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RESEARCH ARTICLE

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Applying a logic of appropriateness to understand behavioral differences between common resource dilemmas and public good dilemmas

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Abstract

Common resource dilemmas (CRDs) and public good dilemmas (PGDs) are distinct types of social dilemmas, yet they model the same underlying conflict between the collective interest and one's self-interest. Here, we study and interpret behavioral differences between these two main types of social dilemmas by applying a logic of appropriateness. In two experiments, we argue and demonstrate that CRDs, relative to PGDs, evoke higher levels of cooperation, because taking from collective property (in CRDs) is generally considered less appropriate than not giving from personal property (in PGDs). Importantly, these differential considerations of appropriateness are reflected not only in the willingness to cooperate but also in the willingness to punish and reward others' (non)cooperative behavior. Taken together, the findings reveal that CRDs and PGDs elicit different norms of appropriateness.

KEYWORDS
common resource dilemmas, cooperation, logic of appropriateness, public good dilemmas, punishment, reward

1 | INTRODUCTION

Social dilemmas arise when collective endeavors require individual sacrifices. In such situations, individuals face the dilemma whether or not to cooperate in furthering the interest of the collective at the expense of their self-interest. Examples are numerous, but two main types of social dilemmas are *common resource dilemmas* (CRDs) and *public good dilemmas* (PGDs) (e.g., Van Lange et al., 2013).

CRDs refer to situations in which individuals can *take* from a (scarce) common resource (e.g., drinking water, energy and rainforests), with the preservation of this *collective property* being threatened by those individuals who further their self-interest by taking too much for themselves (Hardin, 1968; Ostrom, 1990). PGDs refer to situations in which individuals can *give* to a (freely accessible) public good or service (e.g., blood transfusions, public transport and medical care), with its realization being challenged by those individuals who further their self-interest by giving too little from their *personal property* (Olson, 1965; Samuelson, 1954).

Although CRDs and PGDs differ in the sense that individuals can take from collective property in a CRD and give from personal property in a PGD, it is evident that these distinct types of social dilemmas model the same underlying conflict between the collective interest and self-interest (Dawes, 1980; Van Dijk & De Dreu, 2021; Van Lange et al., 2013). Having a similar underlying outcome structure does, however, not mean that CRDs and PGDs will also evoke similar

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behaviors. In other words, structural equivalence does not necessarily imply behavioral equivalence.

Indeed, behavioral experiments showed that CRDs and structurally equivalent PGDs can elicit different behaviors in terms of cooperation (for a review, see Van Lange et al., 2013). These previous experiments, especially those in the early days (e.g., Brewer & Kramer, 1986; Rutte et al., 1987), were largely inspired by Kahneman and Tversky's (1979) seminal work on prospect theory. Prospect theory's distinction between prospective outcomes in terms of *gains* and *losses* resembles the prospective outcomes in respectively CRDs (i.e., gains by taking from a common resource) and PGDs (i.e., losses by giving to a public good). Although prospect theory can explain behavioral differences in various domains of individual decision making (for reviews, see Kühberger, 1998; Levin et al., 1998), it turned out to be difficult, if not impossible, to consistently predict behavior in social dilemmas based on prospect theory (Schwartz-Shea & Simmons, 1995; Van Dijk & Wilke, 1995, 2000).

In the present article, we move beyond this prior work and invoke Weber et al.'s (2004) *Appropriateness Framework* to study and interpret behavioral differences between CRDs and PGDs.

2 | THE APPROPRIATENESS FRAMEWORK

The kernel of the Appropriateness Framework is that—similar to the "logic of appropriateness" as formulated by March (1994)—decision making is best understood as a function of situational recognition, identity, and the application of rules. Ultimately, the framework posits that decisions result from individuals asking themselves, implicitly or explicitly, the fundamental question: "What does a person like me (identity) do (rules) in a situation like this (recognition)" (Weber et al., 2004). The Appropriateness Framework thus implies that asymmetries in the willingness to cooperate between CRDs and structurally equivalent PGDs originate from asymmetries in what would be considered appropriate behavior in these two types of social dilemmas. Importantly, however, if there are indeed differential considerations of appropriateness, the Appropriateness Framework dictates that this should be reflected not only in people's own behavior in the social dilemma (i.e., the decision to cooperate) but also in other (behavioral) indicators of appropriateness (Messick, 1999; Tenbrunsel & Messick, 1999; Weber et al., 2004). Put differently, if the effect of social dilemma type is indeed grounded in considerations of appropriateness, the type of social dilemma that people face may affect not only their willingness to cooperate but also other related judgments or behaviors.

In social dilemmas, we posit two of the strongest behavioral indicators of what individuals consider the appropriate course of action are how willing they are to *punish* and *reward* others. After all, appropriateness considerations are normative and should, according to normative models of cooperation (e.g., Bendor & Swistak, 2001; Boyd & Richerson, 1992; Buckholtz & Marois, 2012; Elster, 1989; Fehr & Fischbacher, 2004a; Fehr & Schurtenberger, 2018; Henrich et al., 2006), apply to one's own cooperative behavior as well as to the cooperative behavior of others. As such, individuals may feel that those who deviate negatively from the level of cooperation that is deemed appropriate deserve some form of punishment (from a disapproving frown to financial or even physical harm). In a similar vein, individuals may feel that those who cooperate accordingly or deviate positively from the appropriate course of action deserve some form of reward (from an approving nod to privileges or actual financial benefits).

However, it is important to realize that imposing punishments and rewards in real-life situations typically comes at a personal cost (i.e., money, time, effort, and social exposure). Therefore, it is not self-evident that people will actually punish or reward others (Fehr & Gächter, 2002; Yamagishi, 1986). Nevertheless, it has been shown repeatedly that people often bear the costs of punishing noncooperation or rewarding cooperation (e.g., Fehr & Gächter, 2000; Rand et al., 2009), even when this costly behavior yields no direct material or reputational benefits to oneself (Fehr & Gächter, 2002; Walker & Halloran, 2004). Thus, if the (non)cooperative behavior of others triggers the desire to punish or reward under such conditions, this provides us with "a potential tool for identifying the norm" (Fehr & Schurtenberger, 2018, p. 464) that people may implicitly uphold. Here, we utilize this tool to identify differential norms of appropriateness across PGDs and CRDs, and we thus assess both people's willingness to cooperate and their willingness to punish or reward others in these two distinct, yet structurally equivalent, social dilemmas.

3 | APPROPRIATE BEHAVIOR IN SOCIAL DILEMMAS: COLLECTIVE PROPERTY VERSUS PERSONAL PROPERTY

If behavioral differences between CRDs and PGDs are indeed rooted in appropriateness considerations, it is important to identify the distinguishing feature(s) of these otherwise identical situations that lead to the differential appropriateness considerations. We propose that the initial distribution of property is such a key feature.

In CRDs, property is initially located in a common resource and is, therefore, referred to as *collective property*. In PGDs, by contrast, property is initially possessed by the individual and is, therefore, referred to as *personal property*. These different forms of initial property shape people's perceptions of property rights (e.g., Van Dijk & Wilke, 1997). Generally, previous research has shown that individuals are reluctant to infringe on another person's property rights. For instance, in their study on the dictator game, Oxoby and Spraggon (2008) showed that dictators who could distribute money between themselves and a recipient allocated less money to themselves if they felt that the money was earned not by themselves but, instead, by the recipient. Even more relevant for the current purposes is a study by Krupka and Weber (2013), who studied dictator games in which they manipulated the location of the initial property: money was either initially owned by the recipient or by the dictator. In the former case, dictators had to decide how much money they would *take* from the recipient's property; in the latter case, they had to

decide how much of their own money they would *give* to the recipient. Krupka and Weber's results fit with those of Oxoby and Spraggon: dictators allocated less money to themselves if they had to do this by taking from the recipient's money than if they had to do this by giving from their own money to the recipient.

Krupka and Weber (2013) did not use the Appropriateness Framework as the basis for their predictions. However, it is interesting to see that their hypotheses were based on the notion that what people consider to be socially appropriate behavior differs when they have to take from other's property as opposed to when they have to give from their own property. As they put it (p. 504), "'taking' would generally be considered less socially appropriate than 'giving', even when they produced identical outcomes." A similar connection was recently made by Korenok et al. (2018), who argued that the moral costs of taking from other's property exceeds the costs of not giving from one's own property, which they described as "taking aversion." In agreement with this, they found that participants would prefer being the dictator in a dictator game in which they could then decide how much to give to the recipient over being the dictator if they would then have to take money from the recipient.

The dictator game studies described above are relevant to the situations we study, be it that our focus is not on the mere allocation of initial property by taking from another person's property or giving from one's own property. The issue we address is whether the Appropriateness Framework helps us understand decisions in CRDs versus PGDs, that is, when individuals can take from collective property or give from their personal property. The role of social norms and the issue of what is appropriate behavior in interpersonal situations like the dictator game may not necessarily apply to social dilemmas (Krupka & Weber, 2013). One of the complicating matters, of course, is that taking from collective property is not the same as taking from other's personal property: After all, collective property denotes property that is "owned" by others *and* by oneself. This feature may affect what would be considered appropriate. It might render taking from collective property somewhat less inappropriate (as compared with taking from other's property). However, we would argue that although this might somewhat reduce the magnitude of the effect, its direction may be similar: taking from collective property may generally be considered less appropriate than not giving from one's own property. Based on this reasoning, we hypothesize people to be more reluctant to take from collective property in CRDs than they are willing to give from personal property in PGDs. Accordingly, we expect that CRDs will typically evoke higher levels of cooperation than PGDs.

Importantly, however, the Appropriateness Framework would suggest that considerations of appropriateness should not only shape the willingness to cooperate but also the willingness to punish and reward others (see Weber et al., 2004). Thus, in addition to using the framework to explain cooperation in CRDs and PGDs, we apply the same logic of appropriateness—rooted in the initial distribution of property—to punishment and reward. Specifically, we argue that if taking from collective property is indeed considered less appropriate than not giving from personal property, individuals will probably condemn and thus punish such selfish actions accordingly. That is, we hypothesize people to be more willing to punish those who take from collective property in CRDs than they are willing to punish those who keep personal property to themselves in PGDs.

The willingness to use rewards may yield the opposite pattern. If keeping personal property to oneself would be considered relatively appropriate, people may feel that those who nevertheless are willing to give from their personal property to the public good deserve to be rewarded. Cooperative actions in PGDs then may be rewarded more than cooperative actions in CRDs. After all, not taking from the common resource may be considered the only appropriate thing to do, not necessarily something that needs much reward. Therefore, we hypothesize people to be less willing to reward those who leave collective property to the collective in CRDs than they are willing to reward those who give from personal property in PGDs. Taken together, we thus expect that punishment will typically be more frequent, whereas reward will typically be less frequent, in CRDs than in PGDs.

In line with the above reasoning, Molenmaker et al. (2014) showed that *third-party* norm enforcement—through either rewarding cooperation or punishing noncooperation—is contingent on the type of social dilemma people face. Here, we extend this prior work in various respects. First, in two experiments, we study *second-party* norm enforcement, and second, we focus not only on the willingness to punish or reward but also on the willingness to cooperate because we believe that both reflect the same appropriateness considerations. Third, we examine participants' cooperation decisions and their punishment or reward decisions in CRDs as well as structurally equivalent PGDs (i.e., participants always faced both social dilemma types). We specifically chose to manipulate type of social dilemma within participants because this enabled us to highlight the resemblance between CRDs and PGDs in their underlying outcome structures. If participants would nevertheless uphold differential norms of appropriateness between these two types of social dilemmas, this would provide more compelling evidence for our reasoning. Fourth, in our second experiment, we test whether our logic of appropriateness—rooted in the initial distribution of property (collective versus personal, respectively)—holds, independent of the form of action that can be undertaken with the property (taking vs. giving, respectively).

4 | EXPERIMENT 1

The aim of Experiment 1 was to provide a first test of our ideas. Participants faced both CRDs and PGDs with either the opportunity to punish or reward. Thus, in our experimental design, social dilemma type (CRD vs. PGD) was a within-participants factor, and sanction type (punishment vs. reward) was a between-participants factor.[1] The CRDs and PGDs that participants faced were several one-shot social dilemma games, each structured in such a way that the individual costs of cooperation were always higher than the individual returns. Participants, therefore, obtained higher individual outcomes when they would not cooperate. Moreover, the payoff structures of the

CRDs were identical to the payoff structures of the PGDs (cf. Dawes, 1980; Molenmaker et al., 2014; Van Dijk & Wilke, 1995).

In each social dilemma game, participants first had to indicate to what extent they would cooperate. After this cooperation stage, participants were not informed about their fellow group members' cooperation decisions, but they had to indicate for each feasible cooperation decision in each game whether they would impose a fixed punishment or reward (depending on the condition they were in) when one or more fellow group members would make that particular decision. Thus, in the sanctioning stage, we used the so-called strategy method (e.g., Brandts & Charness, 2011; Fehr & Fischbacher, 2004b; Selten, 1967), which basically implied that participants made precompiled punishment or reward schemas for responding to their group members' cooperation decisions.

4.1 | Method

4.1.1 | Participants and design

This experiment was approved by the Psychology Research Ethics Committee of Leiden University. Participants were 84 students from this university (60 women and 24 men; M_{age} = 21.75 years, SD_{age} = 2.82), recruited to participate in a 1-h experiment in exchange for a monetary compensation (€6.50). We did not base our sample size on an a priori power analysis but aimed to recruit as many participants as possible within the given time available in the laboratory (approximately 2 weeks), with a minimum of 40 participants per cell. Experiment 1 employed a 2 (social dilemma type: CRD vs. PGD) × 2 (sanction type: punishment vs. reward) mixed factorial design with repeated measures on the first factor. Participants were randomly assigned to either the punishment condition or the reward condition. The two dependent variables were the cooperation decisions and sanctioning decisions (i.e., either punishment or reward decisions).

4.1.2 | Procedure

Upon arrival in the laboratory, a written informed consent was obtained from all participants, and they were seated in individual cubicles, each containing a personal computer used to present the instructions and to register their responses. Throughout the experiment, we used neutral terms to describe the social dilemmas, and there was no mentioning of the words cooperation, competition, sanctioning, punishment, or reward.

The instructions began by informing participants that they were about to engage in a group decision-making task in which their decisions would be grouped with the decisions of three fellow participants. It was stressed that they would not make their decisions at the same time but that the four-person groups would be formed once the entire experiment would be completed, by combining their decisions with those of three other randomly selected participants. Outcomes would, therefore, also be calculated after the data of all participants were collected. Furthermore, participants were also informed that all their decisions in the group decision-making task, and those of their fellow group members, would determine the number of points they earned, which would be converted to euros (1000 points = €3) afterwards.

The group decision-making task had two stages: a cooperation stage in which participants faced multiple social dilemma games (both CRDs and PGDs) and a sanctioning stage in which participants specified their punishment or reward schemes (depending on the condition they were in) for each game they faced.

Cooperation stage

The cooperation stage consisted of 15 CRDs and 15 structurally equivalent PGDs.[2] In the CRDs, a group account contained a particular number of *group points* and participants decided how many of these group points to *take* for themselves. Group points taken from the group account would be transferred to the participant's personal account, and group points left in the group account would be doubled and divided equally among the four-person group (i.e., the marginal per capita return [MPCR] was 0.5). The exact number of group points that participants could maximally take from the group account was the same for each group member and one fourth of the total size of the group account (because groups consisted of four persons, overextraction was thus not possible), yet it varied across the 15 dilemmas, ranging from 5 points to 75 points in steps of 5 points. However, there always were six choice options per dilemma because the number of group points that each participant could take from the group account ranged from 100% to 0% in steps of 20% (for an example, see Figure 1a).

In the PGDs, by contrast, participants were endowed with a particular number of *personal points* and decided how many of these personal points to *give* to the group account. Personal points given to the group account would be doubled and divided equally among the four-person group (i.e., the MPCR was 0.5), and personal points kept would be transferred to the participant's personal account. Each participant in the four-person group was endowed with the same number of personal points, but the exact number varied across the 15 dilemmas, ranging from 5 points to 75 points in steps of 5 points. The number of personal points that participants could give to the group account in each dilemma ranged from 0% to 100% in steps of 20%. Thus, like in the CRDs, there always were six choice options per dilemma (for an example, see Figure 1b).

To highlight that the two types of social dilemmas were structurally equivalent, examples of their identical payoff structures were given. Furthermore, the instructions also explained—before participants had to make their cooperation decisions—that a second stage would follow in which they (i.e., the four-person group) could respond to each other's decisions in the first stage by decreasing (punishment condition) or increasing (reward condition) one another's personal earnings. Participants were informed that this would be explained more thoroughly after they made their decisions in the first stage.

Next, participants made their cooperation decisions. The games were presented one at a time. For each game, the six choice options

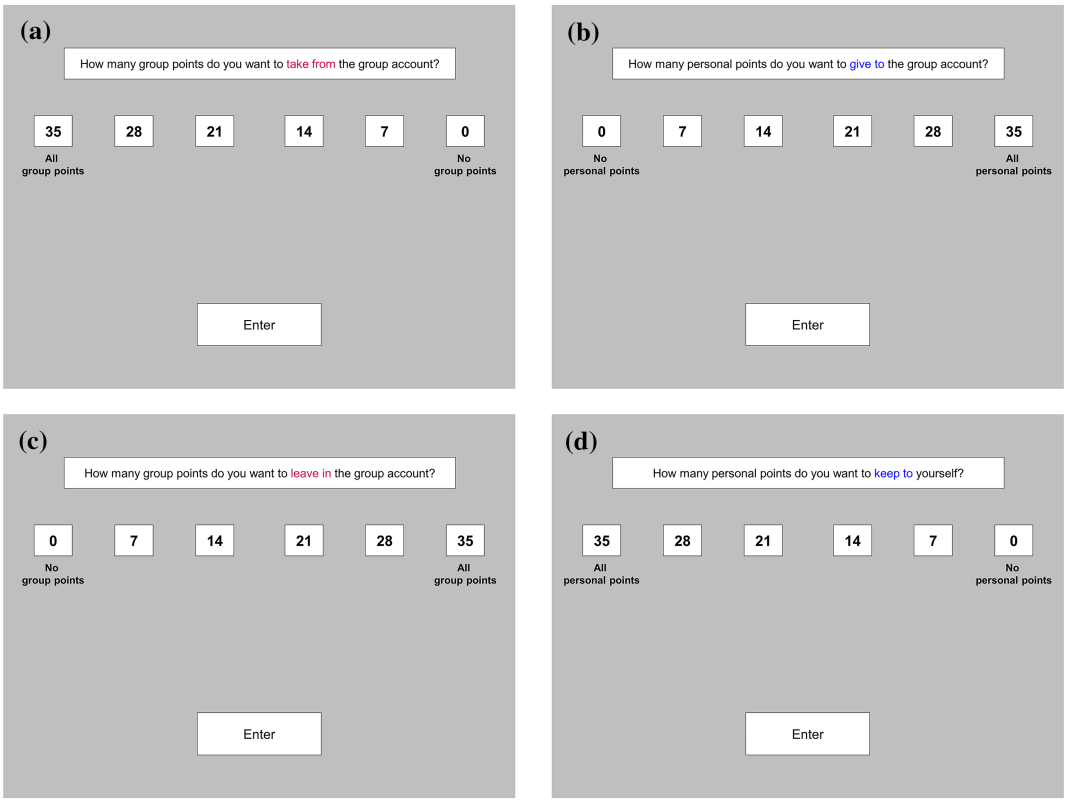

FIGURE 1 Examples of a decision screen in the cooperation stage. Depicted is the same game involving 35 points across the four versions. In Experiment 1, only (a) the taking version of the common resource dilemmas (CRDs) and (b) the giving version of the public good dilemmas (PGDs) were used. In Experiment 2, (c) the leaving version of the CRDs and (d) the keeping version of the PGDs were also used

were displayed, with the leftmost option always being the least cooperative choice and the rightmost option always being the most cooperative choice. Participants had to select one choice option, indicating how many group points they would take (in the CRDs) or how many personal points they would give (in the PGDs). Note that this procedure allowed us to compare the cooperation decisions across all games, because each choice option always represented the same degree of cooperativeness in percentage of the total number of group points that one could take in the CRDs and personal points that one could give in the PGDs (i.e., 1 = cooperativeness of 0%, 2 = cooperativeness of 20%, 3 = cooperativeness of 40%, 4 = cooperativeness of 60%, 5 = cooperativeness of 80%, and 6 = cooperativeness of 100%).

To control for sequence effects, the order in which participants faced the CRDs and PGDs was counterbalanced between participants. More specifically, participants first faced a block of 10 dilemmas that were presented as one type of social dilemma (as CRD or PGD), followed by another block of 10 dilemmas that were presented as the other type of social dilemma (as PGD or CRD, respectively). Finally, to test our hypotheses not only with a between-block design but also with a within-block design, participants faced a third block of five dilemmas, which were presented twice: as CRD and as PGD. Within each block, the social dilemmas were presented in fixed but random order, and participants had unlimited time to make their cooperation decisions.

Sanctioning stage

In the sanctioning stage, participants specified binding punishment or reward schemes for responding to their fellow group members' decisions in the cooperation stage. For each choice option in each CRD and each PGD, participants had to indicate whether they would assign a decrement point (punishment condition) or increment point (reward condition) when one or more group members would opt for that particular choice option. Because there were 15 CRDs and 15 PGDs in the first stage, with six choice options each, participants thus had to make 180 sanctioning decisions in total.

In the punishment condition,[3] participants learned that assigning a decrement point would cost the punishing participant 1 point (per group member) while it would cost the punished group member 3 points. In the reward condition,[4] assigning an increment point would cost the rewarding participant 1 point (per group member) while it would benefit the rewarded group member 3 points (for similar operationalizations of punishment and reward, see Molenmaker et al., 2014, 2016). The decrement or increment point would be assigned only when a group member would actually opt for that particular choice option. When a fellow group member would opt for a choice option for which the participant assigned no decrement or increment point, this would cost the participant zero points. Because participants were in a group together with three fellow group members, assigning decrement or increment points could cost them

maximally three points (one for each group member) per game, and receiving points could cost (in the punishment condition) or benefit (in the reward condition) them maximally nine points (three by each group member) per game.

Participants were explained that they would make one decision at a time. The six options of a particular game were displayed in a similar fashion as in the first stage. However, in this second stage, a choice option would be selected (for an example, see Figure 2a,b). Participants learned that they would have to indicate whether or not they wanted to assign a decrement point (in the punishment condition) or increment point (in the reward condition) when one or more group member(s) would opt for that particular choice option in that particular game. The instructions also explained that there would be a time limit of 5 s per decision to prevent this sanctioning stage from taking too long. To become familiar with making the sanctioning decisions in time, some practice trials were given. When participants were too late with making their sanctioning decision, this was recorded as missing data (this was the case in only 2.14% of the total number of sanctioning decisions across all participants).

To control for sequence effects in the sanctioning stage, participants had to make their sanctioning decisions in three blocks. Similar to the order in the cooperation stage, participants first faced a block in which the six choice options of 10 dilemmas were presented as one social dilemma type, followed by another block in which the six choice options of the same 10 dilemmas were presented as the other social dilemma type. To also test our hypotheses with a within-block design, participants faced a third block in which the six choice options of five dilemmas were presented twice: as CRD and as PGD. Thus, within each block, participants made 60 sanctioning decisions. The social dilemmas and the selected choice options were presented in fixed but random order, in which we ensured that a particular choice option was never followed by the same choice option in another game (see also Figure 3).

Immediately after the sanctioning stage, participants were debriefed, thanked, and paid. For practical reasons, payment consisted of the participation fee plus an additional fixed bonus of €2 (instead of participants' actual earnings) from the group decision-making task.

4.2 | Statistical analyses

We analyzed the data by fitting mixed models using the lme4 package in R. To account for the dependency in the data structure, we added one random intercept for each participant, one random intercept for each of the 15 games, and—for sanctioning decisions—one random intercept for each of the six choice options.

To analyze cooperation decisions, we first recoded the six choice options into degree of cooperativeness (ranging from 0% to 100%

FIGURE 2 Examples of a decision screen in the sanctioning stage. Depicted is the same game involving 35 points across the four versions and in the punishment condition. In Experiment 1, only (a) the taking version of the common resource dilemmas (CRDs) and (b) the giving version of the public good dilemmas (PGDs) were used. In Experiment 2, (c) the leaving version of the CRDs and (d) the keeping version of the PGDs were also used

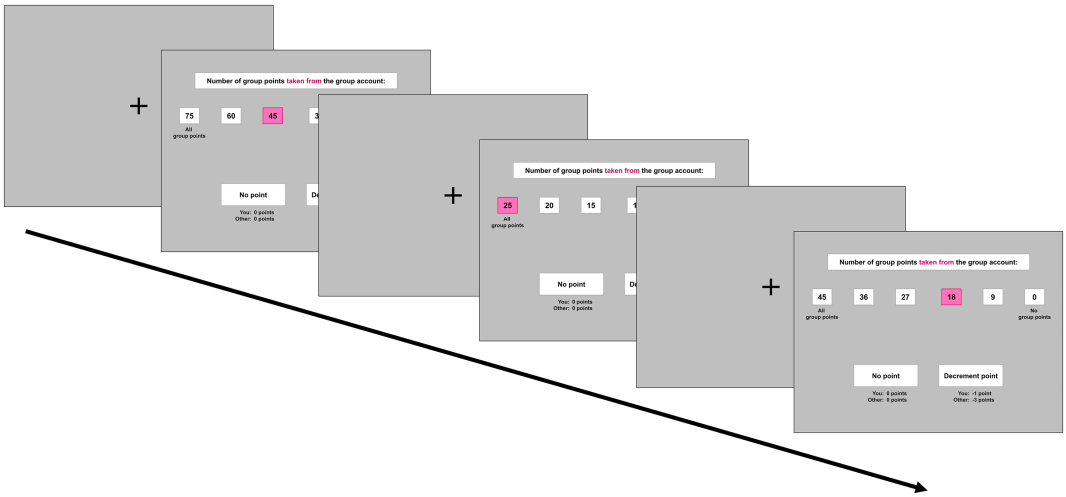

FIGURE 3 Example of how the different social dilemmas (in this particular case, the common resource dilemmas involving 75, 25, and 45 group points) and selected choice options (in this particular case, the third, first, and fourth choice option, respectively) were presented over time in the sanctioning stage. Note that a fixation screen (random 2.2–6.6 s) was displayed before each decision screen (max. 5 s)

cooperativeness), and we subsequently specified a linear mixed model (using the Satterthwaite's method; Kuznetsova et al., 2017) with fixed effects for social dilemma type (−0.5 = PGDs, 0.5 = CRDs) and sanction type (−0.5 = punishment, 0.5 = reward), as well as their interaction. To analyze sanctioning decisions (0 = not sanctioned, 1 = sanctioned), we specified a generalized linear mixed model with a logit link function (using the Laplace approximation; Raudenbush et al., 2000). We included the same fixed effects as in the model for cooperation decisions and, in addition, a fixed effect to control for participant's own cooperation decisions (mean centered). To test our hypotheses about sanctioning, we fitted two additional models to estimate the simple effects within punishment and reward.[5]

Because the social dilemma games in the third block were presented both as CRD and PGD, we also tested whether our hypotheses would hold when we fitted the mixed models to the cooperation or sanctioning decisions in this "mixed" block only.[6]

4.3 | Results and discussion

4.3.1 | Cooperation decisions

As shown in Figure 4, the majority of participants (56.0%) were on average more cooperative in CRDs, whereas the other participants were on average either more cooperative in PGDs (25.0%) or equally cooperative in both types of social dilemmas (19.0%). The linear mixed model for cooperation decisions (see Table 1) yielded only a significant social dilemma type main effect, which indicated that the percentage of group points participants left in the group account in the CRDs ($M_{\%}$ = 67.60, $SD_{\%}$ = 33.38) was on average 9.27 percentage points higher than the percentage of personal points they gave to the group account in the PGDs ($M_{\%}$ = 58.33, $SD_{\%}$ = 29.79). These results support our hypothesis that people are more reluctant to take from collective property in CRDs than they are willing to give from personal property in PGDs.

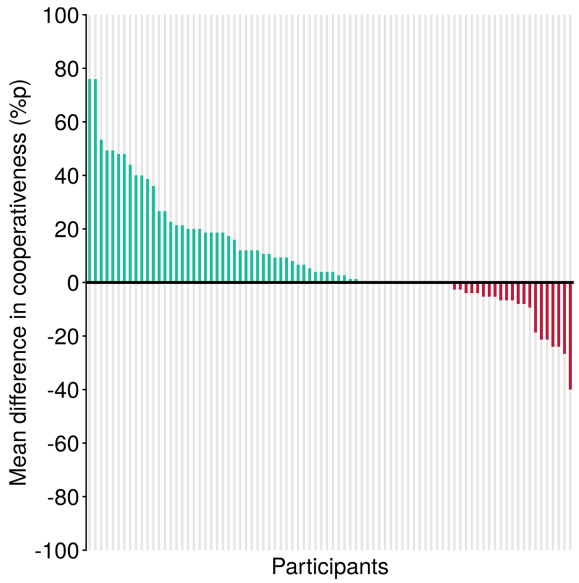

FIGURE 4 The mean difference in cooperation between common resource dilemmas (CRDs) and public good dilemmas (PGDs) per participant (i.e., each bar is one participant). A positive value (green) implied that a participant was on average more cooperative in the CRDs, a negative value (red) implied that a participant was on average more cooperative in the PGDs, and zero implied that a participant was on average equally cooperative in the CRDs and PGDs

4.3.2 | Sanctioning decisions

See Figure 5 for the mean relative frequency of sanctioning by social dilemma type and sanction type across the six choice options (in terms of cooperativeness). The generalized linear mixed model for sanctioning decisions (see Table 2) yielded a significant social dilemma type × sanction type interaction effect (odds ratio = 0.31, 95% CI [0.26, 0.36]). Corroborating our hypothesis that people are more

TABLE 1 Cooperation as a function of social dilemma type (Experiment 1)

	n = 2520	*n* = 840
Intercept	63.012*** (2.96)	63.077*** (3.83)
Social dilemma type	9.312*** (0.88)	7.909*** (1.51)
Sanction type	−1.842 (5.22)	−2.245 (5.39)
Social dilemma type × sanction type	−1.776 (1.76)	−2.182 (3.01)
Random intercept individual variance	555.26	562.14
Random intercept game variance	29.44	36.88
Residual	489.14	474.54

Note: This table shows the estimation results from two linear mixed models fitting cooperation decisions across all three blocks (Column 1) and only the third "mixed" block (Column 2). SEs are shown in parentheses.
*p < .05. **p < .01. ***p < .001.

TABLE 2 Sanctioning as a function of social dilemma type × sanction type (Experiment 1)

	n = 14,796	*n* = 4916
Intercept	−1.337*** (0.27)	−1.270*** (0.26)
Cooperation decision	0.071* (0.03)	0.024 (0.05)
Social dilemma type	−0.060 (0.04)	−0.020 (0.07)
Sanction type	−0.172 (0.36)	−0.202 (0.32)
Social dilemma type × sanction type	−1.172*** (0.08)	−1.235*** (0.14)
Random intercept individual variance	2.60	1.93
Random intercept game variance	0.002	0.005
Random intercept choice option variance	0.23	0.23

Note: This table shows the estimation results from two generalized linear mixed models fitting sanctioning decisions across all three blocks (Column 1) and only the third "mixed" block (Column 2). SEs are shown in parentheses.
*p < .05. **p < .01. ***p < .001.

willing to punish those who take from collective property in CRDs than they are willing to punish those who keep personal property to themselves in PGDs, the simple effects showed that punishment was 1.69 times more frequent (proportionally) in CRDs (34.78%) than in PGDs (25.60%), B = 0.526, SE = 0.06, p < .001, odds ratio = 1.69, CI [1.51, 1.90]. By contrast, reward was 1.92 times less frequent (proportionally) in CRDs (24.12%) than in PGDs (34.40%), B = −0.645, SE = 0.06, p < .001, odds ratio = 0.52, CI [0.47, 0.59]. This supports our hypothesis that people are less willing to reward those who leave collective property to the group in CRDs than they are willing to reward those who give from personal property to the group in PGDs.

Moreover, the model also yielded a significant effect of participant's own cooperation decisions (odds ratio = 1.07, 95% CI [1.01, 1.14]), suggesting that the more cooperative people are, the more likely they are to either punish or reward others. This effect was not observed, however, when analyzing only the third "mixed" block (see Table 2, Column 2).

When looking at the overall pattern of results, the findings of Experiment 1 are consistent with our central premise that taking from collective property in CRDs is generally considered less appropriate than not giving from personal property in PGDs.

5 | EXPERIMENT 2

Our reasoning about the origin of behavioral differences between CRDs and PGDs hinges on the inherent difference in how property is initially distributed across the two types of social dilemmas (collective property versus personal property). Note, however, that these social dilemma types also inherently differ in what form of action can be undertaken with this property: taking versus giving. It could, therefore, very well be that these distinct forms of action (co)contributed to our findings in Experiment 1.

One could, for instance, reason that the differential actions draw attention to differential goals. Whereas taking in CRDs is an action that directly furthers the self-interest, giving in PGDs is an action that

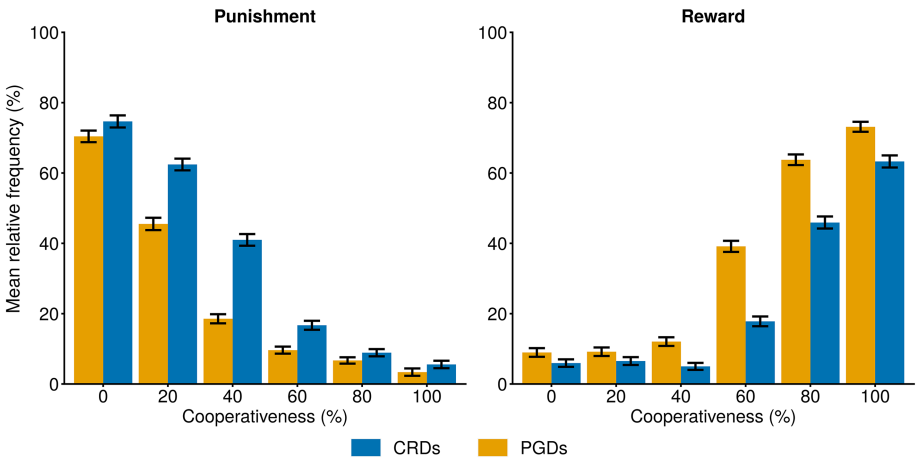

FIGURE 5 The mean relative frequency of sanctioning (±SEM) by social dilemma type and sanction type across the six choice options (in terms of relative cooperativeness)

directly furthers the collective interest. Thus, opposite interests (self-interest vs. collective interest) are explicitly represented in the action of taking versus giving, respectively. Consequently, by asking participants how much to take from the common resource, we might have induced a focus on the extent to which the self-interest is furthered, whereas by asking participants how much to give to the public good, we might have induced a focus on the extent to which the collective interested is furthered; a difference in focus which could have affected decision making across the two types of social dilemmas (see Kühberger, 1998; Levin et al., 1998). Indeed, a large body of literature showed that the presentation of social decision-making tasks can influence behavior (e.g., Allison et al., 1996; Pillutla & Chen, 1999; for a review, see Weber et al., 2004).

Importantly, the differential focus across CRDs and PGDs need not be connected to how property is initially distributed or whether individuals decide about collective property or personal property. After all, work by Van Dijk and Wilke (2000) showed that decision focus can be shifted, while letting the initial distribution of property unchanged. In CRDs, participants are usually asked how much collective property they would take for themselves (inducing a focus on the extent to which the self-interest is furthered); an alternative is to ask participants how much collective property they would leave in the common resource (inducing a focus on the extent to which the collective interest is furthered). In similar vein, participants in PGDs are usually asked how much they would give to the public good (inducing a focus on the extent to which the collective interest is furthered) and can also be asked how much personal property they would keep to themselves (inducing a focus on the extent to which the self-interest is furthered). The aim of Experiment 2 is to disentangle the theorized effects of how property is initially distributed from these possible decision-induced focusing effects.

If—as we claim—the findings of Experiment 1 indeed hinge on the initial distribution of property, any effect that shifting the decision focus may have should emerge independently of the impact that the initial distribution of property has on the difference in appropriateness norms and, hence, the difference in behavior between CRDs and PGDs. In other words, we should replicate the same pattern of results, regardless of whether we phrase the actions in terms of *taking* or *leaving* in case of the CRDs and in terms of *giving* or *keeping* in case of the PGDs. To test this reasoning, we further modified our experimental design in Experiment 2. More specifically, as in Experiment 1, social dilemma type (CRD vs. PGD) was a within-participants factor and sanction type (punishment vs. reward) was a between-participants factor in our second experiment. However, in Experiment 2, we also employed four between-participants treatments to systematically vary the focus that the cooperation decisions may induce.

First, we developed a *taking* versus *giving* treatment in which participants decided how many group points to take for themselves (in the CRDs) and how many personal points to give to a group account (in the PGDs). Note that this treatment was the same as to how the form of action is usually presented in the two social dilemma types (Van Dijk & Wilke, 2000), as well as to how we presented them in Experiment 1. Consequently, they may thus induce the typical focus on the extent to which the self-interest is furthered in CRDs and on the extent to which the collective interest is furthered in PGDs, because these interests are explicitly represented in the actions. Second, we developed a *leaving* versus *keeping* treatment in which participants decided how many group points to leave in a group account (in the CRDs) and how many personal points to keep for themselves (in the PGDs). In this treatment, the forms of action in both social dilemma types were thus presented in their atypical, opposite version (Van Dijk & Wilke, 2000), and they may, therefore, induce a focus on the extent to which the collective interest is furthered in CRDs and on the extent to which the self-interest is furthered in PGDs.

Note that the above two treatments by itself are not a manipulation of decision focus because the actions in the CRDs refer to an opposite interest than the actions in the PGDs in both treatments. What they manipulated is whether the actions induce a focus on the self-interest in CRDs and on the collective interest in PGDs ("taking vs. giving" treatment) or on the collective interest in CRDs and the self-interest in PGDs ("leaving vs. keeping" treatment). To test the theorized effects of initial property distribution while keeping the decision-induced focus consistent within both types of social dilemmas (i.e., within participants), we also developed a *taking* versus *keeping* treatment in which participants decided how many group points to take for themselves (in the CRDs) and how many personal points to keep for themselves (in the PGDs). In this treatment, the actions in both social dilemma types were thus presented in such a way that they may induce a focus on the extent to which the self-interest is furthered. Furthermore, we developed a *leaving* versus *giving* treatment in which participants decided how many group points to leave in a group account (in the CRDs) and how many personal points to give to a group account (in the PGDs). In this treatment, the actions in both social dilemma types may, therefore, induce a focus on the extent to which the collective interest is furthered.

In Experiment 2, we thus extended the familiar distinction between CRDs versus PGDs with a distinction between actions that may either induce a focus on the extent to which the self-interest is furthered versus the extent to which the collective interest is furthered. In line with Van Dijk and Wilke (2000), we refer to the former distinction as *social dilemma type* and to the latter distinction as *decision focus* (see Table 3). Note that decision focus thus has two levels, which we manipulated by using either the taking version or leaving version of the CRDs, and by using either the giving version or keeping version of the PGDs. Based on our hypotheses, we expected that—irrespective of the varying focus that these different versions may

TABLE 3 Form of action by social dilemma type and decision focus

Decision focus	CRD	PGD
Self-interest	Taking	Keeping
Collective interest	Leaving	Giving

Abbreviations: CRD, common resource dilemma; PGD, public good dilemma.

induce within and between treatments—(i) CRDs will evoke higher levels of cooperation than PGDs and (ii) punishment will be more frequent, whereas reward will be less frequent, in CRDs than in PGDs.

5.1 | Method

5.1.1 | Participants and design

Experiment 2 was approved by the Psychology Research Ethics Committee of Leiden University. We recruited 240 students from this university (167 women and 73 men; M_{age} = 21.41 years, SD_{age} = 3.86) to participate in a 1-h experiment in exchange for a monetary compensation (€6.50). As in Experiment 1, we again aimed to recruit as many participants as possible within the given time available in the laboratory (approximately 4 weeks). Based on the results of Experiment 1 to inform expected effect sizes, we ran—post hoc—1000 simulated power analyses using the SIMR package in R for mixed models (Green & MacLeod, 2016), which showed that a sample size of 240 participants yielded 97.30% power to observe a Social dilemma type × Sanction type interaction effect on sanctioning decisions equivalent to −0.2 (the observed effect size was −1.17 in Experiment 1 and −0.42 in Experiment 2).

Experiment 2 employed a 2 (social dilemma type: CRD vs. PGD) × 2 (sanction type: punishment vs. reward) × 2 (decision focus: self-interest interest vs. collective interest) mixed factorial design. As in Experiment 1, social dilemma type was a within-participants factor and sanction type was a between-participants factor. Depending on the treatment participants were in, decision focus either varied within participants (in the "taking vs. giving" and "leaving vs. keeping" treatments) or was the same within but varied between participants (in the "taking vs. keeping" and "leaving vs. giving" treatments). Participants were randomly assigned to either the punishment condition or the reward condition and to one of the four treatments. The two dependent variables were the cooperation decisions and sanctioning decisions (i.e., either punishment or reward decisions).

5.1.2 | Procedure

The procedure was similar to the procedure of our first experiment, with the exception that this time we had two versions of the same 15 CRDs and 15 structurally equivalent PGDs. These different versions merely differed in how the cooperation decisions were phrased. The treatment that participants were in determined which version of the CRDs and the PGDs they faced.

In both versions of the CRDs, a group account contained a particular number of *group points*, which varied across the 15 dilemmas, and participants either had to decide how many of these group points to *take* for themselves (taking version) or *leave* in the group account (leaving version). As in Experiment 1, there always were six choice options per game, which were depicted either in terms of points to take or points to leave (for an example of both versions, see Figure 1a,c). In similar vein, participants were endowed with a particular number of *personal points* in both versions of the PGDs, with the exact number of personal points varying across the 15 dilemmas. Participants either had to decide how many of these personal points to *give* to the group account (giving version) or *keep* for themselves (keeping version), and the six choice options per game were depicted either in terms of points to give or points to keep (for an example of both versions, see Figure 1b,d).

Note that this procedure not only allowed us to compare the cooperation decisions across all games, as in Experiment 1, but also across all four treatments, because each choice option always represented the same degree of cooperativeness in percentage of the total number of group points that one could take or leave in the CRDs and personal points that one could give or keep in the PGDs.

Again, the cooperation stage was followed by a sanctioning stage in which participants specified their punishment or reward schemes (depending on the sanctioning condition they were in) for each game they faced in a similar fashion as in Experiment 1 (see Figure 2a,b,c,d). When the data of all participants were collected (1.3% of the total number of sanctioning decisions across all participants were recorded as missing data because some participants were too late), it was randomly determined who interacted with whom, and the outcomes of each participant were calculated based on their actual decisions in the group decision-making task. Through an anonymized procedure, participants received their additional payments via bank transfer. Thus, whereas participants in Experiment 1 received a fixed bonus instead of their actual earnings, Experiment 2 was fully incentivized and without such deception.

5.1.3 | Statistical analyses

As in Experiment 1, the data were analyzed using mixed models. In the mixed models, we included the same fixed effects as in Experiment 1. Additionally, because we systematically varied decision focus within and/or between participants in Experiment 2, we collapsed across the four treatments and included a fixed effect for decision focus (−0.5 = self-interest, 0.5 = collective interest) and its interactions with the other variables in our mixed models to isolate their effects.

5.2 | Results and discussion

5.2.1 | Cooperation decisions

The large majority of participants (74.2%) were on average more cooperative in CRDs, whereas the other participants were on average either more cooperative in PGDs (10.4%) or equally cooperative in both types of social dilemmas (15.4%). See also Figure 6 for the mean difference in cooperation between CRDs and PGDs per participant and by treatment.

The linear mixed model for cooperation decisions (see Table 4) yielded a significant social dilemma type main effect, indicating that the percentage of group points participants left in the group account (did not take for themselves) in CRDs ($M_{\%}$ = 64.58, $SD_{\%}$ = 34.22) was on average 18.01 percentage points higher than the percentage of personal points they gave to the group account (did not keep to themselves) in PGDs ($M_{\%}$ = 46.57, $SD_{\%}$ = 34.09). Moreover, the social dilemma type × sanction type interaction effect was significant. This indicated that the effect of social dilemma type on cooperation decisions was somewhat weaker in the punish condition (B = 16.164, SE = 0.80, p < .001) than in the reward condition (B = 19.918, SE = 0.81, p < .001); an effect not observed, however, when analyzing only the third "mixed" block (see Table 4, Column 2).

These results provided strong support for our hypothesis that people are more reluctant to take from collective property in CRDs than they are willing to give from personal property in PGDs. We find these results irrespective of the focus that the form of action may have induced and the prospect of having the opportunity to either punish or reward each other.

TABLE 4 Cooperation as a function of social dilemma type (Experiment 2)

	n = 7200	n = 2400
Intercept	55.586*** (2.00)	56.888*** (3.22)
Social dilemma type	18.041*** (0.57)	16.498*** (1.04)
Sanction type	0.866 (3.23)	−0.028 (3.28)
Decision focus	1.212 (0.79)	4.198** (1.39)
Social dilemma type × sanction type	3.754*** (1.14)	0.799 (2.07)
Social dilemma type × decision focus	−1.615 (1.59)	2.359 (2.80)
Decision focus × sanction type	0.165 (1.58)	−0.472 (2.78)
Dilemma type × sanction type × decision focus	1.583 (3.18)	2.712 (5.60)
Random intercept individual variance	606.91	581.98
Random intercept game variance	21.16	38.25
Residual	581.95	642.91

Note: This table shows the estimation results from two linear mixed models fitting cooperation decisions across all three blocks (Column 1) and only the third "mixed" block (Column 2). SEs are shown in parentheses. *p < .05. **p < .01. ***p < .001.

5.2.2 | Sanctioning decisions

See Figure 7 for the mean relative frequency of sanctioning by social dilemma type and sanction type across the six choice options (in terms of cooperativeness).

The generalized linear mixed model for sanctioning decisions (see Table 5) yielded a significant social dilemma type × sanction type interaction effect (odds ratio = 0.65, 95% CI [0.60, 0.72]). The simple effects showed that punishment was 1.35 times more frequent (proportionally) in CRDs (31.60%) than in PGDs (26.31%), B = 0.302, SE = 0.03, p < .001, odds ratio = 1.35, CI [1.26, 1.45], which is in line with our hypothesis that people are more willing to punish those who take from collective property in CRDs than they are willing to punish those who keep personal property to themselves in PGDs. In addition, corroborating our hypothesis that people are less willing to reward those who leave collective property to the collective in CRDs than they are willing to reward those who give from personal property in PGDs, reward was 1.13 times less frequent (proportionally) in CRDs (30.11%) than in PGDs (32.09%), B = −0.123, SE = 0.04, p < .001, odds ratio = 0.89, CI [0.83, 0.95].

In addition, the generalized linear mixed model also yielded a significant decision focus × sanction type interaction effect (odds ratio = 1.24, 95% CI [1.18, 1.61]). The simple effects showed that punishment was 1.30 times less frequent (proportionally) when the form of action induced a focus on the extent to which the self-interest is furthered (27.12%) than when a focus was induced on the extent to which the collective interest is furthered (30.81%), B = −0.768, SE = 0.70, p < .001, odds ratio = 0.77, CI [0.70, 0.84]. Reward, by contrast, was as frequent, regardless of the induced focus (31.80% and 30.39%, respectively), B = −0.047, SE = 0.05, p = .143, odds ratio = 0.95, CI [0.87, 1.04]. Thus, independent of the hypothesized effects of social dilemma type, we also found that shifting the decision focus had an effect on punishment but not on reward (nor on cooperation).

In contrast to Experiment 1, the model did not yield a significant effect of participant's own cooperation decisions, odds ratio = 1.03, 95% CI [0.99, 1.06] (see also Table 5, Column 2), which resonates with

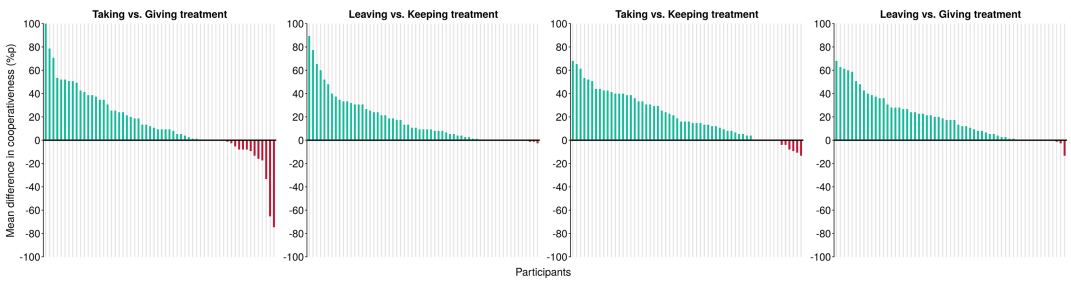

FIGURE 6 The mean difference in cooperation between CRDs and PGDs per participant (i.e., each bar represents one participant) and by treatment

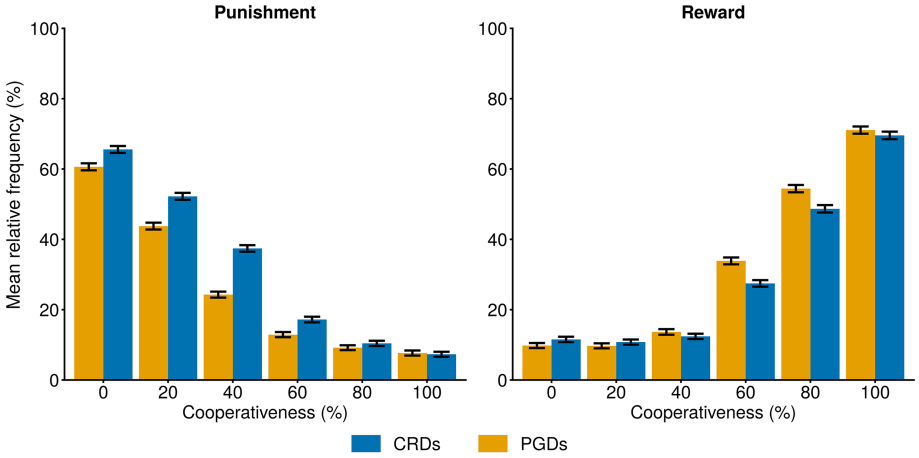

FIGURE 7 The mean relative frequency of sanctioning (±SEM) by social dilemma type and sanction type across the six choice options (in terms of relative cooperativeness)

TABLE 5 Sanctioning as a function of social dilemma type × sanction type (Experiment 2)

	n = 42,640	*n* = 14,217
Intercept	−1.259*** (0.19)	−1.342*** (0.20)
Cooperation decision	0.027 (0.02)	0.057 (0.04)
Social dilemma type	0.089*** (0.03)	0.063 (0.04)
Sanction type	0.288 (0.20)	0.220 (0.19)
Decision focus	−0.156*** (0.03)	−0.193*** (0.06)
Social dilemma type × sanction type	−0.424*** (0.05)	−0.559*** (0.08)
Social dilemma type × decision focus	−0.060 (0.07)	−0.003 (0.12)
Decision focus × sanction type	0.217*** (0.07)	0.286* (0.11)
Dilemma type × sanction type × decision focus	0.197 (0.13)	0.162 (0.23)
Random intercept individual variance	2.24	1.97
Random intercept game variance	0.02	0.03
Random intercept choice option variance	0.14	0.14

Note: This table shows the estimation results from two generalized linear mixed models fitting sanctioning decisions across all three blocks (Column 1) and only the third "mixed" block (Column 2). SEs are shown in parentheses.
*p < .05. **p < .01. ***p < .001.

the more general observation that, at the individual level, the willingness to cooperate and the willingness to punish or reward are not necessarily linked (Raihani & Bshary, 2019; Weber et al., 2018).

The observed differences in sanctioning between CRDs and PGDs—obtained while systematically varying the phrasing of the cooperation decisions—provide strong support for our hypotheses that people are more willing to punish, and less willing to reward, in CRDs than in PGDs. When looking at the overall pattern of results, the findings of Experiment 2 again fit our reasoning that taking from collective property in CRDs is generally considered less appropriate than not giving from personal property in PGDs.

6 | GENERAL DISCUSSION

The purpose of the present research was to further the understanding of behavioral differences between CRDs and PGDs by applying a logic of appropriateness. Although these distinct types of social dilemmas can be structurally equivalent in terms of their underlying outcomes, it was our central premise that taking from collective property in CRDs is generally considered less appropriate than not giving from personal property in PGDs. Based on Weber et al.'s (2004) *Appropriateness Framework*, we postulated that these differential considerations of appropriateness should be reflected in both the willingness to cooperate and the willingness to punish or reward others (see also Messick, 1999; Tenbrunsel & Messick, 1999). Consistent with our reasoning, the results of two experiments demonstrated that CRDs, relative to PGDs, evoked higher levels of cooperation. In accordance with this difference in the willingness to cooperate, punishment was more frequent, whereas reward was less frequent, in CRDs than in PGDs. Taken together, we thus revealed that CRDs and PGDs elicit different norms of appropriateness.

Importantly, we argued that these different norms of appropriateness and, hence, different behaviors originate from the inherent difference in how property is initially distributed in CRDs versus PGDs, that is, as collective property versus personal property, respectively. Consistent with prior research on the reluctance to take from other's property (e.g., Korenok et al., 2018; Krupka & Weber, 2013), the current findings provide compelling evidence that individuals consider taking from collective property—which denotes property that belongs to a group of people including oneself—less appropriate than not giving from their own personal property. These findings were obtained with a within-participants design (Experiments 1 and 2) and observed regardless of whether actions were presented in terms of taking or leaving in case of the CRDs, and in terms of giving or keeping in case of the PGDs (Experiment 2). Thus, the impact of the different appropriateness considerations on people's willingness to cooperate and their willingness to punish or reward others is stable and does not reflect a different focus induced by the different forms of action that people can undertake in CRDs versus PGDs.

Research by Van Dijk and Wilke (2000) showed that manipulating the phrasing of cooperation decisions can indeed affect people's focus and, hence, their preference for proportional rather than equal outcomes. In asymmetric social dilemmas, in which some group members, for example, possessed twice as much personal property in the PGD or had access to twice as much collective property in the CRD, these preferences resulted in different behaviors when the decision focus was shifted. In symmetric social dilemmas, however, it is not possible to distinguish between proportional and equal outcomes, and shifting the decision focus did, therefore, not result in different behaviors. Complementing this prior work, our results also showed that shifting the decision focus did not have an impact on the willingness to cooperate (in symmetric social dilemmas), nor on the willingness to reward others. However, the willingness to punish others was affected by shifting the decision focus. That is, punishment was more frequent when actions were phrased in terms of *leaving* in the CRDs and *giving* in the PGDs, as opposed to *taking* and *keeping* (in the CRDs and PGDs, respectively), because with these specific phrasings, the actions explicitly represented the extent to which others (failed to) further the collective interest. Thus, the willingness to punish others, and not the willingness to cooperate and reward others, seems susceptible to how actions are presented in social dilemmas.

The Appropriateness Framework offers an account of decision making specifically designed for social situations, which CRDs and PGDs are par excellence. Therefore, it has been suggested that this theoretical framework has the potential to provide more accurate predictions of behavior in social dilemmas than other, less social-oriented accounts of decision making (Weber et al., 2004), such as prospect theory (Kahneman & Tversky, 1979), or expected utility and rational choice models originating from a tradition in which psychological concepts like social norms have long been explicitly excluded (Bruni & Sugden, 2007).

We invoked the Appropriateness Framework to study and interpret behavioral differences between CRDs and PGDs, and we revealed that the inherent difference in how property is initially distributed is essential for understanding them. As such, we believe that our research has actionable implications for future research. For instance, whereas the general picture emerging from the psychological literature is that people are generally more willing to cooperate in CRDs than in PGDs (e.g., Brewer & Kramer, 1986; McCusker & Carnevale, 1995; for reviews, see Van Lange et al., 2013; Weber et al., 2004), there are also experiments, mainly in realm of economics, that actually showed the opposite effect (e.g., Gächter et al., 2017; Komorita, 1987; for reviews, see Cox & Stoddard, 2015; Dufwenberg et al., 2011) or no difference at all (e.g., Cubitt et al., 2011; Fleishman, 1988; Rutte et al., 1987). To explain these inconsistencies in the literature, a testable prediction deriving from our work is that the salience of the initial distribution of property and, more importantly, the accompanying property right perceptions may moderate whether and how the willingness to cooperate is affected by the type of social dilemma that individuals face.

Before closing, we would like to note that participants in our experiments made their cooperation decisions in the CRDs and PGDs while knowing that a second stage would follow in which group members could either decrease or increase each other's earnings (i.e., punish or reward, respectively). This procedure may constitute a limitation because participants might have conditioned their cooperation decisions on their beliefs of what others would consider an appropriate course of action to avoid punishment or obtain reward that way. For example, if participants expected that others would uphold and, hence, enforce differential norms of appropriateness between CRDs and PGDs, they may have cooperated accordingly. Thus, with the prospect of a possibility to punish or reward each other, people's cooperation decisions may reflect not only their own judgments of appropriateness but also their anticipation of others' judgments of appropriateness. At the same time, one may wonder if appropriateness considerations are ever independent of beliefs of others' appropriateness judgments (see Weber et al., 2004). Therefore, it would be a good idea for future research to further explore the role of beliefs in the emergence of behavioral differences between CRDs and PGDs. For the same reason, it would also be informative to use alternative and preferably more direct approaches—in addition to using punishment or reward decisions—to identify differential norms of appropriateness across CRDs and PGDs. For this purpose, one could use a recently introduced procedure with incentivized coordination games (Krupka & Weber, 2013) and/or ask participants to describe what they would consider appropriate behavior.

Finally, it is worth mentioning that in the present research, we were interested in general effects between CRDs and PGDs rather than individual differences and, therefore, we did not focus on the identify factor included in the Appropriateness Framework. Because our results suggest that there is quite some variance between individuals' decisions, an interesting avenue for future research could be to further utilize our experimental paradigm by exploring these individual differences. It may, for example, be worthwhile to relate behavioral preferences in both types of social dilemmas to individual differences in moral identity (Aquino & Reed, 2002) or justice sensitivity (Schmitt et al., 2010), as these dispositions might influence what people consider appropriate behavior, both for themselves and for others. It is our hope that studies along these lines may further contribute to the understanding of how the Appropriateness Framework can be used to predict and gain more insight into the decisions that individuals make in social dilemmas.

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DATA AVAILABILITY STATEMENT

All the materials, data, and syntax associated with this article are available from the first author upon request.

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ENDNOTES

[1] Sanction type was a between-participants—and not a within-participants—factor to ensure that the punishment and reward decisions were made independently, which cannot be guaranteed if participants have to make both types of sanctioning decisions sequentially (see also Molenmaker et al., 2014, 2016).

[2] The payoff function from a game in the cooperation stage for participant *i* can be formally described as

$$\pi_i^1 = y - c_i + r\sum_{j=1}^{n} c_j,$$

where $5 \leq y \geq 75$ (in steps of 5) denotes participant's share of the group account (in the CRDs) or participant's endowment (in the PGDs), $0 \leq c_i \geq y$ (in steps of 20%) denotes the group points left in the group account (in the CRDs) or the personal points contributed to the group account (in the PGDs), and *r* denotes the MPCR of 0.5 from the group account.

[3] The payoff function from a complete game (which includes both the cooperation and sanctioning stage) for participant *i* in the punishment condition can be formally described as

$$\pi_i = \pi_i^1 - \sum_{j \neq i} p_{ij} - m\sum_{j \neq i} p_{ji},$$

where p_{ij} (0 or 1) denotes the assigned decrement point, p_{ji} (0 or 1) denotes the received decrement point, and *m* denotes the multiplication factor of 3 for the received decrement points.

[4] The payoff function from a complete game (which includes both the cooperation and sanctioning stage) for participant *i* in the reward condition can be formally described as

$$\pi_i = \pi_i^1 - \sum_{j \neq i} r_{ij} + m\sum_{j \neq i} r_{ji},$$

where r_{ij} (0 or 1) denotes the assigned increment point, r_{ji} (0 or 1) denotes the received increment point, and *m* denotes the multiplication factor of 3 for the received increment points.

[5] For brevity concerns, we do not report the results of the generalized linear mixed model for sanctioning decisions in which we also estimated the fixed effects of choice option and its interactions with the other variables. Note, however, that including these fixed effects did not influence the results of the hypothesized effects of social dilemma type on sanctioning behavior.

[6] Because the order in which participants faced the CRDs and PGDs across the first two blocks was counterbalanced between participants, we also analyzed the between-participants effects of social dilemma type by fitting the mixed models to the cooperation and sanctioning decisions in the first block only. The general picture emerging from these additional analyses is that the social dilemma type effects did not yet emerge in the first block (i.e., between participants), except on cooperation in Experiment 2. When we controlled for block number (i.e., the block number of the respective decision) by including dummy variables (contrast coded) in the mixed models fitted to the cooperation and sanctioning decisions in all three blocks, this did not influence the significance of any of the fixed effects. That is, significant effects remained significant and nonsignificant effects remained nonsignificant. Therefore, we omitted these control variables from the mixed models reported in this article to increase readability.

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