly (32% all together, 11% crew) and 57% report that the gear is chosen in a hierarchical structure (51% owner, 6% captain). Hence, also the decision of gear choice is split about equally between egalitarian and hierarchical structure. When resolving a two-to-one split within teams, the distribution is very similar (39% egalitarian to 61% hierarchical).

[9] The financial incentives offered in the experiment are substantial. As a reference point, the median daily catch earnings in the Lake Victoria fisheries are below 5,000 TZS. At time of data collection, 1 Euro translated to approx. 2,600 TZS.

specific role matches the reported decision maker of the firm. Therefore, we have to consider three possible structures (an egalitarian firm, an owner-led hierarchical firm, and a captain-led hierarchical firm) which allows for more inconsistencies of self-reporting between the three team members. We address these inconsistencies in further detail and present alternative classifications for role experience in Online Appendix A.4.

Norm-Nudge Treatment

To test the effect of a norm-nudge, we run a social information treatment, randomized across sessions. Teams in the norm-nudge treatment are given information about the behavior of other teams in a previous session of the experiment while teams in the no norm-nudge treatment play the prisoner's dilemma without prior information on others' behavior. The following message is verbally provided to all participants in the norm-nudge treatment during the instructions of the game:

You are not the first landing site where fishermen participated in this survey. In a previous session, many/most teams left the points in the shared account.[10]

Note that the message provides information about the behavior of other teams but it does not convey the normative appeal that the behavior is the right thing to do or that others believe it is. Following the distinction first introduced by Cialdini et al. (1990), the message aims to affect the "descriptive norm" rather than the "injunctive norm" of cooperation.

Normative Beliefs

The norm-nudge is designed to affect normative beliefs. If participants see informational value in the message provided, their beliefs should adjust. We elicit participants' expectations about others' behavior by asking what they "guess most teams in this session will actually do?". The elicitation of these *empirical expectations* (Bicchieri, 2017) uses the same binary choice set as the cooperation decision. It is incentivized with one extra point such that participants have a financial incentive to reveal their true beliefs. Additionally, we ask participants what they think is the right thing to do in the given situation (their *personal normative belief*). Here, participants can additionally respond with a third option through which they can indicate a preference for conditional cooperation (*i.e.*, "one ought to do what other teams do"). The elicitation of participants' personal normative belief is not incentivized.

Disapproval

After indicating whether participants want their team to cooperate or defect, participants have the opportunity to express their disapproval of specific strategies. We chose a disapproval vote as a weak form of social sanctioning, which is often necessary to enforce social norms (Diekert et al., 2022a). Each participant has to simultaneously choose one of the following options: (i) to disapprove defection, (ii) to disapprove cooperation, or (iii) to disapprove neither action. All participants are informed about the number of participants disapproving each option during feedback, see below. Disapproval votes are given without knowledge of the choices by other team members, the actions chosen by the other team that they are matched with, or the actions chosen by the other teams in the session.

Repetitions

The prisoner's dilemma is repeated for a total of five rounds of one-shot interactions. Teams are re-matched into new pairs based on a perfect stranger matching protocol, *i.e.*, for each new round of the game, teams are randomly matched with another team that they have not played with before and will not play with afterwards. The composition of participants in a team, who work in the same firm in real life, is fixed over all five rounds.

We chose this design for a conceptual, a material and a technical reason. Conceptually, repeated interactions are necessary to conclude whether our norm-nudge is effective. That is, at least part of the behavioral change induced by the nudge is likely to transpire through the process of retrospection and learning through the observation of other people's behaviors in repeated interaction. Materially, recurring interactions with other crews is a central feature of the social dilemma of common pool resource use at Lake Victoria that is encountered by our participants on a daily basis.[11] Moreover, there is de facto open access to the lake, and each fishing firm has a limited catch capacity. Therefore, the nature of cooperation at Lake Victoria is essentially binary: Firms either follow existing formal and informal rules and regulations (*e.g.*, not using illegal gear, not fishing in breeding grounds, not landing undersized fish) or violate them. Technically, a repeated prisoner's dilemma allows us to maintain a binary choice set in each round

[10] In Swahili, the meaning of both "many" and "most" is expressed by the word "wengi". Hence, the original Swahili message does not imply a strict majority but conveys the general information that cooperation was a common choice by other teams. The message was verbally provided by the same research assistant in all sessions and relies on data from one of the first sessions during the field trip (without a nudge) in which half the teams cooperated.

[11] The fact that the resource stock dynamics creates inter-temporal spillovers is of second order importance at Lake Victoria. Both Nile perch and Dagaa, the two main commercial species at the lake, have rapid growth dynamics and stochastic fluctuations in environmental conditions are more important in determining production possibilities (Yongo et al., 2018; Nyamweya et al., 2020).

and construct a finer measure of cooperation (average cooperation over five rounds). Thereby, we attain statistical advantages and keep the game in a format that is both easy to explain and ensures a clear outcome of the majority voting procedure.

Feedback

At the end of each round, participants are informed about the outcome of the prisoner's dilemma game in that round. First, everyone within a team is informed about the choices of their team members and the resulting team action. However, team members are not informed about the identity behind the decisions of their team members, *i.e.*, in case the other two team members made different choices, it cannot be inferred with certainty which team member made which decision. Second, all participants within a team are informed about the action of the other team in their pairing. They are however not informed about the individual choices that lead to the aggregate decision of the other team. Third, participants are informed about their own team's total payoff from the prisoner's dilemma. No information is given about the outcomes in other team-pairings. Finally, everyone is informed about the number of participants in the session that disapprove of either action and the number of participants that do not disapprove of any action.

Implementation

The experiment was implemented with crews from fishing firms at Lake Victoria, Tanzania in March 2020. The data collection comprised 36 sessions at 22 landing sites. The sampled landing sites represent the entire Tanzanian lakeshore, from Musoma in the East to Bukoba in the West (see Fig. 1).[12] In a total of ten sessions (five with a nudge and five without), we imposed the dictatorial management structure while in 26 sessions (13 with a nudge and 13 without), we imposed majority voting.

For each session, six firms were randomly selected from the list of registered fishing firms at a given landing site. From each firm, we then randomly selected three fishermen that were willing to participate in the experiment as a team.[13] In each session, we therefore observe 18 participants in six teams that form three pairs in the prisoner dilemma in every round of the game. Participant characteristics are balanced across almost all relevant observables, see Online Appendix A.1. For teams that decide by dictatorial decision, the only difference between treatments is with respect to age. For teams that decide by majority voting, the sample is unbalanced with respect to crew size and their main target species. We control for all unbalanced characteristics throughout our analysis, see section 5.

A seating arrangement ensured that crew members would not sit next to each other. Informed consent was obtained and a detailed explanation of the game's rules was given. In particular, it was highlighted that all decisions have to be made anonymously, that communication is not allowed, and that the points earned during the game directly translate to real money at the end of the experiment. To ensure that rules were understood, we played out example scenarios and assessed comprehension of the scenarios' outcomes with test questions. Responses serve as a measure of understanding in the analysis.[14] After all repetitions of the prisoner's dilemma game were completed, one round was randomly chosen for payout. Each session lasted about two hours.

5. Hypotheses and testing

On the one hand, one may reasonably expect that a norm-nudge does not work on teams. The literature documents that teams act selfish and rational. If defection is the dominant strategy (like in our experiment), a rational and selfish decision maker should ignore a nudge that tries to induce pro-social behavior.

On the other hand, one may reasonably expect that a norm-nudge does work on teams. The conjecture draws on the many successful applications of norm-nudges with individuals. Also in teams, the message is received and processed by individuals. Maintaining that individuals trust the source of the nudge and that the message has normative implications, at least for some, there is no reason to believe that the message has a *negative* effect on cooperation. Hence, we pre-registered directed hypotheses that predict a positive effect of the nudge on cooperation.[15]

Since the management structure may affect how the message is perceived and how the social dilemma game plays out in intra- and inter-team processes, we discuss the arguments for a positive effect of a norm-nudge on cooperation separately for majority voting and dictatorial decisions.

[12] The present data collection effort is the third field trip of the research team to Lake Victoria. In contrast to the second field trip (see Diekert et al., 2022a) that was conducted in 2018, re-sampling of participants was not an objective during the third trip. Out of 36 experimental sessions, 26 were hosted in re-visited communities and ten sessions were hosted in communities that we visited for the first time.

[13] Fishing firms at Lake Victoria are heterogeneous in size. Most are small enterprises, operating one or two vessels, but some firms operate up to thirty boats. That is, the random selection of three crew members sometimes sampled the entire workforce of a firm, and in other cases a smaller subset. For the larger firms, fishermen usually live in camps during the fishing season and crews rotate. While voluntary participation may raise concerns about selection, we do not think this is an issue in our case. First, financial stakes in the experiment were substantial such that participation was worthwhile. Therefore, at all landing sites, the number of volunteering teams far exceeded the number of available slots in the experiment. Second, we find no observable differences between the fishermen that were both part of our 2018 field study (Diekert et al., 2022a) and the current study, and those fishermen that participated in 2018, and could have participated in 2020, but did not do so, see Online Appendix Table A.9.

[14] All decisions in the experiment were made on tablet computers using the oTree software (Chen et al., 2016). Screenshots of all relevant choice situations (incl. end of the round feedback) and the experimental instructions are available in Online Appendices A.6 and A.7.

[15] The pre-analysis plan is available at: https://doi.org/10.1257/rct.5542-1.0.

Majority Voting

We highlight three reasons why a norm-nudge works when teams use an egalitarian management structure such as majority voting. First, team members may fear less exploitation by other teams. Therefore, they see no need to protect the in-group by defecting. Second, team members may be motivated by preferences for equitable outcomes (fairness) across teams. When other teams are expected to cooperate, cooperation of the own team is the fair response. Third, participants could experience disutility when the actions of the own team differ from the actions of other teams, or when the own vote differs from the votes of the other team members, or both. If the nudging message is understood as a statement on the likely action of other teams, preferences for conformity increase the likelihood to vote for cooperation.

These three motivations differ in underlying preferences, but they have the same implication for observable outcomes:

Hypothesis 1a. Average cooperation by teams with majority voting is higher with a norm-nudge.

Dictatorial Decisions

Also for teams with a hierarchical management structure, the reduced fear of exploitation, preferences for fairness, and preferences for conformity suggest a positive effect of a norm-nudge on cooperation. Yet, hierarchical management differs from egalitarian management because the dictator cannot evade the responsibility for the team's outcome.

On the one hand, responsibility may increase the effect of a norm-nudge. First, if team dictators themselves have a preference for fairness or conformity with other teams, they should act in line with the message as they alone determine the team's decision. Second, when dictators believe that the members of their team have such preferences and they are unwilling to let their team members down, they would also want to act in line with the intervention.

On the other hand, responsibility may decrease the effectiveness of a norm-nudge. The obligation to represent the team may induce loss aversion and thereby crowd out cooperation. Similarly, dictators may feel the responsibility to maximize team payoffs. While these adverse effects of responsibility would not cause the intervention to backfire, it could mean that dictators ignore the message.

Responsibility thus has an ambiguous impact on the effectiveness of the nudge. Nevertheless, a reduced fear of exploitation, preferences for fairness, and preferences for conformity still suggest an increase of average cooperation due to the norm-nudge intervention:

Hypothesis 1b. Average cooperation by teams with a dictatorial decision is higher with a norm-nudge.

There is no prior evidence for the effect of a norm-nudge on team decisions and findings on how a variation in the team's management structure affects cooperation decisions are inconclusive. While majority voting and dictatorial decisions differ by the amount of responsibility that is given to the individual team member, our discussion above highlights that the effect of responsibility on cooperation and its interaction with the norm-nudge is ex-ante ambiguous. Therefore, we pre-registered a null hypothesis:

Hypothesis 2. The effect of a norm-nudge does not differ between egalitarian and hierarchical management structures.

Role Experience

In our experiment, some participants have role experience (Huckman et al., 2009). That is, they have experience with their role in the experiment because it coincides with their current role in the management structure of their fishing crew. Role experience could moderate the effect of the norm-nudge.

On the one hand, the nudge could be more effective when individuals have role experience. Individuals that are familiar with taking decisions in a hierarchical or egalitarian structure may be more receptive to the nudge and have a better idea what to expect from other teams. Then, the nudge is useful to inform own choices and one may expect that role experience amplifies the effect of the treatment.

On the other hand, the effect of the norm-nudge could be weaker for individuals with role experience. If these individuals use internalized responses in familiar decision situations, they may put less weight on the message. In contrast, those that find themselves in an unfamiliar decision situation may view the information about others' behavior as especially valuable. Given the ex-ante ambiguous effect of role experience, we treat it as an open question.

Statistical Methods

The main treatment effect of interest is the difference in average team cooperation over all five rounds between treatments with and without the norm-nudge, see Hypotheses 1a and 1b. In teams that reach a decision through majority voting, all three team member decisions are necessary to determine a team action such that the outcome of interest is the team's aggregate decision. In teams that use a dictatorial decision, each individual team member makes a simultaneous and private decision on behalf of the three

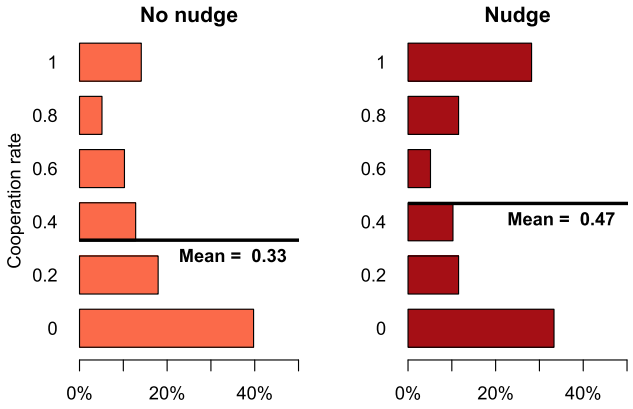

Fig. 3. Average team cooperation rate of majority decisions by nudge treatment (combined $N = 156$). For each team there are five decisions such that the cooperation rate can take six distinct values (0, 0.2, …, 1).

person team before a random draw determines whose decision is implemented as the team's action. Hence, each individual decision is analyzed as a team decision.[16] We average the binary cooperation decisions over all five rounds and observe a cooperation rate (in discrete steps of 0.2 including zero and one) for $N = 156$ (78 in each treatment) teams that use majority voting and a cooperation rate for $N = 180$ (90 in each treatment) team dictators. Our primary focus on the cooperation rate in the repeated game recognizes the need for repeated interactions while refraining from an intricate analysis of behavior and beliefs over time. Such an analysis is beyond the scope of this paper, see Diekert et al. (2022a) for a study that measures social norms over time in a nudging experiment with seven repeated interactions.

To test Hypotheses 1a and 1b, we first present descriptive results and report non-parametric tests. Throughout, we take the non-normal distribution of our outcome variables into account and report one-sided Wilcoxon Mann-Whitney two-sample tests according to the pre-registered hypotheses. Additionally, we conduct power analyses for Hypotheses 1a and 1b. Here, we follow advice by (Faul et al., 2007) and conduct compromise power analyses that consider a logistic parent distribution, the observed effect size, the given sample size, and an error probability ratio of $\beta/\alpha = 4$, balancing type I (α) and type II error (β) risks.

Second, we support our results with regression analyses. We use fractional probit models and report average marginal effects to ease interpretation. We first analyze the model separately for each management structure. An interaction of treatment and management structure is included for a pooled data analysis that compares the effect of the nudge between the egalitarian and hierarchical management structure to test Hypothesis 2. We include additional interaction terms when we study heterogeneous treatment effects with respect to role experience. In all specifications, standard errors are clustered on the session level. When moving to regression analyses on individual behavior over time, we use standard probit models.

6. Results

We first analyze the main treatment effect of interest: Does a norm-nudge increase average cooperation when decisions are made by teams? Since the effect of the intervention likely depends on the management structure and in turn on the motivations associated with partaking in a majority decision or being a team dictator, we begin by studying egalitarian and hierarchical team decisions separately in sections 6.1 and 6.2 before comparing the two structures in section 6.3. In section 6.4 we study how the effect of the nudge varies with participants' role experience and in section 6.5, we turn to individual beliefs and behavior to understand how the nudge affects the first round and the repeated game.

6.1. The effect of the norm-nudge under majority voting

Fig. 3 plots the distribution of cooperation rates for majority decisions by norm-nudge treatment. Note that teams decide to cooperate or defect five times, such that the cooperation rate of each team can take six distinct values (0, 0.2, …, 1). In both treatments, most teams use a strategy of zero cooperation across all rounds. Yet, with the nudge, the share of teams that cooperate in all five rounds doubles from 14% to 28%. The average cooperation rate without the nudge is 33%, see left panel of Fig. 3. With the nudge, this rate increases by 14 percentage points to 47%, $p = 0.029$, combined $N = 156$. The test has 76% power with $\alpha = 0.06$. Hence, we observe a positive treatment effect of the norm-nudge.[17]

Our results suggest that the norm-nudge is successful in changing team decisions under a majority voting mechanism. This is supported by a fractional probit regression that controls for demographics, fishing related characteristics, and comprehension. For

[16] Following Selten's (1965) strategy method, asking everyone to make a decision before randomly determining which decision is carried out allows for an incentive compatible way of gathering data not only on those decisions that were implemented but also on those that were not implemented.

[17] For robustness analyses on the treatment effect (session level analysis and limiting observations to the first round), see Online Appendix A.2.

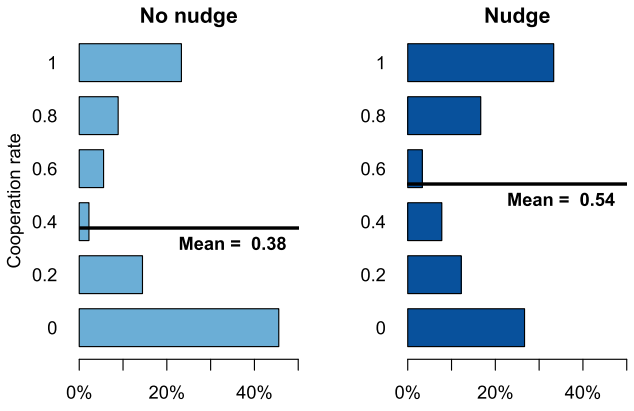

Fig. 4. Average cooperation rate of dictatorial decisions by nudge treatment (combined $N = 180$).

Table 2
Regression results: team cooperation.

	Team Cooperation Rate		
	Maj. voting (1)	Dict. decision (2)	Pooled (3)
Nudge	0.149*	0.181**	0.142**
	(0.079)	(0.086)	(0.073)
Dict. decision			0.056
			(0.084)
Nudge × dict. decision			0.041
			(0.112)
Controls	Yes	Yes	Yes
N	156	180	336

Notes: The table reports average marginal effects from team-level fractional probit regression models on the team cooperation rate. Robust standard errors are clustered at the session level (in parentheses). Margins are calculated at mean values of all covariates. Controls include age, age squared, crew size, an indicator whether the crew mainly targets dagaa, and a measure for comprehension (see Online Appendix Table A.5 for coefficients). All controls variables are averaged among the three team members for teams that use majority voting. ***, **, and * indicate significance at the 1,5, and 10% level.

the average marginal treatment effect, see column (1) in Table 2. The regression model predicts that the nudge leads to a marginally significant increase (at the 10% level) in team cooperation by, on average, 14.9 percentage points. We therefore accept Hypothesis 1a: The norm-nudge increases cooperation by teams under majority voting.

6.2. The effect of the norm-nudge under dictatorial decisions

Fig. 4 plots the distribution of cooperation rates for dictatorial decisions by norm-nudge treatment. In both treatments, the majority of team dictators either cooperate always or never. Without the nudge, the most frequent strategy is zero cooperation across all rounds. With the nudge, the most frequent strategy is full cooperation. We consequently observe a strong positive treatment effect. The average cooperation rate is 16 percentage points higher with a norm-nudge (54%) than without (38%), a significant increase with $p = 0.004$, combined $N = 180$. The test has 84% power with $\alpha = 0.04$.

Our results on the treatment difference strongly suggest that the norm-nudge is successful in changing team decisions when teams use a hierarchical structure. This is supported by a significant coefficient for the treatment in a fractional probit regression. For the average marginal treatment effect, see column (2) in Table 2. The model predicts that the nudge leads to an increase in team cooperation by, on average, 18.1 percentage points (significant at the 5% level). Hence, we accept Hypothesis 1b: The norm-nudge increases cooperation by teams when decisions are made by a dictator.

6.3. Comparing majority voting and dictatorial decisions

We find that the nudge increases team cooperation in the prisoner's dilemma for both types of management. In column (3) of Table 2, we present average marginal effects of a fractional probit model that compares the dictatorial structure with majority voting. That is, we regress the team cooperation rate, where we consider individual choices when decisions are made by team

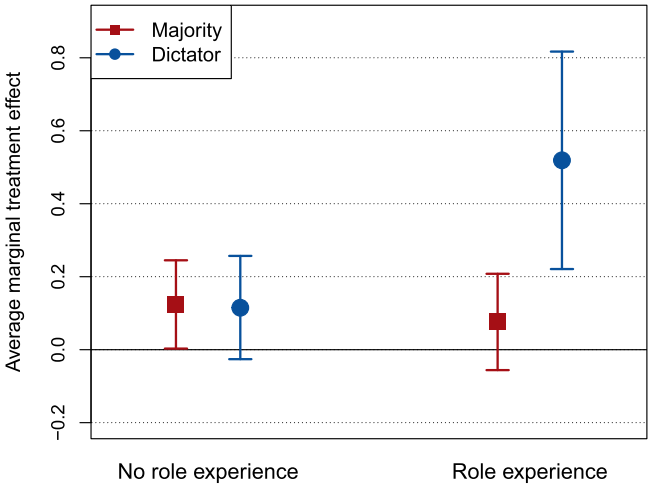

Fig. 5. Heterogeneous treatment effects by role experience. *Notes:* The figure plots average marginal treatment effects of the norm-nudge on individual cooperation conditional on role experience in the imposed management structure. Whiskers indicate a 95% CI. For the regression coefficients, see Online Appendix Table A.6.

dictators ($N = 180$) and majority voting outcomes otherwise ($N = 156$), on the treatment, an indicator for the dictatorial management structure, and an interaction term.

While we find that the joint effect of nudge and dictatorial decisions is significantly different from zero (at the 5% level), the interaction term is not significant. Hence, we cannot reject Hypothesis 2. Moreover, we document no differences between egalitarian and hierarchical management structures for team cooperation rate in the baseline (without a nudge). For robustness of the result with respect to limiting observations to the first round, see Online Appendix A.2.

6.4. Experience moderates the effect of the norm-nudge

The random assignment of the management structure in the experiment enables us to identify whether role experience moderates the nudge's effect on team cooperation. Some of the participants in the experiment can apply their real world experience with making decisions in a given management structure (as proxied by the self-reported decision making process in their fishing firm, see Fig. 2) while other individuals are put in the position to make a decision using an unfamiliar structure. In other words, some team dictators in our experiment report to dictate their team's decisions also in real life and some teams in the majority voting treatment report to also use an egalitarian approach to determine their firm's decisions. Everyone else uses a management structure in the experiment that they do not report to use while fishing on the lake.[18]

We test for heterogeneous treatment effects of the norm-nudge with respect to role experience using a fractional probit regression on the individual cooperation rate. To ease interpretation of the results, we plot the average marginal treatment effects with and without role experience for both management structures in our experiment, see Fig. 5. We find that participants without role experience are moderately affected by the nudge treatment when their team uses the majority voting procedure (left part of Fig. 5). Here, cooperation increases by about 12 percentage points ($p = 0.044$). For those that take dictatorial decisions without role experience, the treatment appears to increase cooperation as well. The model predicts a treatment effect of about 12 percentage points, which is however not significant ($p = 0.111$).

The right part of Fig. 5 plots the average marginal treatment effect for participants with role experience. Our results are striking. Team dictators with role experience are particularly responsive to the nudge treatment: the regression model predicts an increase in cooperation of 51.9 percentage points ($p = 0.001$). In contrast, the nudge treatment seems to fail with experienced team members in the majority voting mechanism (7.6 percentage point increase, $p = 0.260$).[19]

These results are neither due to the fact that real life team dictators (captains or owners) cooperate more per se, nor due to the fact that fishermen from firms with an egalitarian management are less cooperative. For a detailed robustness check, see Online Appendix Table A.8. While captains cooperate less than crew members and owners in the baseline (without the nudge), the treatment effect is significant and positive across all roles. When we include the real world firm management structure, we see that captains and owners who have the responsibility for their firm in real life, make significantly less cooperative choices when in the experimental role of a team dictator, but they cooperate substantially more upon receiving the norm-nudge.

[18] Out of the 180 participants in the dictatorial decision mechanism, 29 report to be team dictators in real life and for the majority voting mechanism, 218 out of 468 participants have role experience in an egalitarian structure. For a comparison of participant characteristics across role experience, see Online Appendix Table A.3.

[19] As discussed in section 3.2, the categorization of teams into having experience with either management structure relies on self-reported data. For a discussion on alternative categorizations and a respective robustness analysis of the heterogeneous treatment effect with respect to role experience, see Online Appendix A.4.

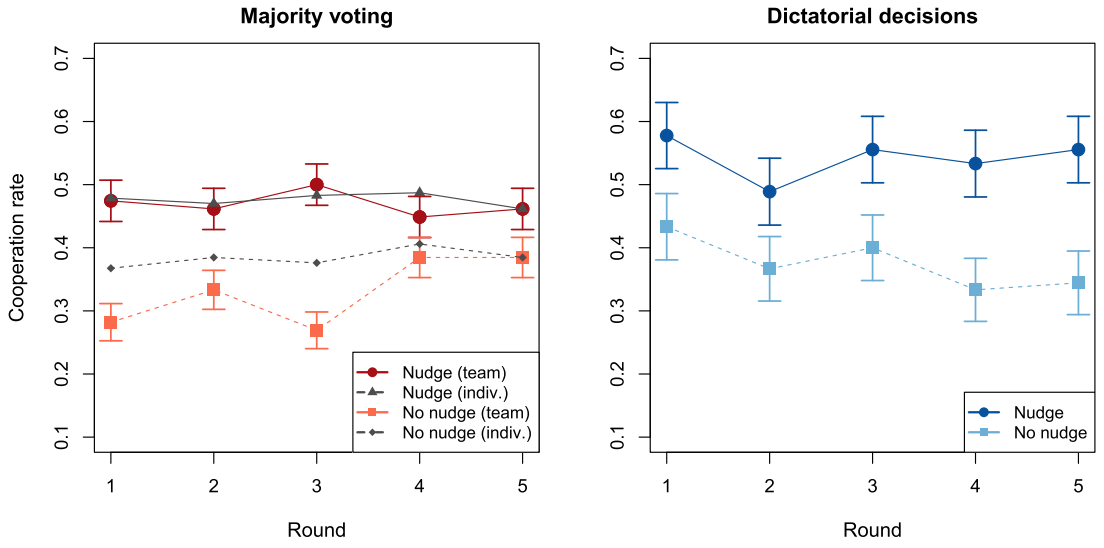

Fig. 6. Average cooperation rates over rounds. *Notes*: Team cooperation rate across all five repetitions of the prisoner's dilemma game by the nudge treatment (solid line with a nudge, dashed line without a nudge) for majority voting (left panel) and dictatorial decisions (right panel). For majority voting, we additionally plot average individual cooperation rates (in gray). Whiskers indicate ±1 SE.

6.5. Repeated interaction

So far, we have focused on our main outcome, the cooperation rate over the five rounds of the repeated game. In the following, we break up this measure and study cooperation in the individual rounds.

We plot average team cooperation in each of the five rounds of the prisoner's dilemma (Fig. 6) under majority voting (left panel) and for dictatorial decisions (right panel). For dictatorial decisions, there is a positive and significant treatment effect in each round ($p < 0.050$). For majority voting, there is a positive and significant treatment effect in the first three rounds. In the fourth round, the treatment effect decreases to 6.4 percentage points and is no longer significantly different from zero ($p = 0.209$, combined $N = 165$). The volatility in the team cooperation rate under majority voting is largely due to a mechanical effect of aggregating the individual votes within the team.[20] To illustrate this mechanical effect, we additionally plot average cooperation by the individual participants for both groups under majority voting, see the gray lines in the left graph of Fig. 6. Throughout the five round game, the treatment effect in average individual cooperation is positive and relatively stable, *i.e.,* between a 7.7 (fifth round, $p = 0.046$, combined $N = 468$) and a 11.1 (first round, $p = 0.008$, combined $N = 468$) percentage points increase due to the norm-nudge.

The first round. We begin our analysis of the repeated game in the first round, *i.e.*, the round where the nudge not yet competes with the information provided in the end-of-round feedback. It is a common finding that a norm-nudge does not work through a pure demand effect (*i.e.*, participants interpreting the message as a directive for own behavior) but rather that those who receive information about cooperative behavior of others, expect them to cooperate and subsequently cooperate themselves (Croson et al., 2009). We test whether this channel is active also in our experiment. Note that the change in empirical expectations cannot happen on the team level but only in the perception of the individual member. We therefore turn to the outcomes of individual team members.

We analyze how the provision of the norm-nudge affects empirical expectations in round 1, *i.e.*, the initial belief about what other teams do. Fig. 7 shows the distribution of empirical expectations in round 1 by nudge treatment and management structure. For dictatorial decisions, we find that empirical expectations are affected by the nudge. Without the nudge, 31% of the participants believe that other teams will cooperate. With the nudge, this share increases by 26 percentage points to 57%. The difference is significant with $p < 0.001$, combined $N = 180$. To our surprise, we cannot document a significant effect of the norm-nudge on empirical expectations when decisions are determined by majority voting. Without the nudge, 38% of participants believe that other teams are cooperative. With the nudge, this share is 43%, an insignificant increase with $p = 0.129$, combined $N = 468$.

To analyze more formally how the nudge affects empirical expectations and how this translates to a change in behavior, we conduct a mediation analysis, for marginal effects see Table 3. First, the analysis confirms that the norm-nudge leads to a significant increase in cooperative empirical expectations with dictatorial decisions (27.5 percentage point increase with $p < 0.001$) but not with majority voting (6.5 percentage point increase with $p = 0.189$). Second, we find that empirical expectations are a significant predictor for cooperation in both management structures, independent of whether we isolate the first round (columns 2 and 5) or focus on the rate of cooperation in the full game (columns 3 and 6). Hence, the mediation analysis indicates that for dictatorial decisions, about 18

[20] Suppose the individual propensity to vote for cooperation is p. The probability P that a three-person team cooperates under majority voting when members' votes are independent from each other is then given by $P = p^3 + 3p^2(1-p)$. P is a sigmoid function on the domain $p \in [0,1]$ with $P < p$ for $p \in [0, 1/2)$, and $P > p$ for $p \in (1/2, 1]$. Hence, there is a difference between the individual propensity to vote for cooperation and the resulting cooperation rate of teams (unless $p = 1/2$).

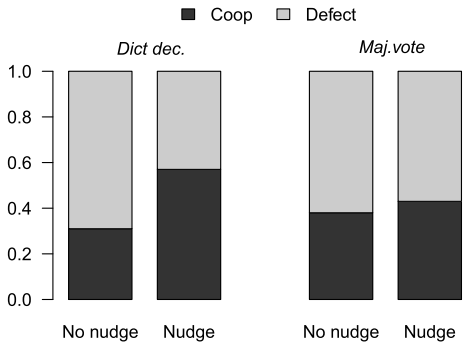

Fig. 7. Distribution of empirical expectations in round 1. *Notes*: The figure displays the distribution of participants' empirical expectations in round 1 by management structure and norm-nudge treatment. The dark (light) areas show the share of participants that expect other teams to cooperate (defect).

Table 3
Mediation analysis of the effect of the nudge on cooperation through empirical expectations (EE) in round 1.

	Dict. decision			Maj. Voting		
	EE R1	*Coop. R1*	*Ind.Coop.Rate*	*EE R1*	*Coop. R1*	*Ind.Coop.Rate*
	(1)	(2)	(3)	(4)	(5)	(6)
Nudge	0.275***	-0.115	0.055	0.065	0.142**	0.084*
	(0.079)	(0.091)	(0.085)	(0.050)	(0.066)	(0.042)
EE		0.655***	0.235***		0.717***	0.573***
		(0.089)	(0.065)		(0.072)	(0.052)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
N	180	180	180	468	468	468

Notes: The table reports average marginal effects from individual level probit models for empirical expectations in round 1 (EE R1) and individual level fractional probit models for cooperation in round 1 (Coop. R1) as well as cooperation rates. Robust standard errors are clustered at the session level (in parentheses). Margins are calculated at mean values of all covariates. Individual controls include the personal normative belief, age, age squared, crew size, an indicator whether the crew mainly targets dagaa, and a measure for comprehension. ***, **, and * indicate significance at the 1,5, and 10% level.

percentage points of the treatment effect in round 1 and about 6.5 percentage points of the total treatment effect in the full game is transmitted to a behavioral response through a change in the first round's expectation of other teams' actions.[21] For majority voting, we cannot document this relationship as empirical expectations are not responsive to the nudge treatment.[22] While this points to the role of responsibility as a key difference between management structures, an exact identification of the various channels through which the norm-nudge affects behavior under different structures is beyond the scope of this paper. Certainly, it is an interesting avenue for future research.

Repetitions. Finally, we study how individual cooperation decisions in the repeated game evolve after the first round. Remember that participants are informed about the outcome of the two-team prisoner's dilemma at the end of each round, including the choices of the other members of their own team and the aggregated decision made by the other team. A nudge that induces an initial behavioral change may be complemented by observations during such feedback. That is, feedback may confirm the nudge's message and lead to a self-enforcing alignment of beliefs and behavior over time, as shown in Diekert et al. (2022a). However, the nudge may also compete with the end-of-round feedback. For example, if teams conditionally cooperate such that they defect after being exploited by another team, the nudge's overall effect will fade over time as cooperation breaks down. While we purposefully imposed repeated one-shot interactions with perfect stranger re-matching to minimize such competition between feedback and nudge, we nonetheless study whether cooperation over time depends on the experience that individuals make in previous rounds.

In Table 4, we present marginal effects of a probit model that regresses individual cooperation decisions on the nudge treatment, the previous rounds' outcome of the two-team prisoner dilemma (proxied by the payoff for the own team, see Table 1 for the payoff matrix), and a time trend. The baseline is the social optimum of mutual cooperation where both the own and the other team earn 6 points in the previous round. We highlight three important results from our analysis in Table 4. First, in both management structures, individual participants appear to not be conditionally cooperative but rather play a strategy of cooperation or defection, independent

[21] The size of the treatment effect transmitted through a change in empirical expectations is calculated by multiplying the size of the effect of the nudge on empirical expectations with the size of the effect of empirical expectations on cooperation, *e.g.*, $0.275 \times 0.655 = 0.180$ for cooperation in round 1 under majority voting.

[22] We study participants' personal normative beliefs (incl. a mediation analysis) in Online Appendix A.3 to see whether the norm-nudge changes what participants think is the morally right thing to do, and if so, how this change translates into differences in behavior.

Table 4
Analysis of individual cooperation in the repeated game.

	Individual Cooperation Decision		
	Maj. voting	Dict. decision	
	(1)	(2)	(3)
Payoff in previous round			
— 3 points	-0.047	-0.030	-0.029
	(0.031)	(0.061)	(0.063)
— 4 points	-0.346***	-0.263***	-0.259***
	(0.038)	(0.074)	(0.079)
— 7 points	-0.367***	-0.213***	-0.210***
	(0.033)	(0.069)	(0.070)
Nudge	0.048	0.154**	0.148**
	(0.039)	(0.073)	(0.073)
Round	-0.002	-0.001	-0.001
	(0.009)	(0.011)	(0.011)
Real-life leader chosen in R1			0.024
			(0.068)
Controls	Yes	Yes	Yes
N	1872	720	720

Notes: The table reports average marginal effects from individual level probit models for cooperation over time. Robust standard errors are clustered at the session level (in parentheses). Margins are calculated at mean values of all covariates. Individual controls include, age, age squared, crew size, an indicator whether the crew mainly targets dagaa, and a measure for comprehension. A payoff of 6 points in the previous round is the baseline category, see Table 1 for the payoff matrix. ***, **, and * indicate significance at the 1,5, and 10% level.

of the experience they make in the previous round. That is, the coefficient for earning 3 points in the previous round is not significantly different from zero, indicating that participants whose team cooperated but earned a sucker payoff in the previous round are as likely to cooperate as participants whose team earned 6 points due to mutual cooperation. A significantly negative effect on cooperation is only observed for participants whose team earned 4 or 7 points in the previous round, *i.e.*, when the team defected. Second, we observe no time trend suggesting that individual cooperation is stable over the repeated game. Third, we test whether participants under dictatorial voting make different decisions when the respective real-life leader (who is particularly responsive to the nudge, see section 6.4) is randomly chosen to determine the team's action in the first round. Results indicate that this is not the case, see column (3) in Table 4.

In summary, we find that independent of the imposed management structure, individual participants do not condition their decisions on their experience from the previous round but rather play a strategy of cooperation or defection over the repeated game. Such patterns are consistent with the high share of teams that cooperate either always or never, see Figs. 3 and 4. The behavior can be explained by the perfect stranger matching procedure and the fact that there are no payoff linkages across rounds. These design choices help to isolate the effect of the nudge but limit spillover effects over time due to *e.g.,* retaliating against another team, making history dependent strategies less viable.

7. Discussion

Collective action problems such as climate change, corporate collusion, or community resource management are social dilemmas that need to be solved by teams. While formal regulations are often unavailable or fail to address those dilemmas, informal management tools may induce a shift in social norms that govern behavior. The related literature has – by and large – documented that norm-nudges can successfully nudge individual behavior towards socially desirable outcomes. We complement these findings by showing that a norm-nudge can also change collective actions when decisions are taken by teams.

The teams in our experiment are crews from different fishing firms at Lake Victoria that face the social dilemma of natural resource use in their daily lives. These crews make their harvest decisions in either hierarchical or egalitarian structures, a feature that we mimic in the experiment by contrasting two decision making mechanisms (majority voting and dictatorial decision). We find that a norm-nudge increases cooperation for both egalitarian and hierarchical management structures. Under majority voting, average team cooperation increases from 33% to 47%, while team cooperation increases from 38% to 54% for dictatorial decisions. These are large effects. For dictatorial decisions, the nudge tips the most frequent behavior from constant defection to constant cooperation. Somewhat surprisingly, the observed behavioral change is accompanied by a change in empirical expectations only for team dictators.

Furthermore, we show that experienced leaders in a hierarchical structure (those that are in power in real life) are particularly receptive to a nudge. The result is consistent with a theory that leaders have to pay attention to their social surrounding to avoid condemnation that could threaten their position of power (Cabrales and Hauk, 2011). Therefore, experienced leaders have a higher tendency to adhere to social norms. As such, pro-social leadership emerges from cooperative norms and the leaders' tendency to honor them (Henrich et al., 2015). Here, our results show how policies may leverage this tendency to induce cooperative decision

making in hierarchical organizations. Given that pro-social leaders are found to increase cooperative behavior of those that follow (Jack and Recalde, 2015; Kosfeld and Rustagi, 2015), our results suggest potential multiplicative effects of nudging. In contrast, we do not find such an effect for egalitarian teams. This is an interesting result that warrants further research: Are members of egalitarian teams less responsive to norm-nudges because the relevant reference network are the other members of their own team (and not the behavior of other teams), or because they are less likely to be pivotal in determining their team's decision?

Further research should also study differential payoff structures within teams. Unitary teams serve as an intuitive starting point to establish whether a norm-nudge can change team decisions and this setup reflects the payoff structure not only of fishing firms at Lake Victoria, but more generally: Fishing crew members are almost always paid in shares (McConnell and Price, 2006). Nevertheless, firms in other settings may have more complicated and nested structures. In particular, many scenarios at the workplace pose questions of free-riding incentives within teams or self-selection into teams, processes which underlie norms of themselves (Huck et al., 2012). Here, future research should study whether norm-nudges can be used to improve the management of multi-level public goods (Buchan et al., 2009; Gallier et al., 2019) or to discourage inefficient competition (Sheremeta, 2018).

The specific setting of our study naturally raises the question about its external validity.[23] Here, the scalability of the intervention is a key condition to discuss. One may be concerned that the application of norm-nudges is limited. The concern rests on the following paradox: When it is known that no one is cooperating, a statement that highlights the cooperative behavior of others is not credible. And when everybody cooperates, a norm-nudge is not necessary. The tacit assumption in posing such a paradox is that behavior is readily observable. In most field settings, however, behavior is not directly observable outside of the team. Teams and firms that transgress formal regulations or bend them to serve their self-interest, *e.g.*, fishing crews at Lake Victoria that choose to harvest in breeding areas or discard fish, will try to keep their behavior private, thereby obscuring the true extent of cooperation. In such a situation, beliefs about the behavior of others are still malleable (Dimant and Gesche, 2023). If combined with social sanctions or changes in the moral valuation of different behavior, norm-nudges may help turning cooperation problems into coordination problems and provide a focal point for desirable behavior (Binmore, 2010; Diekert et al., 2022a).

Our study addresses a gap in the literature on norm-nudges and in the literature on team behavior by providing a proof of concept that norm-nudges can affect team behavior. This proof of concept is relevant for two reasons: First, the well-documented differences between individual and team decision making means that one cannot infer that norm nudges work with teams when they work with individuals. Second, changing the level of decision making from teams to the individual is rarely a viable policy option, yet team decision making is common in many social dilemmas.

As many other lab-in-the-field experiments, we position ourselves at a crossroads that allows both looking at the behavioral patterns under the experimental microscope and exploiting specific features of the field as a reagent. By trading off experimental control with the richness of the field, we make the compromise that we can only speculate how well our results translate to the real harvesting decisions of fishers at Lake Victoria (see *e.g.*, Fehr and Leibbrandt (2011); Carpenter and Seki (2011); Kosfeld and Rustagi (2015) for important studies that link experimental behavior to field outcomes). Still, our study opens the door for testing the boundary conditions of how and when norm nudges affect team behavior. We believe that the following three features which we deliberately controlled in our experiment are promising avenues for future work:

First, we allow for only very limited communication among team members and across teams.[24] Irrespective of the decision making structure imposed in the experiment, team members can observe each others' choices, but they cannot freely express the reasons for their decisions. Similarly, while participants can express their general disapproval with cooperating or defecting, they cannot publicly speak to convince others in their team or in other teams that one action is preferable to another. There is little evidence on how norm-nudges and direct communication interact. Norm-nudges may be more effective if people can use communication as an additional tool to coordinate on a mutually beneficial action (Charness et al., 2021). It may help to make social identities more salient (Abrahamse and Steg, 2013) and enforce social norms even before transgressions occur (Kinzig et al., 2013).[25]

Second, while restricting communication allows us to identify the difference between hierarchical and egalitarian management structures, the restriction is plausibly more artificial for egalitarian teams than for teams that use an hierarchical structure in real life. Egalitarian teams would naturally discuss which decision to take (and may even do so until consensus is reached), but a captain or owner may take decisions autonomously, without much deliberation with other crew members. Nevertheless, also dictators may want to know the opinion of their crew. In fact, previous research has shown that representatives cooperate more when they can communicate with their team (Iida and Schwieren, 2016). More work is needed to explore how the within-team power distribution affects outcomes by gradually increasing the involvement of the other team members in the decision.

Third, we use a simple game to represent the social dilemma of common pool resource use. While the experimental setup is abstract, both the take-frame and the binary choice set capture essential features of resource extraction at Lake Victoria. Other features may be less realistic: We impose repeated one-shot interactions with a perfect stranger matching such that there are no spillover effects over

[23] See List (2020) for an unconventional treatise on this topic. Of the four transparency conditions set forth in that paper, we discuss the issue of naturalness and scalability here. There is no attrition in our sample, and the issue of selection into our sample is discussed in section 4.

[24] As discussed above, there is a trade-off between the naturalness of the decision making process and experimental control. With free communication, it is not possible to tell whether a team reached a decision in an egalitarian way, or whether one person was more influential because he was more powerful than others (and not because he had the better argument). For an innovative attempt to allow free communication yet classify whether a specific team member proposes a certain rule of action, see Andersson et al. (2020).

[25] In other words, a nudge and communication may complement each other in a setting where teams have to decide between cooperation and defection. In settings where teams have to solve a puzzle, such as guessing the number of beans in a jar, nudges and communication may act as substitutes because both can reduce the effect of idiosyncratic biases.

time. Thus, teams cannot build a reputation and behavioral patterns of reciprocity or directed altruism cannot consolidate. Also, the absence of payoff linkages across rounds implies that there is no room for history-dependent strategies. At least in theory, depleting a slow-growing resource stock (Polasky et al., 2005), or threatening to push a system beyond a tipping point (Barrett, 2013), could be used as an effective way to enforce cooperation.

Our findings are a proof of concept that nudges work with teams. Policy makers may consider nudges as a tool to change behavior whenever collective decision making is important, be it in egalitarian or in hierarchical structures. While nudges are unlikely to be more effective than enforcing formal rules and regulations, in many settings they may be the only option available. A particularly important application of nudging team decisions is exemplified in our case study of the Lake Victoria fisheries: nudges may be a policy tool to promote effective nature conservation and sustainable collective resource management in developing countries and emerging economies, when teams have to solve social dilemmas under weak formal institutions (Segerson, 2022). Here, the pro-social forces of social cohesion, informal punishment, and leadership are decisive for cooperation (Janssen et al., 2010; Gutiérrez et al., 2011). Especially norm-nudges, *i.e.*, nudges that utilize social norm comparisons, can be used to change behavior (Kinzig et al., 2013; Nyborg et al., 2016) and our findings suggest that resource users in leadership positions are particularly important multipliers.

A concrete recommendation in a context like the Lake Victoria fisheries is an information campaign to nudge the purchase of production inputs such as legal wide-meshed fishing nets that reduce harvesting pressure on the resource stock. As the firm's owner usually also owns the means of production, such purchase decisions are made in hierarchical structures that we show to be particularly receptive to nudging. The Lake Victoria Fisheries Organization, an intergovernmental institution with a mandate to coordinate the management and development of the fisheries, could serve as a platform for such a nudging intervention through regular surveys and community meetings that specifically target resource users in leadership positions.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data is available at https://doi.org/10.11588/data/KAO28I.

Appendix A. Supplementary material

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.geb.2024.07.009.

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