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Abstract: This paper presents the first experimental study on how higher-order punishment affects third-party sanction enforcement in the presence of multiple third parties. The design varies across treatments the number of third parties witnessing a norm violation and the opportunities available for third parties to costly punish each other after observing their peers' enforcement actions. To test generalizability of higher-order enforcement effects, the experiment is conducted across two contrasting societies – India and the United Kingdom – using a prisoner's dilemma game. These societies are selected for their positions at opposite ends of the tight-loose ancestral kinship spectrum. In both societies, third parties punish defectors who exploit their paired cooperators more strongly than any other person, consistent with prior research. However, punitive patterns differ. In the UK, third parties punish defectors less frequently and less strongly when other third parties are present. However, when higher-order punishments are available among third parties, their failure to punish defectors and acts of anti-social punishment invite strong higher-order punishment from their peers, which encourages their pro-social first-order punishments and makes mutual cooperation a Nash equilibrium outcome in the primary cooperation dilemma. However, in India, overall punishment levels are lower, group size and incentive structure changes have no discernible effects, and higher-order punishments are not better disciplined. These findings support a model of norm conformity for the UK and do not contradict such a model for India.

JEL codes: C92, H41, D01, D91

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1. Introduction

How to achieve cooperation in society remains an enduring question in the social sciences. Societal cooperation and self-governance can be achieved without a centralized governing body if the threat of punishment is strong enough (Ostrom, 1990). Informal punishment inflicted by independent parties helped in promoting cooperation and trust before the emergence of states, such as in medieval Iceland and Europe, gold rush California (e.g., Hadfield and Weingast, 2013), and agency relations between Maghribi traders in the eleventh century (e.g., Grief, 1993). More recently, decentralized punishment underpinned trading agreements among nonstate firms in Vietnam at the end of the twentieth century (McMillan and Woodruff, 1999a, b), and substituted for formal institutions during warfare among nomadic societies in East Africa (Mathew and Boyd, 2011). Due to its importance, recent theoretical research has studied how costly (third-party) norm enforcement may sustain cooperative behaviors in societies or organizations (e.g., Acemoglu and Wolitzky, 2020, 2021; Dixit, 2003; Levine and Modica, 2016; Acemoglu and Jackson, 2017). However, there is little empirical work on the *coordination* of decentralized collective punishment – punishment where there is no direct material gain to the norm enforcer – among multiple third parties.

Norm enforcement by uninvolved parties is a second-order public good, typical for a collective action problem (Olson, 1965; Ostrom, 1990). Free-riding problems can arise in third parties' sanctioning behaviors, but the aggregate punishment (i.e., the sum of individual punishments) may be larger when there are more third parties confronted with a norm violation. Thus, efficiency depends on the extent of free-riding relative to the number of third parties. If free riding is harmful or third parties' inclinations to punish per se are weak, to ensure efficient punishment, it may be necessary to establish institutions that assist them in coordinating punitive acts. Existing theory emphasizes people's strong free riding tendencies and the potential role of second-order punishment, i.e., punishment of the failure to commit a pro-social act of sanctioning a defector (e.g., Acemoglu and Wolitzky, 2020, 2021; Axelrod, 1986; Hadfield and Weingast, 2013; Hechter, 1987; Henrich, 2004; Henrich and Boyd, 2001) or punishment for committing an anti-social act of sanctioning a norm cooperator (e.g., Kamei and Putterman, 2015).

The research question asked in this paper is the following: Do third parties change their punishment acts (whether pro-social or anti-social) when there are multiple third parties and how does second-order norm enforcement among third parties affect first-order punishment acts?[1] To the best of the authors' knowledge, no study has previously investigated third parties' free-riding tendencies on first-order when higher-order punishments are possible. Examples where second-order enforcement can discipline or worsen third-party punishment in relation to cooperation norms are ubiquitous, ranging from local

[1] While there is a rich research agenda on higher-order punishment in the context of direct (peer-to-peer) punishment, i.e., norm enforcement by involved parties, there is no prior experimental research on higher-order enforcement among third parties. The prior research on direct punishment suggests that only giving punishment rights to those involved in revenge (e.g., the "Revenge Only" treatment in Denant-Boemont *et al.*, 2007; Nikiforakis, 2008; Hopfensitz and Reuben, 2009) undermines cooperation norms, but higher-order punishment opportunities boost cooperation if the opportunities cover the full set of potential dyads without restricting it to counter-punishment (e.g., Kamei and Putterman, 2015; the "6 Stage Full information" treatment in Denant-Boemont *et al.*, 2007).

economic life to international relations. For example, norm enforcement tends to be executed by uninvolved specialized enforcers in modern societies (e.g., Acemoglu and Wolitzky, 2020). When law enforcers such as police officers, a vigilante group, and the like, witness a transgression, how does their enforcement differ between when they are alone or with their colleagues? Less disciplined enforcement behavior may invite criticism (second-order punishment) by their peers when others are around. As another example, when a firm breaks an implicit cooperative agreement or convention in business, other firms (whether they are in the same industry association or are completely unrelated) may decide not to interact with the firm as a business partner; and failure to do so may result in being ostracized. Online interactions on social media are another example. People may punish or praise uncooperative behavior or transgressions by commenting on news websites such as Yahoo using an anonymous username, but it could firestorm by anonymous unrelated others if the comment violates norms. While the world is full of conflicts in recent years (whether international or civil), a disciplinary incident inside a military group (e.g., regiment) can invite third-party punishment by other friendly troops, maybe backed by higher-order enforcement. Further, mob justice and vigilantism (punishment by many lawless, unrelated third parties) may be intensified by higher-order enforcement. Lastly, turning to international affairs, breach of agreements (e.g., emissions targets to mitigate climate change) may invite sanctions from other unaffected countries; but failure to inflict first-order punishment may disrupt international relations with other third-party countries, for example through diplomatic isolation.

To address the research question in a setting with high internal validity, a novel laboratory experiment was conducted to study higher-order sanction enforcement among uninvolved individuals in anonymous interactions. In the experiment, groups of two players—the PD players hereafter—engaged in a prisoner's dilemma (where defection is the strictly dominant strategy) in the presence of either a single third party or multiple third parties who may punish the PD players' actions at a private cost. The distinctive feature of the design is that it varies across treatments the number of third parties confronted with a norm violation *and* the opportunities available for third parties to punish each other at a cost after observing their peers' norm enforcement acts (i.e., the availability of higher-order norm enforcement). The experiment was designed using a one-shot setup in the format of a strategy method to elicit punishment preferences *without* having any confounding factors such as material motives (e.g., repetition effects or reputation concerns).

As the experiment uses a one-shot setup, standard theory based on self-interested preferences and common knowledge of rationality predicts that no third party is willing to incur a cost to punish a PD player, or to higher-order punish a fellow third party given such sanction enforcement opportunities, in any treatment. Anticipating no punishments by third parties, the PD players would defect.

However, inequality-averse preferences (Fehr and Schmidt, 1999) and preferences for norm conformity (e.g., Akerlof, 1997; Bernheim, 1994) predict punishment by third parties. First, the inequality-averse preference model assumes that actors are concerned about income inequality with others. This model predicts that, regardless of the number of third parties per group, third parties inflict stronger punishment on a defector who exploits a cooperator than on any other in the prisoner's dilemma game, as doing so reduces inequality between themselves and their PD players. It also predicts that the pro-social punishment is weaker per third party when there are multiple third parties in the group, as they can share the punishment cost in equalizing payoffs (i.e., the negative group size effect). This model does not predict any higher-order punishments among third parties, because doing so worsens inequality among third parties. Therefore, the predicted negative group size effect is *unaffected* by higher-order punishment opportunities.

Second, the theory of norm conformity assumes that actors are concerned about following prevailing norms. The model is formulated under the assumption that third parties intend to minimize the behavioral distance between themselves and the other third parties. This model again predicts third parties' stronger punishment of a defector who exploits a cooperator relative to any other in all treatments. However, unlike the inequality-averse preference model, the norm conformity model predicts that the negative group size effect occurs only when higher-order punishments are *not* available. This is because, as discussed earlier, the failure to sanction a defector and the imposition of unjustified sanctions invoke normative considerations according to prior empirical findings. This norm will in turn encourage pro-social first-order punishments. The present experiment can address which theory better explains behavior by examining the frequency of particular forms of higher-order punishments, and its effects on first-order punishments. To foreshadow results, subjects' behavior is more consistent with the theory of norm conformity than social preferences.

Prior research by social scientists has found that human altruistic tendencies differ markedly across societies and reflect the emergence of variable norms and institutions over time (e.g., Herrmann *et al.*, 2008; Henrich *et al.*, 2006; Marlowe *et al.*, 2008; Henrich *et al.*, 2010). Recent research has further revealed systematic variation in the perceived restrictiveness ("tightness") of social norms in different societies (e.g., Gelfand *et al.*, 2011; Harrington and Gelfand, 2014).[2] To test the generalizability of the research findings, this experiment selects two societies that differ according to their ancestral kinship tightness (Enke, 2019): the United Kingdom (UK), a country with relatively loose ancestral kinship ties, and India, a country with relatively tight ancestral kinship ties. The evidence suggests that differences in the historical tightness of kin-based institutions across countries persist (Schulz *et al.*, 2019). More recently, Enke (2019) linked cross-cultural data sets and information in the Ethnographic Atlas to argue that contemporary societies with loose ancestral kinship ties may display a greater willingness to engage in third-party punishment than those societies with historically tight kinship ties. Similarly, the literature in economic growth suggests that the extent to which people in pre-industrial societies were embedded in extended and interconnected family networks is positively related to societal patterns of cooperation and trust for in-groups, and inversely related to the willingness of people to engage in productive economic interactions with strangers (Alesina and Giuliano, 2013). According to the theory of norm conformity, higher-order punishment may not effectively discipline third-party punishment in India, unlike in the UK, because the prevailing punitive norms are weaker in the former. Therefore, it is crucial to consider the

[2] In his book, "The WEIRDest People in the World," Henrich (2020) discussed the evolutionary approaches to explaining this variation, such as the kin-based morality versus universalist morality theme. See also Sharma and Siddique (forthcoming) for cross-country differences for social, risk, time, and several other preferences.

role of culture in order to test the effects of higher-order norm enforcement in social dilemmas and robustness of the research findings in different societies.

The experimental results reveal that in both societies, third parties punish a defector who exploits his/her paired cooperator significantly more frequently and more strongly than any other person in the prisoner's dilemma in all treatments. Such strong punishments of defectors are correctly anticipated by people in both societies.

Two cross-societal differences are detected. First, in the UK, a third party tends to punish a defector significantly *less* frequently and *less* strongly when there are multiple third parties in the group. However, this negative group size effect is sufficiently mild that the sum of punishments is *larger* when multiple third parties confront the defector. In contrast, such negative group size effects are absent in India.

Second, higher-order enforcement is more effective in the UK than in India. Specifically, consistent with the theory of norm conformity, a third party's failure to punish a defector and the commission of anti-social punishment both invite strong higher-order punishments from peers in the UK. However, in India, only higher-order punishment of a third party's failure to punish a defector stands out. As a result, the presence of multiple third parties and the availability of higher-order punishment helps enforce cooperation norms more strongly in the UK than in India, as evidenced by incentive changes for PD players. In the UK, the material incentive that PD players face when aggregate punishment is accounted for (i.e., the payoff from their prisoner's dilemma game interaction minus their expected loss due to third-party punishment) is akin to a "stag-hunt" game in which mutual cooperation is a payoff dominant Nash Equilibrium outcome. That is, first-order punishments deprive a defector from obtaining a gain.

The same calculation reveals that, in India, even when both third-party punishment and higher-order punishment are available, defection remains the strictly dominant strategy for the PD player in the game. Notably, both the absence of a negative group size effect—due to weak inclinations to punish—and the less disciplined higher-order punishment in India are not inconsistent with the theory of norm conformity. As discussed earlier, recent research such as Enke (2019) suggests that punitive norms differ between the UK and India. The behavioral patterns detected for India may thus emerge from adherence to weaker third parties' punishment norms, although we lack affirmative evidence to support this conjecture. In sum, the behavioral patterns detected are roughly in line with the theory of norm conformity.

The findings of this study advance our understanding of the conditions under which decentralized collective punishment is likely to be effective at promoting cooperative behaviors when there is no direct material gain to the enforcer and provide useful policy implications. In a society with loose ancestral kinship ties such as the UK, while a negative group size effect on punishment may arise among third parties, it remains possible to effectively enforce cooperation norms in the aggregate. Norm enforcement may be strengthened by having appropriate higher-order institutions in place to discipline punitive norms among third parties.[3]

[3] While in the experiment the higher-order institution was implemented as a costly punishment action, in practice the higher-order institution may also constitute social rewards. Under this interpretation, the threat of second-order peer punishment – or the anticipation of peer rewards – may improve social norm enforcement in large groups.

The cross-societal component of this study, however, suggests caution in generalizing about collective action tendencies and the welfare implications of policies across diverse populations. Although punishment is a second-order public good, the results presented here suggest that in a society with relatively tight ancestral kinship ties, introducing multiple third parties may *strengthen* punitive norms because aggregate punishment may then become larger. In such cases, introducing a mechanism to allow for multiple independent third parties to be involved – for example, through improving the design of public space by increasing visibility – may improve cooperative behavior. Nevertheless, as the presence of multiple third parties does not fundamentally alter the underlying incentive structure, an additional mechanism, say coercive power of the state to deter defection, may be desired. This finding has broader implications for the study of cooperation, sanction enforcement, and social norms in that the effects of culture and historical backgrounds must be considered in designing policies to promote pro-social norms.

A central challenge for policymakers and researchers is to design institutions that can successfully coordinate the actions of diverse actors to enforce cooperative behaviors (Ostrom, 2010). Previous experimental work in the public goods literature has considered the coordination of direct punishment by *involved* individuals to improve cooperation and deter anti-social punishment. A coordination mechanism that has been found effective in repeated interactions is a democratic commitment to a punishment rule (e.g., Ertan *et al.*, 2009; Kosfeld *et al.*, 2009; Sutter *et al.*, 2010; Dal Bó *et al.*, 2010; Putterman *et al.*, 2011; Andreoni and Gee, 2012; Markussen *et al.*, 2014, Kamei *et al.*, 2015; Ambrus and Greiner, 2019; Nicklisch *et al.*, 2016; Fehr and Williams, 2018). However, voting institutions may be less effective in coordinating punishment to sustain cooperation when there are heterogeneous actors (Noussair and Tan, 2011) or in one-shot settings (see Van Miltenburg *et al.*, 2014). Moreover, in reality, while uninvolved or involved individuals may delegate sanctioning power to formal institutions and officials, they are typically subject to indirect democratic control. In such environments, people may have to rely on decentralized enforcement, because they may suffer from a second-order public goods problem if the state is corrupt as argued by Kamei *et al.* (2023, 2024). Further, democratic institutions themselves may not be available for coordination among *uninvolved* parties. The present study is the first to study an alternative higher-order punishment mechanism to coordinate decentralized collective punishment among multiple uninvolved individuals in anonymous one-shot interactions, such as those encountered online, where alternative sanctioning mechanisms may not be feasible to implement and where there is no fear of retaliation (e.g., because anonymity precludes reputation building). The experiment data demonstrate that such a coordination mechanism can be effective in certain contexts, without relying on formal institutions.

The rest of the paper proceeds as follows: Section 2 briefly explains the related literature, and Section 3 summarizes the experimental design and implementation. Section 4 formulates hypotheses based on theoretical analyses and related literature. Section 5 reports the experimental results in the United Kingdom. Section 6 summarizes the results in India, and then discusses the cross-societal differences observed and possible mechanisms behind them. Section 7 concludes.

Nevertheless, caution is needed because peer rewards tend to have a weaker effect than peer punishments (e.g., Sefton *et al.*, 2007)

2. Related Literature

This study speaks to and builds upon two branches of the literature: (a) third-party enforcement of social norms, and (b) direct (peer-to-peer) punishment.

Third-party Enforcement of Social Norms. Most research uses a prisoner's dilemma game to examine norm enforcement. In their seminal study, Fehr and Fischbacher (2004) found that third parties are willing to incur a private cost to punish a defector who exploited a cooperator. Several subsequent experiments confirmed the robustness of third-party punishment tendencies by varying the experimental environment. First, third-party punishment tendencies have been observed to be stronger for in-group rather than out-group settings (e.g., Bernhard *et al.*, 2006; Lieberman and Linke, 2007) and when acts are observable rather than anonymous (e.g., Kurzban *et al.*, 2007; Kamei, 2018). Second, while Fehr and Fischbacher (2004) demonstrated that third-party punishment is driven by outcome-based preferences, such as inequity aversion (Fehr and Schmidt, 1999), it is also driven by emotions such as anger (Nelissen and Zeelenberg, 2009). Third, the tendency for others to take costly action to enforce cooperation norms is also widespread among children (e.g., Lergetporer *et al.*, 2014; McAuliffe *et al.*, 2015). Fourth, a third party inflicts stronger punishment on a free rider when s/he is democratically elected than otherwise (e.g., Marcin *et al.*, 2019). Fifth, while third-party punishment is ubiquitous, its tendencies differ by society (e.g., Henrich *et al.*, 2006; Marlowe *et al.*, 2008; Henrich *et al.*, 2010). Sixth, two recent papers, Martin *et al.* (2019) and Krügel and Maaser (2020), examined how the punishment decision of a third party is judged and is punished by an uninvolved bystander ("fourth party"), both finding that failure to punish the respective norm violation is punished by a fourth party. The research setup of the present study differs markedly from these two papers as their setups still consider the case where only one third party encounters a norm violation. In contrast, this study has multiple third parties witness a norm violation.

All experiments on third-party punishment except Kamei (2020) were conducted with a single third-party. In contrast, Kamei (2020) studied third-party punishment when multiple third parties are faced with a norm violation using a small-scale experiment with a within-subject design. Third-party punishment was still observed in such environments. The present experiment is the first to explore *higher-order* punishment *among third parties*, such that higher-order punishment acts *are also subject to free riding*.

Direct (Peer-to-peer) Punishment. Although higher-order enforcement among third parties is understudied, higher-order punishment has been examined in the context of direct (peer-to-peer) punishment. A typical experimental design in this area adopts a repeated public goods game setup that includes additional punishment opportunities among peers immediately after a direct punishment stage (Fehr and Gächter, 2000, 2002). Higher-order punishment has two opposing effects. On the one hand, human motives for revenge may lead to counter-punishment, thereby worsening group atmospheres and cooperation norms (e.g., Denant-Boemont *et al.*, 2007; Nikiforakis, 2008; Bolle *et al.*, 2014; Nikiforakis and Engelmann, 2011). On the other hand, higher-order punishment acts that support cooperation norms, i.e., punishment of those who failed to punish a norm violation, and punishment of those who committed "mis-directed" punishment (e.g., punishing a cooperator), or the mere visibility of punishment acts, may help discipline punishment activities and promote cooperation norms (e.g., Denant-Boèmont *et al.*, 2007;

Kamei and Putterman, 2015; Fu *et al.*, 2017). Revenge is not applicable to the context of higher-order punishment among third parties, as the third parties are not the victims of a norm violation in the primary cooperation problem. Higher-order punishment acts that support cooperation norms, however, remain relevant if the punitive phenomenon is driven by other regarding preferences (for a survey see, e.g., Fehr and Schmidt, 2006; Sobel, 2005), or an intrinsic preference for norm compliance (e.g., Michaeli and Spiro, 2015). Thus, similar positive effects of sanction enforcement may emerge in the context of third-party punishment when higher-order punishment is allowed.

3. Experimental Design and Implementation

The experiment is designed based on a prisoner's dilemma game with third-party punishment (Fehr and Fischbacher, 2004; Kamei, 2020). There are three between-subjects treatments, which vary (i) the number of third parties per group; and (ii) the possibility of higher-order punishment among the third parties. This results in the following three treatments:

1. Baseline: one third party and two PD players;
2. Trio: three third parties and two PD players; and
3. Higher-Order: three third parties and two PD players, with possibility of higher-order punishment among the third parties.

The effects of having multiple third parties on their third-party punishment are hence examined by comparing the Baseline and Trio treatments. The Higher-Order treatment is used to study how higher-order punishment among third parties enforces first-order punishment norms.

At the outset, two subjects in each group are randomly assigned to play the prisoner's dilemma game (PD players); the other subjects in the group (either one or three depending on the treatment) are assigned the role of a third-party player.[4] The experiment begins with a stage in which the PD players decide whether to cooperate (Section 3.1). This stage is the same for all treatments. After that, third parties make their punishment decisions. The punishment stage differs by the treatment (Section 3.2).

3.1. Prisoner's Dilemma Game

In Stage 1, two PD players are endowed with 40 points each, and simultaneously decide whether to send 16 points to one another (Figure 1). The amounts sent are tripled and become the payoff of the recipient. This is the only decision to make for the PD players. This framing of the prisoner's dilemma game is frequently adopted in the research on third-party punishment (e.g., Fehr and Fischbacher, 2004; Kamei, 2020). The PD player who sent (did not send) 16 points is called a "cooperator" ("defector") hereafter. Third-party players have no decision to make in this stage. They are instead asked to submit

[4] In the experiment instructions, the PD players in a group are referred to collectively as Player As (and individually as "Player A1" and "Player A2"), while the third-party player(s) are referred to as Player B(s) (and individually as "Player B1", "Player B2" and "Player B3" in the Trio and Higher-Order treatments).

their belief, in increments of 10 percentage points, about the percentage of cooperators in the groups that they do not belong to.[5]

Figure 1: *Payoff Matrix in the Prisoner's Dilemma Game*

		Player 2	
		Cooperate	Defect
Player 1	Cooperate (Send)	(a) 72, 72	(c) 24, 88
	Defect (Not send)	(b) 88, 24	(d) 40, 40

Once PD players make sending decisions and third-party players submit their beliefs, Stage 2 begins. The PD players' decisions to send remain anonymous throughout.

3.2. Third Parties' Decisions

Third-party players are each endowed with 60 points. In Stage 2, third-party players make punishment decisions using a strategy method. Specifically, they decide how many punishment points to assign to each of their two PD players under each of the four possible scenarios (in the Trio and Higher-Order treatments, three third parties simultaneously and independently make the punishment decisions):[6]

(a) "Mutual cooperation": how many punishment points to impose on a *cooperator* (a PD player who sent 16 points) while the other PD player is also a *cooperator*.

(b) "Betrayal": how many punishment points to impose on a *defector* (a PD player who did not send 16 points) while the other PD player is a *cooperator*.

(c) "Victim": how many punishment points to impose on a *cooperator* while the other PD player is a *defector*.

(d) "Mutual defection": how many punishment points to impose on a *defector* while the other PD player is also a *defector*.

A third-party player can assign up to ten punishment points (in increments of 2s) to a PD player in each scenario. For each punishment point assigned, the punisher needs to pay one point, and the payoff of the recipient (PD player) is reduced by three points. The cost ratio of 1:3 is commonly used in third-party punishment experiments (e.g., Fischbacher and Fehr, 2004; Kamei, 2020). Third parties' punishment decisions in realized scenarios will be applied based on the two PD players' actual sending

[5] They can earn one point if the difference between their guess and the actual percentage is less than or equal to five percentage points. In this belief question, the two PD players' decisions in their own group are excluded from the reference group to avoid hedging.

[6] Third-party punishment decisions are previously found to be robust to using the strategy method (e.g., Jordan *et al.*, 2016). The four questions are randomly ordered on a computer screen that a third-party player sees, to control for the possibility of spill-over effects between scenarios.

decisions in their own group.[7] There are no decisions for PD players to make in Stage 2. They are instead asked to submit their belief about the average number of punishment points assigned by third parties in each of the four scenarios, in the groups they do not belong to (for comparability with the actual decision data, beliefs are elicited about average punishment per third party). The third-party players (PD players) will not be informed of which scenarios are realized (how they are punished) until the decision-making portion of the experiment ends.

Punishment of a PD player in the "betrayal" or "mutual defection" scenario is called "pro-social" while third-party punishment in the "mutual cooperation" or "victim" scenario is called "anti-social".[8]

The decision-making experiment is over after Stage 2 in the Baseline and Trio treatments. In the Higher-Order treatment, there is a further Stage 3 for higher-order punishment among third parties. In Stage 3, each third-party player will be presented with 30 possible outcomes from Stages 1 and 2 in sequence; and they will then decide how to reduce the payoffs of the other two third-party players in their own group (see Appendix A.4 for a screen image of one scenario). The punishment technology is the same as in Stage 2; and they can assign up to ten punishment points to another third party (in increments of 2s). The 30 scenarios include (a) 29 or 28 hypothetical outcomes randomly constructed by the computer for their PD players' decisions in Stage 1 and their other two third parties' punishment decisions in Stage 2 such that the hypothetical outcomes differ from each other and are different from their real outcomes, and (b) one or two real outcomes up to Stage 2. The third parties' Stage 3 punishment decisions in (b) will be applied to determine their final payoffs (see Section 3.3).[9] They will not be informed of which scenario(s) is real until they make decisions in all 30 scenarios. The reason why we ask third parties to answer their punishment decisions in multiple scenarios is to elicit their higher-order punishment data in every possible situation.

The literature on direct punishment (Section 2) assumes that both higher-order punishment of those who failed to punish a norm violation, and of those who committed mis-directed punishment, i.e., punishing a cooperator, aids the establishment of first-order punitive norms that encourage socially optimal PD interactions. Following Kamei and Putterman (2015), punishments of first-order non-

[7] For example, if (cooperate, defect) is the realized outcome, the third-party player's decision in "victim" and "betrayal" will be applied. If (cooperate, cooperate) is realized, his/her punishment decision in "mutual cooperation" will be applied to the two PD players. Note that third parties are not allowed to punish two PD players differently when (cooperate, cooperate) or (defect, defect) is realized.

[8] In the experimental literature on punishment, the anti-social/pro-social classification is usually made by taking the punisher's own contribution into account (e.g., Herrmann *et al.*, 2008). This paper simply defines that punishing any cooperator in a one-shot PD is anti-social and punishing any defector is pro-social without considering a third party's payoff, because the third party is not materially affected by the PD interactions.

[9] There will be one real and 29 randomly constructed scenarios if the Stage 1 outcome is (cooperate, cooperate) or (defect, defect). The real scenario describes by how much each of their two other third-party players punished the cooperator (defector) under "mutual cooperation" ("mutual defection") in Stage 2. In this case, their Stage 3 punishment decisions in the real scenario are applied twice, as they took punitive actions twice toward two PD players in Stage 2. There will be two real and 28 randomly constructed scenarios if the Stage 1 outcome (cooperate, defect). The one real scenario describes how much each of the other third parties punished the defector ("betrayal"), while the other describes how they punished the cooperator ("victim") in Stage 2; in this case, their Stage 3 punishment decisions in each scenario are applied, respectively, to the cooperator and the defector.

punishers of defectors and of first-order punishers of cooperators are called, respectively, the *punishment enforcement for omission* (PEO) and *punishment enforcement for commission* (PEC). In practice, PEO includes higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection." PEC includes higher-order punishment from *i* to *j* when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim." These two forms of higher-order punishment will hereafter be referred to as "cooperation-conducive", as they support cooperation norms in the prisoner's dilemma game.

Considering that anti-social punishment has been shown to undermine cooperation norms in dilemma situations (e.g., Herrmann *et al.*, 2008), the PEC is always socially desirable, helping to reduce the relative frequency of anti-social to pro-social first-order punishment. In contrast, the normative judgement of the PEO depends on the distribution of first-order punishments. The PEO is socially desirable (undesirable) if third-order punishment of a defector is on average low (unreasonably high) in the community.

There are no decisions for PD players to make in Stage 3. To retain high levels of anonymity and to collect the data on prevailing norms, they are instead presented with 30 possible outcomes from Stage 1 and 2 that third-party players in other groups were presented. They are then asked to submit their beliefs regarding how the third-party players will inflict punishment in Stage 3. Four out of 30 scenarios will be randomly selected for payment based on the accuracy of the responses.[10]

3.3. Payoffs

The payoff of a PD player $i \in \{1,2\}$ depends on their Stage 1 outcome and first-order punishments received from their third-party player(s) as follows:

$$\pi_i = \max\{\pi_{1,i} - 3p_i, 0\}, \tag{1}$$

where $\pi_{1,i}$= 72, 88, 24, or 40 (Figure 1), p_i is punishment points received by i, and $p_i = \sum_{j=3}^{n} p_{j\to i}$, where $p_{j\to i}$ is punishment from third-party player $j \in \{3,4,5\}$ to PD player *i* and *n* is the group size, i.e., *n* = 3 for the Baseline treatment and *n* = 5 for the Trio and Higher-Order treatments.

The payoff of third-party player *j* depends on their punishment activities as follows:

$$\pi_j = 60 - \textstyle\sum_i p_{j\to i} \text{ for the Baseline and Trio Treatments; and}$$

$$\pi_j = \max\{60 - \textstyle\sum_i p_{j\to i} - \sum_k pp_{j\to k} - 3\sum_k pp_{k\to j}, 0\} \text{ for the Higher-Order treatment,} \tag{2}$$

where $pp_{j\to k}$ is second-order punishment from third-party player *j* to *k*.

[10] Each scenario asks two beliefs questions as there are two targets for each third-party player. If the difference between belief about average punishment points and the peers' actual punishment points is less than or equal to one point, they will receive one point. As four scenarios are payoff-relevant, they can earn up to eight points.

As shown in Equations (1) and (2), the payoff is set at zero if their payoff is negative due to punishment activities.[11] As explained in Section 3.2, both PD players and third-party players can earn additional points from the questions about beliefs and Raven's progressive matrices (see Section 3.4).

3.4. Other Parts of the Experiment

This study consists of three parts. In Part 1, all subjects take a short intelligence test consisting of 12 questions –see Appendix A.1 for the instructions. The questions are taken from Raven's progressive matrices (see Raven, 2000). A total of 40 seconds is allocated to complete each question. The subjects can earn one point for every correct answer, while they are not penalized for wrong answers. The Raven's score is used to check whether cognitive ability is similar for the subjects in the two research sites; and it is also included as a control variable. Part 2 is the decision-making experiment summarized in Sections 3.1-3.3. Part 3 is a post-experiment questionnaire, which includes a battery of questions from contemporary surveys that measure moral variables –see Appendix A.5.

3.5. Experimentation

3.5.1. Selection of the Two Societies

Social norms on third-party punishment may differ by society. Therefore, to test the generalizability of the experiment findings, two societies (India and the UK, see Figure C.1) were selected based on the observation that differences in the organization of economic activities across societies may have resulted in different moral systems to regulate behavior. Building on ethnographic datasets (Murdock, 1967; Giuliano and Nunn, 2018), Enke (2019) constructed a normalized index of historical kinship tightness (scale from zero to one) and mapped the index to contemporary country-level population distributions. The UK and India are classified as "loose" or "tight" based on this index: the UK (index score of 0.023, ranked 18 out of 216 countries) and India (index score of 0.776, ranked 128). Historical kinship tightness is found to be a strong predictor of variation in contemporary cross-country moral beliefs. Of relevance for this study, people in contemporary societies with loose ancestral kinship ties (index score < 0.25) are predicted to be more willing to engage in third-party punishment relative to direct (peer-to-peer) punishment. We will validate this conjecture for the experiment sample in Section 6.

There were also two practical reasons for selecting these societies in which to implement the experiments: (a) strong English language abilities in India,[12] and (b) access to an established behavioral economics laboratory that ensures high internal validity in each research site.

3.5.2. Implementation

[11] It is commonly set that an experimenter does not take money from a subject even if the subject receives a negative payoff in experiments on decentralized punishment in general —see, e.g., Fehr and Gächter (2000, 2002) for direct punishment, and Fehr and Fischbacher (2004) and Kamei (2020) for third-party punishment. In the experiment, 8 subjects obtained a negative payoff and the payoffs of these subjects were set to zero.

[12] India is the largest member state of the Commonwealth, an association of countries which are connected through their use of the English language and shared democratic values. Maintaining some similarities on these dimensions is desirable to explore the relationship between historical kinship tightness and punitive behaviors.

The experiment sessions were conducted face to face at the Experimental and Behavioural Economics Laboratory, Newcastle University located in Newcastle upon Tyne, in the north-east of England, from December 2021 to June 2022, and at the Behavioural Laboratory, Ashoka University in the city of Sonipat, in the north Indian state of Haryana, from April 2022 to October 2022. Subjects voluntarily registered for and participated in the experiment sessions.[13] No subject participated in more than one session. The experimental procedures were identical at the two research sites. The number of subjects in Newcastle is 254, and that in Sonipat is 262 (see Table 1 for details).[14] Sessions were conducted with the aim to collect around 20 group-level observations for each of the three treatments in each subject pool.

Table 1: *Treatment and Number of Subjects*

Treatment	# of third parties per group	Higher-order punishment	# of subjects	# of groups
A. United Kingdom (Newcastle)				
Baseline	1	No	69	23
Trio	3	No	90	18
Higher-Order	3	Yes	95	19
Total	---	---	254	60
B. India (Sonipat)				
Baseline	1	No	57	19
Trio	3	No	105	21
Higher-Order	3	Yes	100	20
Total	---	---	262	60
Total	---	---	516	120

The two universities are similar in terms of cognitive ability. The average score on the Raven's progressive matrices was 5.34 in Newcastle and 5.17 in Sonipat (the difference is not significant at p = 0.646, two-sided Mann-Whitney test) – see Appendix Figure C.2.[15] Further, gender, academic major, and family income rank are balanced between the two sites (there are no significant differences at the 5% level; for a full summary, see Appendix Table C.1).[16]

[13] Invitations were sent using *hroot* (Bock *et al.*, 2014) in Newcastle, and via campus advertisements in Sonipat.
[14] As this study used the strategy method, subjects (e.g., 20 [60] third-party punishers in the Baseline treatment [Trio and Higher-Order treatments]) are treated as the unit of independent observations, except for a few group-level analyses performed (e.g., test results in Figures 4 and 8). One session of 15 subjects for the Higher-Order treatment in Newcastle experienced a server outage at the end of the 27th scenario in Stage 3. For this reason, data for the final three scenarios and for the post-experiment questionnaire are missing for these subjects.
[15] As a referee highlighted, the presence of the intelligence test may affect the subjects' behavior (e.g., subjects with better scores may form a greater sense of deservedness in the decision-making part of the experiment). To control for such possible effects, the Raven's test score is included as a control in all regression analyses.
[16] The percentage of female subjects in Newcastle and Sonipat was 48.9% and 43.3% respectively (the difference is not significant at p = 0.209, two-sided Fisher exact test). The percentages of economics majors are 30.4% and 29.7% in the two samples, respectively (the difference is not significant at p = 0.922, two-sided Fisher exact test).

The experiment was computerized based on oTree (Chen *et al.*, 2016). At the onset of each part of the study (Part 1, Part 2 and Part 3), subjects were given instructions for that part only; and were given instructions for the next part only after the current part was over.[17] All subjects had to complete a comprehension test correctly to proceed to the decision-making experiment (see Section A.3 of the Appendix). There is no significant difference in the number of failed attempts in the comprehension test between research sites ($p = 0.429$, two-sided Mann-Whitney test). The experiment sessions lasted around 60 minutes on average. The average per-subject payoffs in terms of in-game currency were 59.67 points in Newcastle and 58.74 points in Sonipat. The average per-subject payoffs in local currency were £14.93 pounds sterling in Newcastle and INR 1022 Indian Rupees (approx. £10.20 at the prevailing exchange rate) in Sonipat.[18]

4. Hypotheses

Standard theoretical predictions based on players' self-interest and common knowledge of rationality are straightforward as third-party punishment is costly and non-enforceable. The logic of backward induction can be applied to all the three treatments. First, in the Baseline treatment, a third-party player inflicts no punishment on a PD player in the second (and final) stage as punishment activities cost the punisher. Knowing this, it is privately optimal for the PD player to defect. Second, the prediction of subgame perfect Nash Equilibrium does not change when there are three third parties per group, as again no third parties are willing to incur a cost to punish their PD players. Thus, in the Trio treatment, defection continues to be the strictly dominant strategy for the PD players. Lastly, the possibility of third parties' higher-order punishments does not change anything, as it is costly for a third party to inflict higher-order punishment on another third party. In other words, the Higher-Order treatment is essentially the same as the Trio treatment for self-interested players. In sum, the assumptions of self-interested preferences and common knowledge of rationality predict that third parties neither first-order punish PD players nor higher-order punish their fellow third parties.

As summarized in Section 2, prior experiments have consistently documented that third parties do inflict altruistic punishment, thereby enforcing cooperation norms effectively under certain conditions (e.g., Fehr and Fischbacher, 2004). There are two likely candidate models of fairness that may rationalize

[17] This kind of gradual learning is often used in an experimental design with many components or with complex decisions to avoid cognitive overload (e.g., Ertan *et al.*, 2009; Kamei *et al.*, 2015).

[18] The payment size in each subject pool was decided following the laboratory norm in each research site. The minimum hourly wage in Newcastle was £6.83. The minimum daily wage for skilled labour in the state of Haryana (where Sonipat is located) at the time of experiment was INR 503. (https://storage.hrylabour.gov.in/uploads/labour_laws/Y2022/Oct/W2/D14/1665746988.pdf, last accessed April 2023). Thus, the average per-subject payment is roughly double the minimum hourly (daily) wage in Newcastle (India). While the payment size differs largely for the two locations, it is known that the Indian students at Ashoka tend to be in high income or family wealth percentiles. For example, the tuition fee for 2021-22 academic year, is INR 825,000 (approximately £8,250), and is much higher than most other Indian universities (e.g., the tuition is only INR 15,000 at the University of Delhi). This aspect can mitigate effects (if any) of different payment sizes. Nevertheless, the difference in the wealth levels between the two research locations might generate other effects. Thus, to reduce such effects, we conduct a robustness check by controlling for family income rank in all regression analyses.

third-party punishments in the behavioral literature (for surveys, see Sobel, 2005; Fehr and Schmidt, 2006): intention-based and outcome-based fairness preferences. Between them, intention-based fairness preferences, such as reciprocity (Rabin, 1993; Dufwenberg and Kirchsteiger, 2004), are not well-suited to explaining third-party punishment behaviors as third parties are not involved in the primary cooperation dilemma. In contrast, inequality-averse preferences by Fehr and Schmidt (1999) are known to explain such first-order punishment behaviors effectively (e.g., Fehr and Fischbacher, 2004; Kamei, 2020). To obtain insights for expected behaviors, this section first derives theoretical predictions for our experimental framework using the model by Fehr and Schmidt (1999):[19]

$$U_i(x) = \pi_i - \frac{\alpha_i}{n-1}\sum_{j\neq i}\max\{\pi_j - \pi_i, 0\} - \frac{\beta_i}{n-1}\sum_{j\neq i}\max\{\pi_i - \pi_j, 0\}, \qquad (3)$$

where n is the number of players per group (= 3 or 5), x is the list of the n players' payoffs, α_i indicates player i's aversion to disadvantageous inequality, while β_i indicates player i's aversion to advantageous inequality, satisfying $\beta_i \leq \alpha_i$ and $0 \leq \beta_i < 1$.[20] An analysis focused on symmetric equilibria provides four useful lessons.

First, some PD players will choose to cooperate with their paired PD players, driven by their inequality concern or by the threat of punishment. Second, third parties will inflict punishment on their PD players in the "mutual cooperation," "victim" and "mutual defection" scenarios only under very stringent conditions.[21] On the other hand, in all treatment conditions, third parties are more likely to inflict punishment on a PD player in the "betrayal" scenario if they are sufficiently averse to inequality.[22] Third, punishment of a "betrayal" defector per third-party player is weaker in the Trio and Higher-Order treatments than in the Baseline treatment. This tendency is the so-called "group size effect" (cf. Olson, 1965): the presence of multiple third parties in the group may create incentives among third parties to reduce their punishment acts. Fourth, a comparison between the Trio and Higher-Order treatments suggests that higher-order punishment opportunities do not affect any predicted behaviors in the Trio treatment. Notice that, in any symmetric equilibrium of the Trio treatment, using higher-order punishment

[19] Online Appendix B summarizes the detailed theoretical analyses, in which the four scenarios in the prisoner's dilemma game, "mutual cooperation," "victim," "betrayal," and "mutual defection," are denoted as, respectively, scenarios CC, CD, DC, and DD, for consistency with the mathematical expressions.

[20] Another outcome-based preference model is the one proposed by Bolton and Ockenfels (2000). However, their model does not rationalize punishment of a norm violation as it assumes that an individual's utility depends on his/her relative payoff standing in the group. More specifically, the individual is concerned about obtaining a fair share of the total payoffs ($\sigma_i = \pi_i / \sum_{j=1}^{N} \pi_j$). If the individual wants to change their share σ_i by inflicting punishment, s/he does not care about the target of the punishment.

[21] More precisely, it predicts that a third party never punishes a PD player in the "victim" and "mutual defection" scenario in all three treatments. In contrast, the third party is predicted to punish a PD player in the "mutual cooperation" scenario if and only if $\alpha_i > 2$ in the Baseline treatment, and $\alpha_i/2 + \beta_i > 2$ in the Trio and Higher-Order treatments – see Appendix B. The two conditions, $\alpha_i > 2$ and $\alpha_i/2 + \beta_i > 2$, are restrictive, however. Almost all people do not satisfy the conditions if using the distribution of α_i and β_i calibrated by Fehr and Schmidt (2010).

[22] A third party is predicted to punish a defector in the "betrayal" scenario if $\alpha_i + \beta_i/2 > 1$ in the Baseline treatment, and $\alpha_i/2 + 3\beta_i/4 > 1$ in the Trio and Higher-Order treatments. These conditions are less restrictive than the ones reported in the previous footnote.

opportunities worsens inequality, as higher-order punishment reduces the payoffs of the punisher and the punished at different rates, thereby making a deviation from the no punishment situation unbeneficial.[23]

Hypothesis 1 (Social preferences):

(1a) Some PD players choose to cooperate (i.e., send 16 points to their paired PD players) in the first stage in each treatment.

(1b) Third parties are more likely to punish a defector in "betrayal" than in any other scenario.

(1c) The punishment per third party of a "betrayal" defector is weaker in the Trio and Higher-Order treatments than in the Baseline treatment.

(1d) Third parties do not inflict any higher-order punishment as doing so increases inequality. As a result, cooperation and first-order punishment behaviors are the same for the Trio and Higher-Order treatments.

Hypothesis 1.d is at odds with a substantial literature in theoretical biology and anthropology in which scholars argue the beneficial role of higher-order punishments in overcoming the emergence of free-riding problems in third parties' sanctioning behaviors when there are multiple third-party peers in a group. Existing theoretical work in this area emphasizes that higher-order punishment among third parties can enforce pro-social first-order punitive norms, thereby strengthening cooperation norms. Such higher-order punishment takes the form of punishment of the failure to sanction a defector (e.g., Hadfield and Weingast, 2013; Axelrod, 1986; Henrich, 2004; Henrich and Boyd, 2001) or punishment for commission, i.e., inflicting unjustified sanctions (e.g., Kamei and Putterman, 2015). Axelrod (1986) used the term "meta-norm" to refer to the punishment of non-punishers, and Henrich and Boyd (2001) and Henrich (2004) argue that such punishment activities effectively stabilize cooperation. Higher-order punishment for commission is also crucial to maintain cooperation norms, as anti-social punishment is widespread in society (e.g., Herrmann *et al.*, 2008; Cinyabuguma *et al.*, 2006).[24]

[23] As an anonymous referee highlighted, third parties may be mainly concerned about inequality among themselves. Appendix B.4 considers an alternative reference group for payoff comparisons which includes third parties only (rather than both third parties and PD players as in the main text) when applying the model by Fehr and Schmidt (1999). This extension is relevant for the treatments with more than one third party in the group. For the Trio treatment, no third-party punishment is predicted in any scenario. For the Higher-Order treatment, there exist symmetric equilibria involving higher-order punishment in *all* scenarios if and only if $\alpha_i > 2$; outside of the symmetric equilibria, third parties are more likely to higher-order punish a third party's failure to punish a defector, which is non-cooperation-conducive in Scenarios CC and CD and cooperation-conducive in Scenarios DC and DD.

[24] Unlike Hypothesis 1.d, higher-order punishment behaviors can be predicted, once deviating from the symmetry in behaviors (see Appendix B for the detailed mathematical analyses). However, the social preference model does not always provide a reasonable prediction. On the one hand, driven by inequality concerns, a third party's failure to (first-order) punish a defector invites higher-order punishments from their peers in both "betrayal" and "mutual defection" scenarios. For instance, when first-order punishments of a defector are heterogeneous in the "betrayal" scenario, a third party that punished less (informally, "non-punisher," hereafter) has an advantage in terms of interim payoff levels. Thus, the peers' higher-order punishment of the non-punisher mitigates inequality by decreasing the non-punisher's payoff advantage. In addition, a third party's punishment of a cooperator in the "victim" scenario invites higher-order punishments, because doing so reduces inequality between the cooperator and the third parties. On the other hand, it unreasonably predicts perverse reactions among inequality-averse third parties in the "mutual cooperation" scenario. Specifically, it states that a failure to anti-socially punish a cooperator in the second stage attracts more higher-order punishment from the peers.

These arguments can be supported by an alternative theoretical approach in which people are concerned about conforming to social norms (e.g., Akerlof, 1997; Bernheim, 1994). Prior experiments demonstrated that the norm-based approach can rationalize behavior well in certain contexts (e.g., Michaeli and Spiro, 2015; Kessler and Leider, 2012), and this model can predict higher-order punishment behaviors that strengthen cooperation norms in the Stage 1 prisoner's dilemma game. Specifically, the model assumes that a third-party player wishes to minimize the behavioral distance between him/herself and the other third-party players as they are inclined to follow prevailing norms. That means the norm is taken as given without taking a stance on the underlying drivers. Several reasons have been proposed in the literature, for example, concerns about status (Bernheim, 1994) or self-image concern (Benabou and Tirole, 2006). To outline motivating predictions, it suffices to assume that the disutility from norm violations consists of a common norm function *f(.)*, continuous, twice differentiable, and concave ($f'' < 0$), and an individual norm sensitivity parameter, $\phi_i \in [0, \infty)$. Suppose that $\bar{p}$ is the observed average cost that third parties spend in inflicting costly punishment in a given scenario. An individual third party's utility function is described by:

$$u_i(p) = -p_i - \phi_i f(p_i - \bar{p}), \tag{4}$$

where the player incurs a utility loss when deviating from $\bar{p}$. An example of such a norm function is the quadratic loss function, $f(p_i - \bar{p}) = (p_i - \bar{p})^2$. Then, third party i maximizes his/her utility by choosing p_i to balance his/her punishment cost relative to his/her preference for conformity. A simple calculation suggests that the optimal p_i is *positively correlated with* $\bar{p}$ (the optimal p is calculated as $\bar{p} - \frac{1}{2\phi_i}$ if f is the quadratic loss function). This means that third parties' punishment behavior depends on the prevailing norms in society. Kamei (2014) and Kamei (2020) examined the relationships between, respectively, direct punishment and third-party punishment, and punishers' beliefs. The research found that punishment decisions were strongly correlated with beliefs on how others punish in a given scenario.

Prior research demonstrated that third parties are believed to be more willing to incur a private cost to punish a defector who exploits a cooperator than any other target (e.g., Fehr and Fischbacher, 2004; Kamei, 2020). Thus, the norm-based approach predicts that third parties are more likely to punish a defector in the "betrayal" scenario among the four scenarios (consistent with Hypothesis 1.b). The presence of such punishment norms is ubiquitous, but the magnitude differs substantially by populations (e.g., Henrich *et al.*, 2006; Henrich *et al.*, 2010). This approach also predicts a negative group size effect in the Trio treatment, because it has been found that having fellow punishers weakens first-order punitive norms per third party (Kamei, 2020).

Unlike the social preference model, the norm-based model can also predict higher-order punishments among third parties, because the failure to sanction a defector (e.g., Hadfield and Weingast, 2013; Axelrod, 1986; Henrich, 2004; Henrich and Boyd, 2001) and the imposition of unjustified sanctions (e.g., Kamei and Putterman, 2015) invoke normative considerations according to prior empirical findings in anthropology, theoretical biology, and economics. The model then explains that a third party incurs a conformity cost when failing to inflict higher-order punishments that support Stage 1 cooperation norms.

Notice that the active higher-order punishments provide a third party with additional costs when breaking the *first-order* punitive norms. Hence, by backward induction, stronger pro-social first-order punishment may emerge in the Higher-Order treatment than in the Trio treatment.

These discussions can be summarized as Hypotheses 2a to 2d below. Notice that cooperation norms in the prisoner's dilemma game are determined by aggregate punishment (i.e., total third-party punishment activities per group). Whether aggregate punishment is stronger when the number of third parties is three rather than one is ambiguous. It depends on people's preferences. For example, to what degree punishment per third party is smaller in the Trio than in the Baseline treatment depends on the utility functions of third parties. Hence, it is not possible to formulate a hypothesis on aggregate punishment between the setups with one third party and three third parties. This means that the cooperation rate in the prisoner's dilemma game can go in either direction; and a definite prediction is also not possible here, as summarized in Hypothesis 2.e.

Lastly, the present experiment is conducted in two countries, India (historically tight ancestral kinship ties) and the UK (loose ancestral kinship ties). According to recent research such as Enke (2019), third-party punishment norms in contemporary societies are stronger with loose than with tight ancestral kinship ties. This means that in India, a third party incurs a loss according to Equation (4) if s/he is engaged in punishment activities strongly unlike the prevailing norm. Thus, subjects in the UK are expected to display a greater willingness to engage in pro-social first-order and cooperation-conducive higher-order third-party punishment acts relative to subjects in India, as summarized in Hypothesis 2.f. This implies that there is less space for the treatment differences in the third parties' punishment pattern summarized in Hypothesis 2.b to be detected in India, as the third-party punishment tendencies per se are weak in the Baseline treatment.

These discussions can be summarized as Hypothesis 2 below:

Hypothesis 2 (Preferences for norm conformity and arguments in theoretical biology and anthropology):

(2a) Third parties are more likely to punish a defector in "betrayal" than in any other scenario.

(2b) The punishment per third party of a "betrayal" defector is weaker in the Trio than in the Baseline treatment. However, it is stronger in the Higher-Order than in the Trio treatment.

(2c) A third party's failure to punish a defector invites higher-order punishment from fellow third parties.

(2d) A third party's punishment of a cooperator invites higher-order punishment from the peers.

(2e) Whether the cooperation rate in the prisoner's dilemma game is higher when the number of third parties is three rather than one is ambiguous. A definite prediction is not possible here.

(2f) Subjects in the UK (the loose kinship society) display a greater willingness to engage in pro-social [first-order] and cooperation-conducive [higher-order] third-party punishment acts relative to subjects in India (the tight kinship society). Anticipating these punitive norms, PD players in the UK exhibit a higher inclination to cooperate than those in India.

This experiment elicits descriptive norms from the subjects (see Section 3). The belief data will be used to investigate how their punishment behavior (frequency and strength) is correlated with their prevailing norms.

5. Punishment Patterns in the UK

This section is devoted to testing hypotheses using the experimental data in the UK (Newcastle). A large number of prior experiments on third-party punishment, such as Fehr and Fischbacher (2004) and Kamei (2020), have been conducted in countries with relatively loose historical kinship ties. A comparison of the results in the UK against these studies allows for a cleaner test of the impact of higher-order punishment on behavior.

5.1. First-Order Punishment

Consistent with the prediction from social preferences and preferences for norm conformity, many PD players selected cooperation.[25] The average cooperation rates are more than 60% in all three treatments (i.e., 67.4%, 80.6% and 63.2% in the Baseline, Trio and Higher-Order treatment, respectively). Two-sided z tests find that the average cooperation rates are not significantly different among any two treatments (see Appendix Table C.8). Notice that it is unsurprising to see that having multiple third parties failed to significantly increase cooperation, since the effects of multiple third parties on cooperation norms are ambiguous, as summarized in Hypothesis 2.e.

The focus of the present study is on third parties' punishment tendencies. Both social preferences and preferences for norm conformity predict that third parties are more likely to first-order punish a defector in the "betrayal" scenario than in any other scenario (Hypothesis 1.b, Hypothesis 2.a). This hypothesis is clearly supported in all three treatments, whether punishment frequencies or per-third-party punishment strength are used for testing (Panel A of Figure 2).[26,27] It is worth emphasizing here that punishment of a defector is significantly more frequent and stronger in "betrayal" than in "mutual defection." This suggests that the context matters for their decision to third-party punish. Hence, in line with prior research (e.g., Fehr and Fischbacher, 2004; Kamei, 2020), a model from self-interested preferences predicts behavior poorly in our environment.

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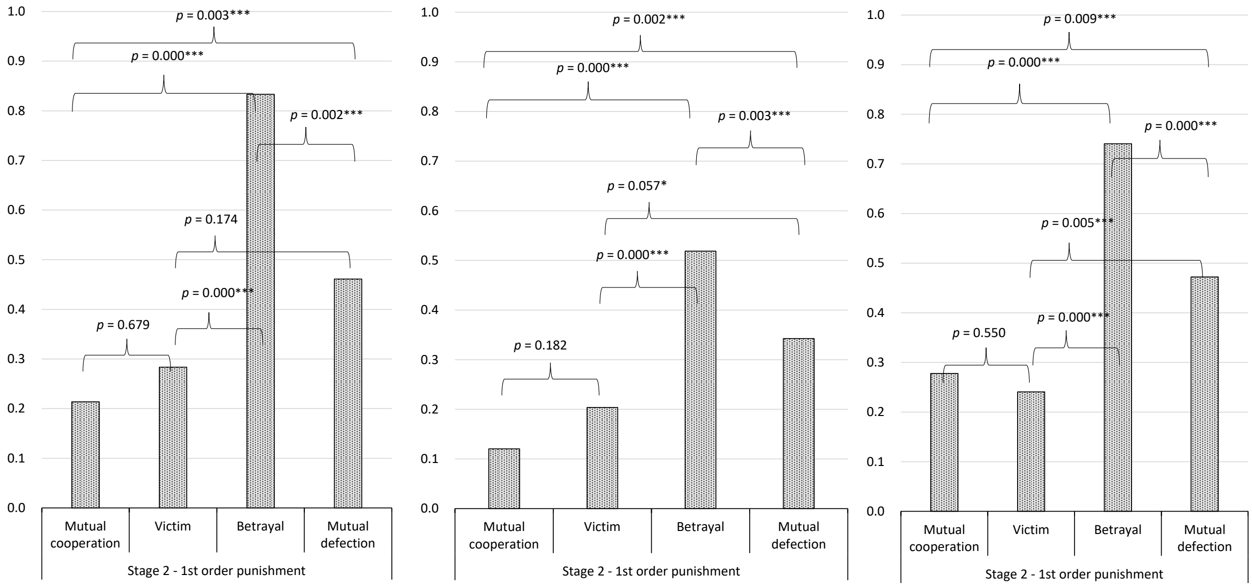
[25] The null hypothesis of no cooperation is rejected at two-sided $p < 0.001$ according to a two-sided z test based on the marginal effects from a Probit regression with no constant in each subject pool.

[26] See Appendix Tables C.2 and C.3 for the detailed regression tables. As almost 30% of the sample were enrolled in economics (footnote 16), we conducted the same regressions excluding those whose majors are not economics or business and management (see Appendix Tables C.4 to C.7). The stronger punishment of a defector (especially in "betrayal") rather than a cooperator is robust and significant in almost all comparisons despite a reduced sample size.

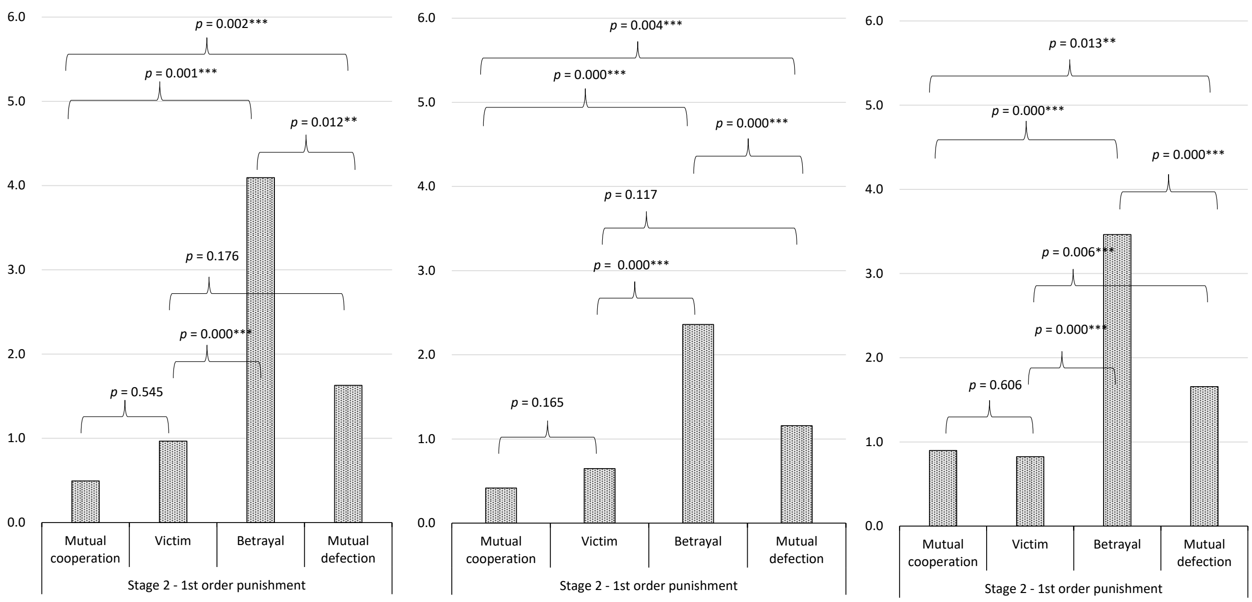
[27] One may wonder whether third parties inflicted punishments to equalize the payoffs of PD players when (cooperate, defect) was realized. A detailed calculation revealed that punishment activities were weak enough that the payoffs of the defectors remained on average much larger than the betrayed cooperator—see Appendix Table C.28 for the detail. This supports our finding below that the model of norm conformity can better rationalize the data than the model of social preferences.

Figure 2: *First-Order Punishment Decisions and Beliefs in the UK*



(i) Baseline treatment (ii) Trio treatment (iii) Higher-Order treatment

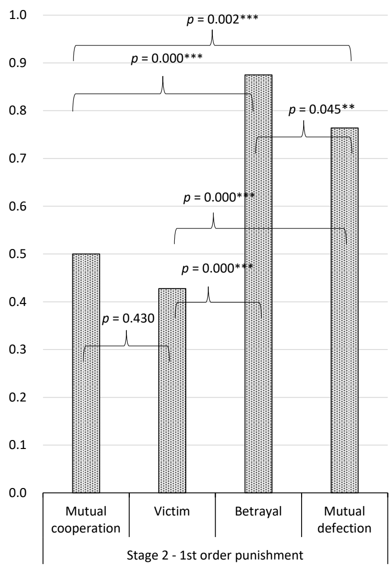
(A1) Punishment Frequency



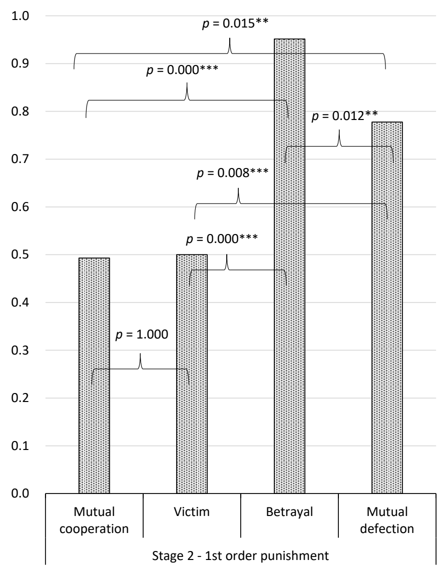
(i) Baseline treatment (ii) Trio treatment (iii) Higher-Order treatment

(A2) Avg. Per-third-party Punishment Points Given

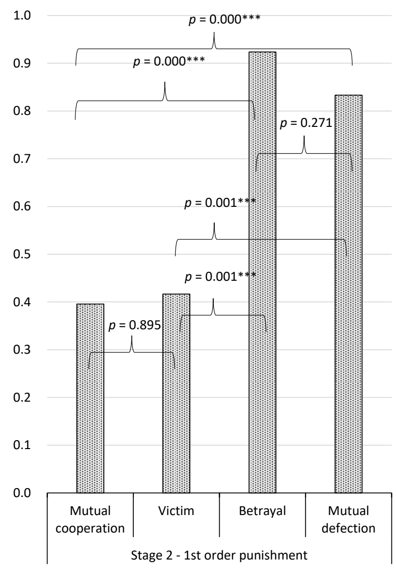
A. Actual Decisions



(i) Baseline treatment

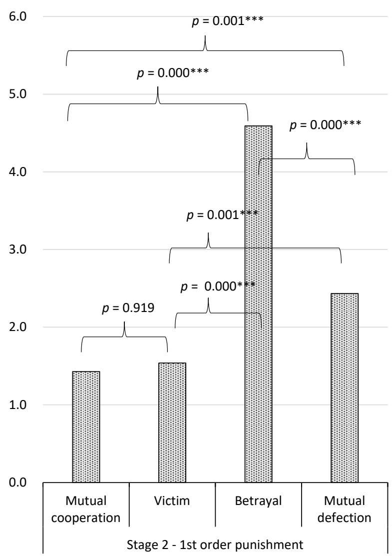


(ii) Trio treatment

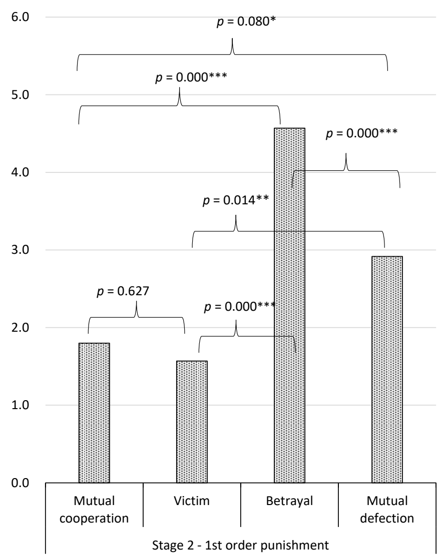


(iii) Higher-Order treatment

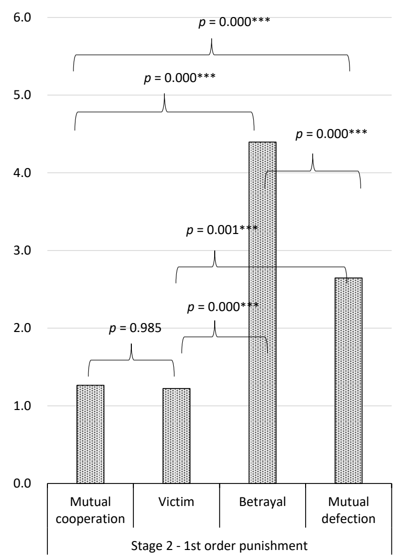
(B1) Punishment Frequency



(i) Baseline treatment



(ii) Trio treatment



(iii) Higher-Order treatment

(B2) Avg. Per-third-party Punishment Points Given

B. Beliefs

Notes: Average values in the figures are constructed based on session averages. *p*-values (two-sided) are based on regression results (Probit regressions for punishment frequency, and Tobit regressions for punishment points given); robust standard errors are clustered at the subject level – see Appendix Tables C.2 and C.3 for the detailed regression tables. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

As explained in Section 3, PD players submitted their beliefs about third parties' punishment behaviors in the second stage. This data provides a measure of empirical expectations about first-order punishment norms in the experiment. Panel B of Figure 2 summarizes the average beliefs about first-order third-party punishment. While per-third-party punishment anticipated is stronger than the actual decision in general, qualitatively similar tendencies hold for beliefs as for decisions: PD players believe that third parties inflict punishment in "betrayal" more frequently and more strongly than in any other scenario. It follows that observed third-party punishments roughly reflect equilibrium behaviors in the game.

The two theories suggest different predictions on group size effects. The model of social preferences predicts weaker first-order third-party punishment in both the Trio and Higher-Order treatments than in the Baseline treatment (Hypothesis 1.c). Notably, the first-order punishment behaviors are predicted to be the same for the Trio and Higher-Order treatments (Hypothesis 1.d). However, the model of norm conformity predicts that while third-party punishment is weaker in the Trio than in the Baseline treatment, it is stronger in the Higher-Order than in the Trio treatment.

The experiment results in the UK are consistent with the prediction from the model of norm conformity. Figure 3 summarizes the differences in per-third-party punishment between the Baseline treatment and, respectively the Trio and Higher-Order treatments.

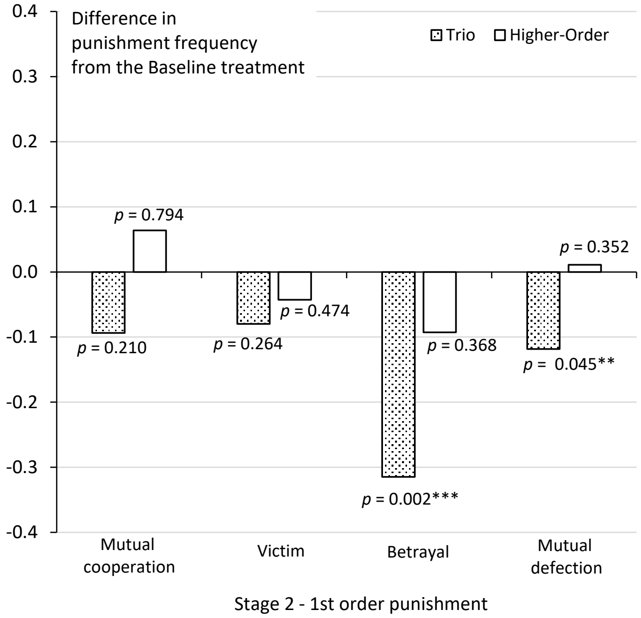
First, a strong group size effect was detected in the Trio treatment. The punishment frequency and the per-third-party punishment strength in the "betrayal" scenario are both significantly lower in the Trio than in the Baseline treatment (Panel A of Figure 3). Weakening punishment does not necessarily imply a welfare loss, as will be discussed below. Second, higher-order punishment opportunities mitigate the negative group size effect. Specifically, third-party players inflict punishment more strongly in the Higher-Order than in the Trio treatment; and the frequency of first-order punishment in the Higher-Order treatment is statistically indistinguishable from the Baseline treatment based on a two-sided z test (p = 0.368 > 0.100; Panel A.i of Figure 3).

Similarly, per-third-party first-order punishment strength in the Higher-Order treatment is not significantly different from that in the Baseline treatment (p = 0.430 > 0.100; Panel A.ii of Figure 3).[28] As there are three third parties per group in the Higher-Order treatment, this implies that a PD player will receive more punishment in the Higher-Order than in the Baseline treatment.

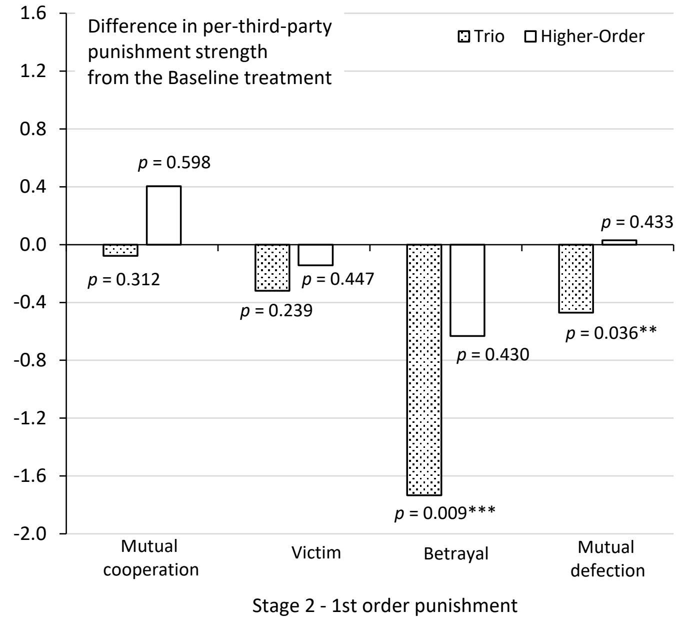
The observed third parties' tendencies to punish less in the presence of fellow third parties are somewhat at odds with the prevailing norms. As shown in Panel B of Figure 3, the beliefs about first-order punishment frequencies and strengths per third party show no significant differences among the three treatments; that is, the negative group size effect found in the decision data for per third party punishment appears to be absent for beliefs about per-third-party punishment.

[28] Both the negative group size effect in the Trio treatment and the positive effect of higher-order punishment in the Higher-Order treatment are robust even if the same analysis is performed using those whose majors are not economics or business and management – see Appendix Tables C.9 and C.10.

Figure 3: *Group Size Effects on (First-Order) Third-Party Punishment in the UK*

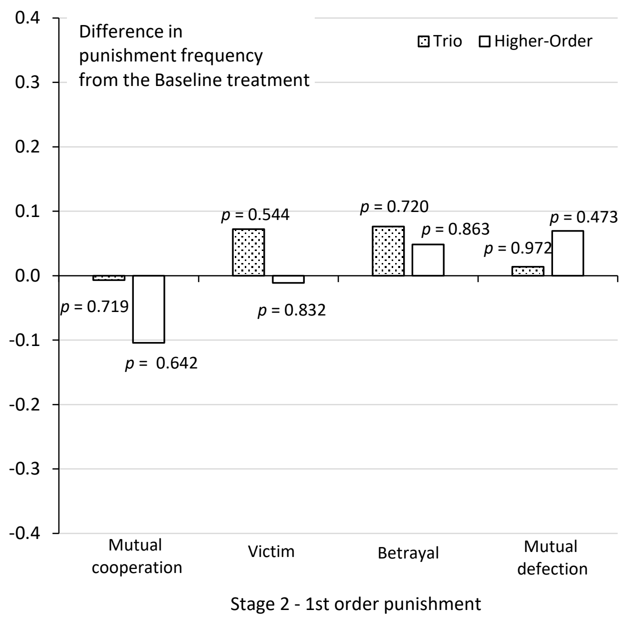


(i) Punishment frequency

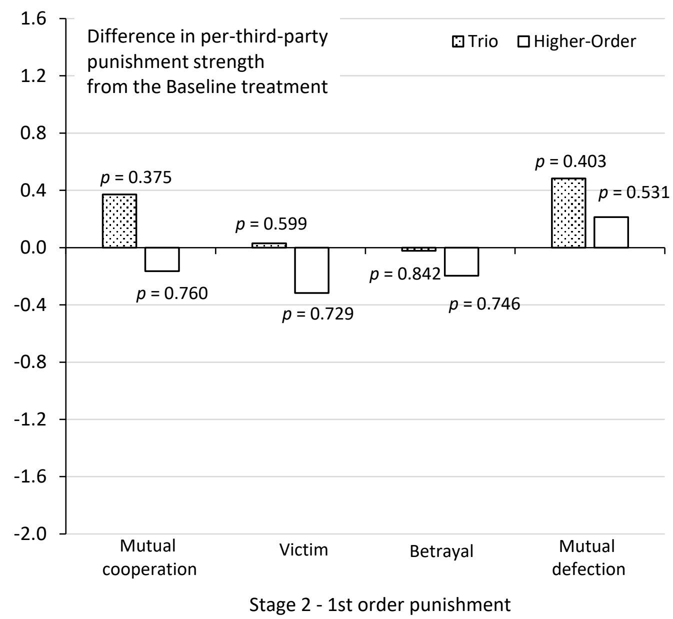


(ii) Avg. per-third-party punishment points given

A. Actual Decisions



(i) Punishment frequency



(ii) Avg. per-third-party punishment points given

B. Belief

Notes: Average values in the figures are constructed based on session averages. p-values (two-sided) are based on regression results (Probit regressions for punishment frequency, and Tobit regressions for punishment points given); robust standard errors are clustered at the subject level – see Appendix Tables C.8 and C.24 for the detail. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Result 1 (Third-party punishment in the UK)**:**

(i) *Third parties' first-order punishment is significantly more frequent and is stronger in "betrayal" than in any other scenario in all three treatments. This is consistent with both Hypothesis 1.b (social preferences) and Hypothesis 2.a (norm conformity).*

(ii) *The punishment per third party in "betrayal" is significantly less frequent and weaker in the Trio than in the Baseline treatment.*

(iii) *Neither per third party punishment frequency nor strength are significantly different between the Higher-Order and Baseline treatments. This is consistent with Hypothesis 2.b (norm conformity), not Hypothesis 1.c (social preferences).*

It was noted above that subjects' beliefs about first-order punishment per third party are somewhat larger than the actual punishment decisions observed in the experiment (Figure 2) and that there is a discrepancy between prevailing beliefs and third parties' behaviors for the group size effect (Figure 3). These behavioral patterns are nevertheless consistent with the results of previous studies: people tend to punish conditionally upon their peers' punitive actions, but somewhat less than the peers' punishment amounts (e.g., Kamei, 2014; Kamei, 2020). The imperfect conditionality may be due to a strategic consideration that third parties have in the Trio and Higher-Order treatments where multiple third parties are present per group. For example, even if a person wants a defector to be punished, the person does not need to incur a punishment cost if his/her peers, instead of the person, inflict third-party punishment on the defector. This may provide material incentives to reduce altruistic punishment among third parties. This strategic consideration is not present in the Baseline treatment.

Observed punishment frequencies and strengths as percentages of the beliefs formed by the PD players ("punishment-belief ratio" hereafter) were calculated to study third parties' inclinations to punish in the Baseline treatment, and their tendency to reduce punitive actions when fellow third parties are present in the Trio and Higher-Order treatments. This ratio is the slope of a subject's conditional punishment preference in relation to the prevailing belief. Table 2 summarizes the calculations.

From the table it is apparent that the punishment-belief ratios are consistently less than one, as anticipated, and in most cases, far below one.[29] Three interesting patterns emerge. First, in the Baseline treatment, third parties punish a defector in "betrayal" very frequently, close to the prevailing beliefs (e.g., the ratio in this case is 95.2%, the closest to 100% among all possible cases – see Part A of Table 2). The punishment-belief ratio for punishment strength in the Baseline "betrayal" is also high at 89.2% (Part B of Table 2). The punishment-belief ratios in the Baseline treatment can be thought of as reflecting subjects' conditional (upon beliefs) preferences, without considering the effects of multiple third parties. This underscores humans' strong non-material motives to punish a defector who exploits a cooperator. Second, the punishment-belief ratio in "betrayal" is significantly lower than 100% in the Trio treatment (only

[29] Unlike third-party punishment, imperfect conditionality on prevailing beliefs was not detected for cooperation in this study. PD players in both societies cooperated more frequently than the third parties' expectation. Specifically, the averaged realized (believed) cooperation rates were 67.4% (59.3%), 80.6% (63.1%), and 63.2% (59.4%) under the Baseline, Trio and Higher-Order treatments, respectively.

54.5%), as was the case for the other three scenarios. The ratio is also always markedly lower than 100% for the case of punishment strength. Third, however, the presence of fellow third parties encourages third-party punishment in the Higher-Order treatment. In this treatment, third parties inflict punishment relatively often in "betrayal," and the frequency (80.2%) is not significantly different from the prevailing belief. The latter two patterns are consistent with Results 1(ii) and 1(iii).

Table 2: *First-order Punishment as a Percentage of Belief in the UK*

	A. Punishment Frequency				**B. Avg Per-Third-Party Punishment Points Given**			
Treatment	mutual coop.	victim	betrayal	mutual defect.	mutual coop.	victim	betrayal	mutual defect.
(a) Baseline	42.8%	66.2%	95.2%	60.4%	34.6%	62.8%	89.2%	66.9%
(b) Trio	24.4%	40.7%	54.5%	44.0%	23.2%	41.3%	51.7%	39.7%
(c) Higher-Order	70.2%	57.8%	80.2%	56.7%	71.1%	67.4%	78.8%	62.6%
[two-sided *p*-values for one-sample Wilcoxon signed ranks tests using group-level data:]								
H_0: (a) = 100%	0.005**	0.052*	0.414	0.020**	0.015**	0.068*	0.088*	0.106
H_0: (b) = 100%	0.001***	0.008***	0.000***	0.006***	0.001***	0.010**	0.006***	0.008***
H_0: (c) = 100%	0.003***	0.051*	0.155	0.044**	0.018**	0.137	0.077*	0.124

Notes: For each treatment / scenario, the percentage values in the upper panel are constructed as the average actual per third party punishment frequency or strength among the third parties, divided by the average belief about per third party punishment frequency or strength among the PD players, multiplied by 100. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

What are the welfare consequences of having multiple third parties confront a norm violation? This question can be examined by studying how third-party punishment changes the incentive structure in the primary cooperation dilemma. Figure 4 reports the payoff matrices when reductions due to punishment are subtracted from the PD players' payoffs. The presence of multiple third parties per norm violation clearly enhances social welfare, regardless of higher-order punishment being available among third parties. The difficulty to enforce cooperation norms in a prisoner's dilemma can be measured by the normalized payoff values related to "fear" and "greed." Fear refers to the loss in payoffs from choosing to cooperate if the other player defects, i.e., the mutual-defection payoff minus the minimum payoff (the payoff of a cooperator when s/he is exploited). Greed refers to the gain in payoffs from choosing to defect if the other player cooperates, i.e., the maximum payoff (the payoff of a defector when s/he exploits a cooperator) minus the mutual-cooperation payoff. Rapoport and Chammah (1965) and Ahn *et al.* (2001) propose to normalize fear and greed by dividing each value by the payoff difference between the minimum and maximum payoff in the stage game.[30]

[30] They further define the "cooperation gain" as the payoff difference between the mutual-cooperation and mutual-defection outcomes. Because (normalized fear) + (normalized greed) + (normalized cooperation gain) = 1, the authors argue that the larger normalized fear and/or normalized greed, the less likely cooperation is to emerge.

Figure 4: *Payoff Matrices in the Experiment after including Third Parties' Punishment in the UK*

(i) Baseline

P1 \ P2	C	D
C	70.43$^{\#1}$ (0.677)	21.39$^{\#3}$ (1.182)
D	**76.26**$^{\#2}$ (1.977)	**35.04**$^{\#4}$ (1.231)

Two-sided p for (#1) = (#2) = 0.010**
Two-sided p for (#3) = (#4) = 0.000***

Fear (normalized) = 0.249
Greed (normalized) = 0.106

(ii) Trio

P1 \ P2	C	D
C	68.00$^{\#1}$ (1.455)	17.67$^{\#3}$ (1.845)
D	66.00$^{\#2}$ (3.726)	**29.33**$^{\#4}$ (2.725)

Two-sided p for (#1) = (#2) = 0.983
Two-sided p for (#3) = (#4) = 0.004***

Basin of Attraction = 0.146

(iii) Higher-Order

P1 \ P2	C	D
C	**64.42**$^{\#1}$ (2.095)	17.05$^{\#3}$ (2.213)
D	58.00$^{\#2}$ (3.494)	**26.42**$^{\#4}$ (3.140)

Two-sided p for (#1) = (#2) = 0.043**
Two-sided p for (#3) = (#4) = 0.002***

Basin of Attraction = 0.407

Notes: The numbers in the payoff matrices indicate the average row player (P1)'s payoff, with standard errors presented underneath in parentheses. To calculate the numbers in the payoff matrices, the payoff matrix that a PD player faced in each group was first calculated. Payoff entries were then computed based on group averages. Each underlined payoff in bold is PD player 1's best response to a given PD player 2's strategy. There is no strict best response for a PD player in the Trio treatment when his/her partner selects C (cooperation), and so neither payoff is underlined in this column. The normalized fear and greed values can be defined only for a prisoner's dilemma game payoff matrix and were calculated according to Rapoport and Chammah (1965) and Ahn *et al.* (2001). That is, the fear and greed values were each divided by the payoff difference between the minimum and maximum payoff in the stage game. The basin of attraction of cooperation was calculated according to Dal Bó *et al.* (2021). Two-sided p is the result from a group-level Wilcoxon signed rank test to the null that the average payoffs are the same between "mutual cooperation" and "betrayal", or between "mutual defection" and "victim". *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The normalized fear and greed values are both calculated as 0.250 in the original payoff matrix (Figure 1) when no punishment is possible. The third-party punishment decreased the normalized greed value strongly in the Baseline treatment, to 0.106, well below the original value without punishment, 0.250 ($p < 0.001$, group-level Wilcoxon signed rank test). Although this creates conditions more favorable for cooperation, overall punishment is still too weak to fundamentally alter the social dilemma incentive structure: The payoff to defection remains significantly higher than the payoff to cooperation conditioned on the opponent's cooperative choice (two-sided $p = 0.010$). As a result, defection is still the strictly dominant strategy in the game. This echoes Fehr and Fischbacher (2004), who concluded that "sanctions by second parties directly harmed were much stronger than third-party sanctions, indeed strong enough to make norm violations unprofitable, whereas the sanctions of a single third party were not. Thus, in context of our experiment, more than one third party is needed to enforce the norm" (page 85).

Panels ii and iii show the material incentives when aggregate punishment is accounted for in the Trio and Higher-Order treatments. Having multiple third parties in the Trio treatment altered the prisoner's dilemma structure. In the Trio treatment, despite the negative group size effect (Result 1.ii) and given the increased number of third parties, the size of aggregate punishment increased. As a result, defection is no longer the unique best response for even a selfish PD player to his/her opponent's selection of cooperation in this treatment: There is no longer a significant difference between the payoffs to cooperation and defect. This means that better cooperation norms can be reinforced at a smaller per-third-party cost in the Trio than in the Baseline treatment. Nevertheless, defection is a weakly dominant strategy, as while defection is the best response strategy to his or her opponent's selection of defection, both defection and cooperation are equally best responses to the opponent's selection of cooperation.

The availability of higher-order punishment, however, did transform the incentive structure in the primary cooperation problem to a stag-hunt game in which mutual cooperation is a payoff dominant Nash Equilibrium outcome (Figure 4.iii). Given that neither per third party punishment frequency nor strength are significantly different when moving from the Baseline to Higher-Order treatments (Result 1(iii)), but the number of third parties increases from one to three, aggregate first-order punishment is larger in the Higher-Order treatment. As a consequence, cooperation is the best response of a PD player to his/her opponent's selection of cooperation (two-sided $p = 0.043$) in the Higher-Order treatment.

Even in a stag-hunt game, where cooperation is mutually beneficial, it remains difficult to achieve because mutual defection is a risk dominant equilibrium outcome (Harsanyi and Selten, 1988); the coordination success depends on the payoff matrix. Dal Bó *et al.* (2021) recently proposed that the Basin of Attraction of the cooperative strategy is a good predictor for coordination success on the efficient equilibrium. The realized incentive structure in the Higher-Order treatment is favorable for cooperation, as evidenced by a sizeable Basin of Attraction of 0.407.[31] As the present experiment purposefully adopted a one-shot design to isolate people's punitive motives without repeated game considerations, whether cooperation would evolve with these incentive changes remains open for further research. However, the results of Dal Bó *et al.* (2021) – based on a meta-analysis (Figure 2 of their paper) and clean experimental design – suggest a high likelihood that high levels of cooperation would obtain for the transformed payoff matrices in the Higher-Order treatment.

Result 2 (Incentive changes with punishment in the UK)**:**

(i) Third-party punishment decreased "greed" significantly in the prisoner's dilemma in the Baseline treatment.

(ii) Having multiple third parties in the Trio treatment changed the incentive structure: defection is only a weakly dominant strategy, as while defection is the best response strategy to his or her opponent's selection of defection, both defection and cooperation are equally best responses in case the opponent chooses cooperation.

(iii) The availability of higher-order punishments among third parties in Higher-Order treatment transformed the incentive structure to a stag-hunt game with a sizable basin of attraction of cooperation due to sufficiently strong collective punishment.

[31] The Basin of Attraction measures stability of one equilibrium against another when there are multiple equilibria. Denote the payoffs in "mutual cooperation," "victim," "betrayal," and "mutual defection" as X, W, Y and Z, respectively. Then, the Basin of Attraction is defined as: $(X - Y)/((X - Y) + (Z - W))$. Here, $X - Y$ is the loss that a player incurs if only s/he deviates from (C, C) by selecting D, while $Z - W$ is the loss that the player incurs if only s/he deviates from (D, D) by selecting C. The equation of the Basin of Attraction of cooperation is a function of the relative size of the deviation loss from (C,C) to the deviation loss from (D,D); the larger this is, the more costly it is for a player to deviate from C to D when (C,C) is realized and thus the more likely the players are to stick to the cooperative equilibrium to avoid a loss. The Basin of Attraction value of 0.407 is larger than most prior experiments in a stag-hunt game with (D,D) being risk dominant (see Table 3 in Dal Bó *et al.* (2021)); the prevalence of cooperation is estimated to be more than 70% at this value (see Figure 2 in Dal Bó *et al.* (2021)).

5.2. Higher-Order Punishment

The greater effectiveness of third-party punishment in the Higher-Order treatment (Results 1.iii and 2.iii) might be driven by higher-order punishment opportunities. Although the aggregate punishment in the Trio treatment was more effective than standalone third-party punishment in the Baseline treatment, defection remains a weakly dominant strategy for PD players in the Trio treatment (Figure 4, Result 2.ii). Thus, not only punishment for committing an unjustified punishment act (PEC), but also punishment of the failure to sanction a defector (PEO) has a potentially important role in changing the incentive structure PD players face, as both the PEC and PEO theoretically strengthen pro-social first-order punitive norms, thereby depriving material incentives to defect of the PD players.

In the Higher-Order treatment, 28% and 24% of cooperators were punished in the second stage in the "mutual cooperation" and "victim" scenarios, respectively (Panel A1.iii of Figure 2). A closer look at the punishment data reveals that there are 596 and 613 cases where third-party player *j* anti-socially punished a cooperator more than third-party player *i* in "mutual cooperation" and "victim," respectively; and in 288 and 276 cases (i.e., 48% and 45%), *i* costly punished *j* in the third stage. The likelihood of PEC is significantly higher than the other form of punishment in these scenarios (Panel A.i of Figure 5). The PEO is also salient in our data: 74% and 47% of defectors were punished in the second stage in the "betrayal" and "mutual defection" scenarios, respectively (Panel A1.iii of Figure 2). Individual-level data show that there are 238 and 119 cases where third-party player *j* pro-socially punished a defector less than third-party player *i* in "betrayal" or "mutual defection," respectively. In 132 and 56 cases (i.e., 55% and 47%), *i* costly punished *j* in the third stage. The punishment frequency in PEO is much stronger than the other form of punishment in "betrayal" and "mutual defection" (see again Panel A.i of Figure 5). Similar behavioral patterns are detected when average per-third-party punishment points given, rather than frequency, is considered (Panel A.ii of Figure 5). In sum, these results support Hypotheses 2c and 2d.[32,33]

Scholars in anthropology and theoretical biology have argued that the emergence of punishment norms may depend on the ability of individuals to engage in collective higher-order punishment of those who do not sanction free-riding behavior in the first instance (e.g., Hechter, 1987). If the costs of being punished are sufficiently large to act as a deterrent, then moralistic strategies enforced by punishment of those who fail to punish free riders can be evolutionary stable (Boyd and Richerson, 1992). The social interactions introduced by the availability of punishment mechanisms increase the likelihood of multiple stable equilibria (Boyd and Richerson, 2010).

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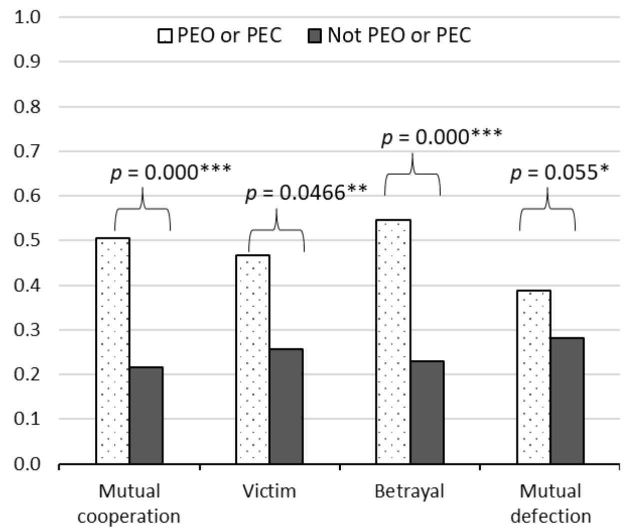
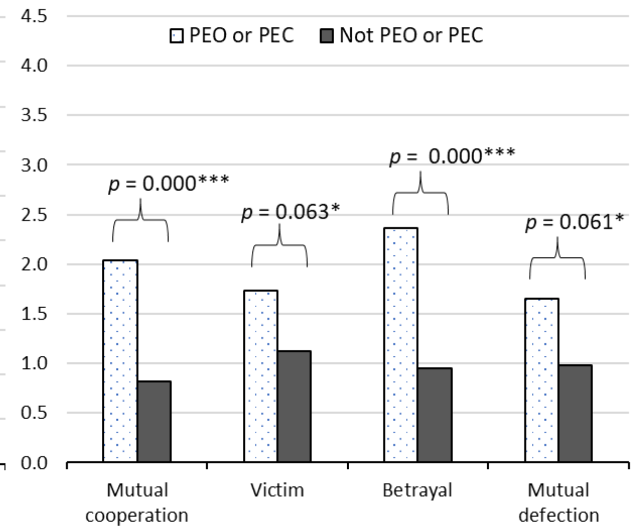
[32] See Appendix Table C.11 for the detailed regression table. The results are qualitatively unchanged when the same analysis is performed using those whose majors are not economics or business and management, although the results are statistically weaker with reduced power to detect an effect – see Appendix Tables C.12 and C.13.

[33] Each third-party player made second-order punishment decisions for 30 scenarios randomly constructed (Section 3.2). As an anonymous referee highlighted, however, some scenarios may be arguably unrealistic. To supplement Figure 5 (i.e., Appendix Tables C.11 and C.25), an additional analysis was performed by considering the set of scenarios realized after Stage 2 for at least one group as "reasonable." The results are summarized in Appendix Tables C.32 and C.34, which indicates that Result 3 holds also for the restricted dataset of "reasonable scenarios."

Figure 5: *Higher-order Punishment in the UK*

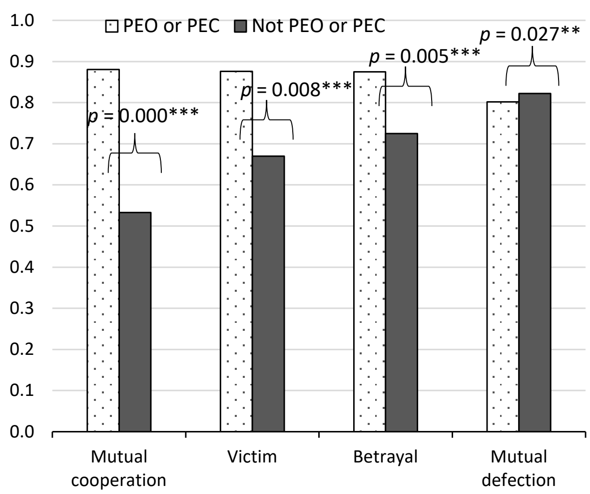


(i) Punishment Frequency

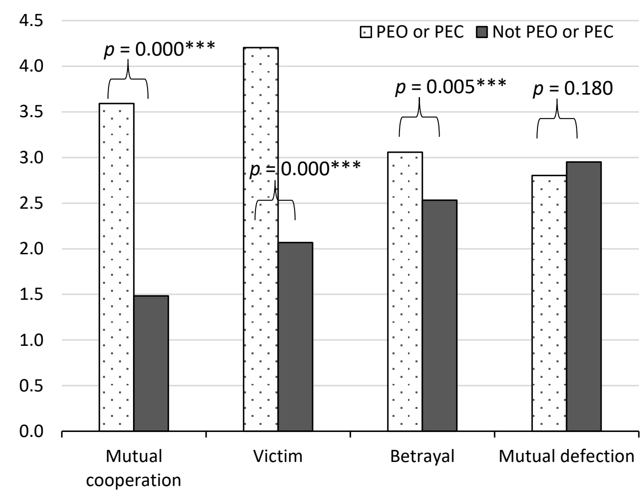


(ii) Avg. per-third-party punishment points given

A. Actual Decisions



(i) Punishment Frequency



(ii) Avg. per-third-party punishment points given

B. Belief

Note: Average values in the figures are constructed based on session averages. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," and when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim" are called, respectively, the PEO and PEC. The *p*-value in each bar shows the result to test the null that the frequency (strength) in PEO or PEC is the same as higher-order punishments in all the other forms; robust standard errors are clustered at the subject level – see Appendix Tables C.11 and C.25 for the detail. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Result 3 (Higher-order punishment in the UK)**:**

(i) *PEC was more prominent than the other form of punishment in "mutual cooperation" and "victim;" i.e., committing an unjustified punishment act toward a cooperator attracted higher-order punishments by fellow third parties.*

(ii) *PEO was more prominent than the other form of punishment in "betrayal" and "mutual defection;" i.e., failure to punish a defector who exploited a cooperator attracted higher-order punishments by fellow third parties.*

Finally, it should be noted that, as was the case for the first-order punishment decisions, third parties' actual higher-order punishments were lower than the beliefs of PD players.[34] This again supports the notion that people are imperfect conditional punishers (e.g., Kamei, 2014 and 2020). Nevertheless, the overall patterns in the beliefs are qualitatively similar to those in the decisions: i.e., subjects anticipated stronger PEC (PEO) than otherwise in the "mutual cooperation" and "victim" ("betrayal" and "mutual defection").

6. Punishment Patterns in the India: Cross-Societal Differences

As discussed earlier, prior research suggests that human altruistic tendencies, such as third-party punishment, differ markedly across societies (e.g., Herrmann *et al.*, 2008; Henrich *et al.*, 2006; Marlowe *et al.*, 2008; Henrich *et al.*, 2010); similar differences may hold for the patterns and the effectiveness of higher-order sanction enforcement among uninvolved individuals. In particular, Enke (2019) proposes that societies with loose ancestral kinship ties may display a greater willingness to engage in third-party punishment than those societies with historically tight kinship ties. The UK is a country with relatively loose ancestral kinship ties; therefore, to test the generalizability of the research findings, we also conducted the experiment in India, a country with relatively tight kinship ties (see row a. of Table 3).

To first check whether the subjects in these two locations have different stated attitudes toward punishment consistent with the prior literature, as shown in Table 3, z-scores of stated willingness to engage in third-party relative to direct punishment for the selected societies were calculated based on responses to questions from the Global Preferences Survey (GPS), which were implemented in the post-experiment questionnaire. It finds that, consistent with the observation in the prior research, respondents in India report a significantly weaker willingness to engage in third-party punishment relative to direct punishment. It is interesting to consider whether these differences in stated punishment preferences

[34] As explained in Section 3, PD players submitted their beliefs about third parties' higher-order punishment behaviors in the third stage. This data provides a measure of empirical expectations about higher-order punishment norms in the experiment. Specifically, beliefs about higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than the PD player's own belief about *i*'s first-order punishment in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than the PD player's own belief about *i*'s first-order punishment in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, beliefs about higher-order punishment are referred to as "non-cooperation-conducive". Average beliefs about cooperation-conducive and non-cooperation-conducive higher-order punishment were then constructed across sessions for each scenario. The same method was used in calculating beliefs for the India sample (Figure 9).

extend to revealed preferences and, if so, the implications for sanction enforcement in the prisoner's dilemma.

Table 3: *Ancestral Kinship Tightness and Stated Punishment Preferences in the Experiment Sample*

Society	UK (Newcastle)	India (Sonipat)	Difference
a. Ancestral kinship tightness index (Enke 2018)	0.023	0.776	
b. Third-party vs. direct punishment (Experiment sample)	0.086	-0.078	-0.164**

Notes: Row *a* was computed based on the country-level score published in Enke (2018). Row *b* was constructed using the approach in Enke (2019, Online Appendix E.2) based on responses to survey items asked in the post-experiment questionnaire. In this construction, two items from the Global Preferences Survey (Falk *et al.*, 2018) were used to measure stated willingness to engage in direct punishment. The two items ask respondents to self-assess on two statements: (i) "If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so"; and (ii) "How willing are you to punish someone who treats you unfairly, even if there may be costs for you?". We aggregated the two responses by computing the average of their z-scores. Stated willingness to engage in third-party punishment is the z-score of responses to the following question: "How willing are you to punish someone who treats others unfairly, even if there may be costs for you?". The row b variable was then constructed as the difference between the measures of third-party and direct punishment. The Difference column is the coefficient of a linear regression of this variable on the study location for our experiment sample (N=501). ** two-sided $p < 0.05$.

6.1. First-Order Punishment in India

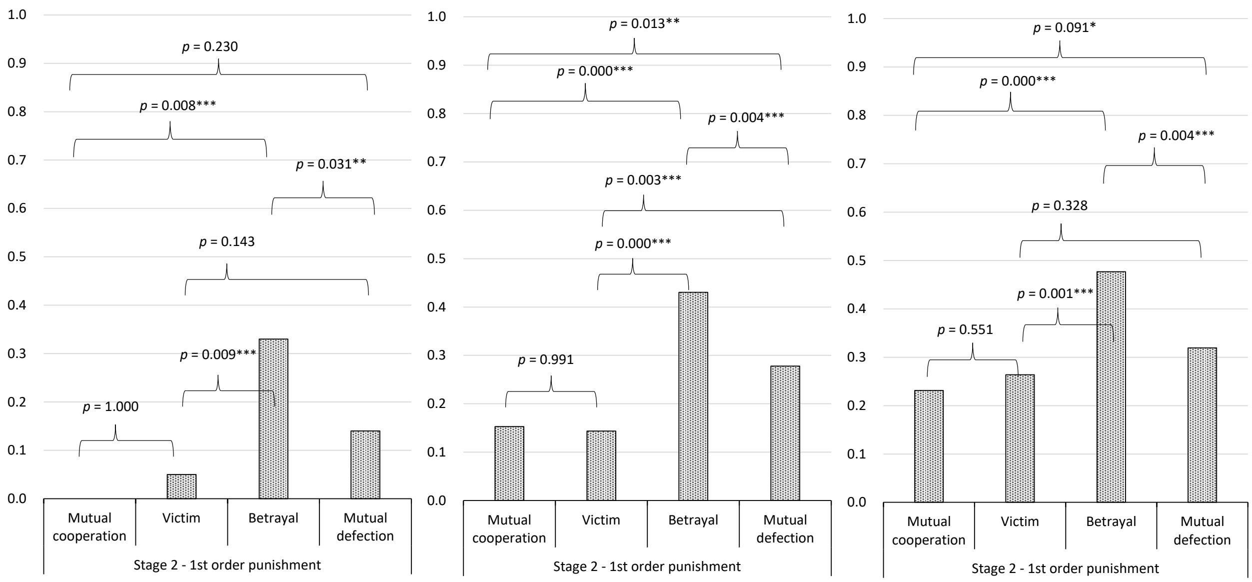
Figure 6 summarizes punishment frequencies and per-third-party punishment strength in India by scenario and treatment. The general across-scenario patterns of third-party punishment are qualitatively similar to those in the UK and Result 1(i) holds for India also (first-order punishment is stronger in "betrayal" than in any other scenario in all three treatments).

While the average beliefs about first-order third-party punishment are stronger than the actual decisions, PD players believe that third parties inflict punishment on defectors, especially in "betrayal," more frequently and more strongly than cooperators. Hence, it can be concluded that prior research findings on the distribution of third-party punishments extend to societies with relatively tight ancestral kinship ties.

However, unlike in the UK, but consistent with Hypothesis 2.f, third-party punishment acts were significantly weaker in India than in the UK for all of the four scenarios in the Baseline treatment (Appendix Table C.29). For example, the third-party punishment strength (frequency) in "betrayal" is 1.12 punishment points (37%) in India, less than one-third (one-half) than those in the UK (the strength and frequency are 4.09 and 83%, respectively, in the UK). Perhaps partly due to this, a negative group size effect was not detected in a group setting in India.

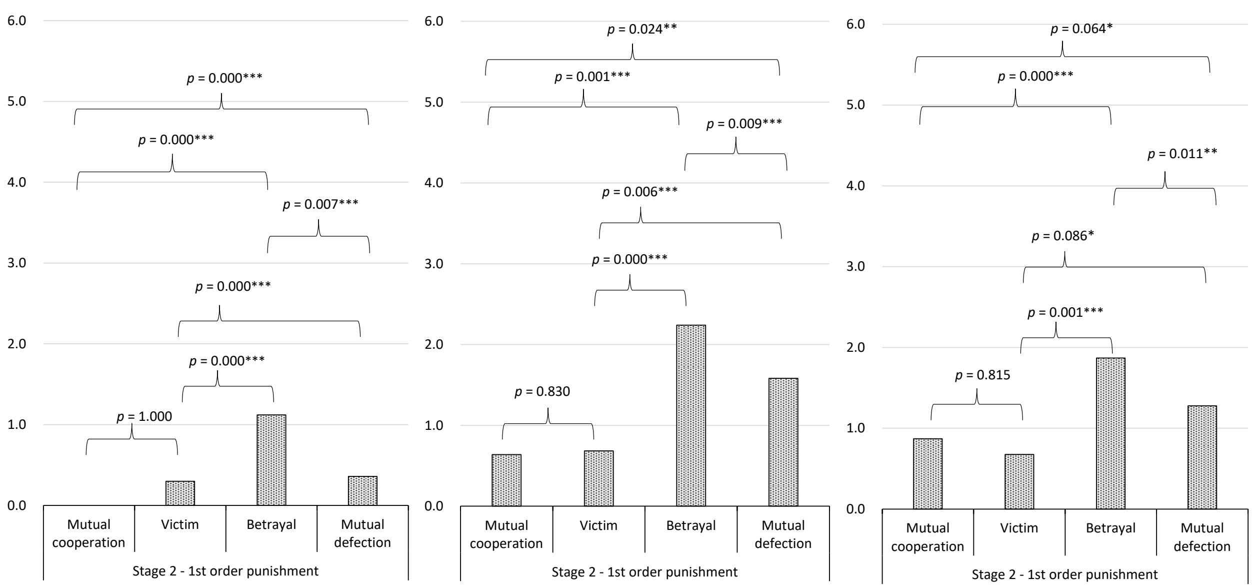
Figure 7 summarizes the differences in third-party punishment between the treatments with a single third party and with three third parties. Regardless of whether higher-order punishment was available, the presence of third-party peers did not decrease per-third-party punishment activities in Stage 2. In fact, it increased the punishment frequency for all four scenarios, i.e., by 15.3 (23.1) percentage points, 9.4 (21.4) percentage points, 10.1 (14.7) percentage points, 13.8 (17.9) percentage points in the "mutual cooperation," "victim," "betrayal," and "mutual defection," respectively.

Figure 6: *First-Order Punishment Decisions and Beliefs in India*



(i) Baseline treatment (ii) Trio treatment (iii) Higher-Order treatment

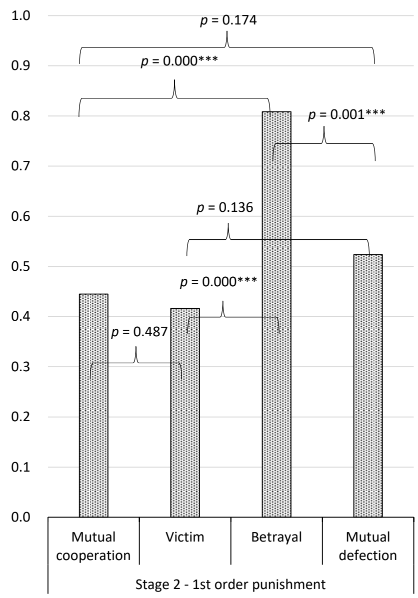
(A1) Punishment Frequency



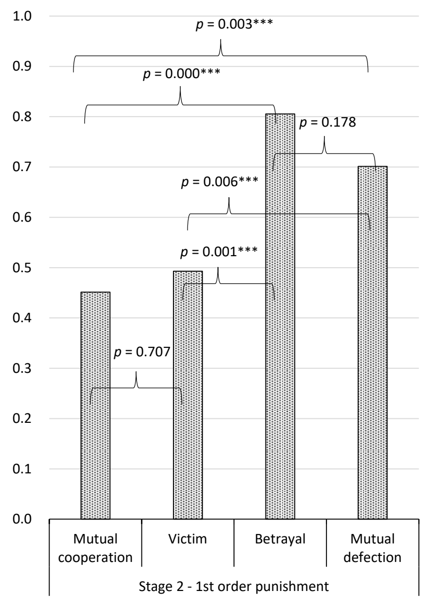
(i) Baseline treatment (ii) Trio treatment (iii) Higher-Order treatment

(A2) Avg. Per-third-party Punishment Points Given

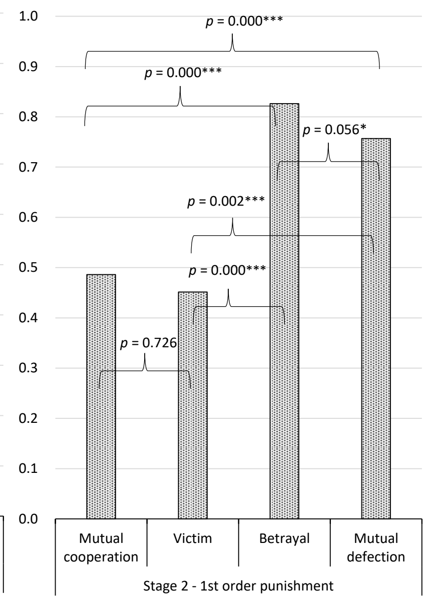
A. Actual Decisions



(i) Baseline treatment

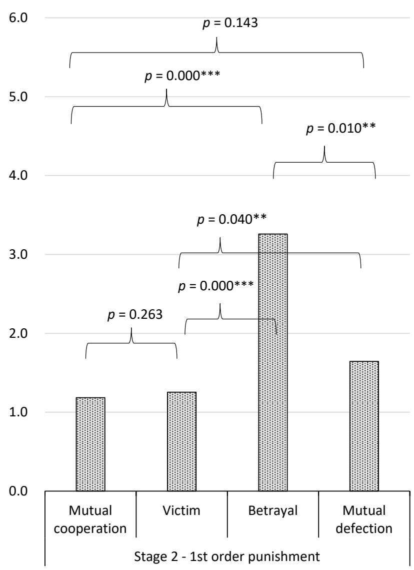


(ii) Trio treatment

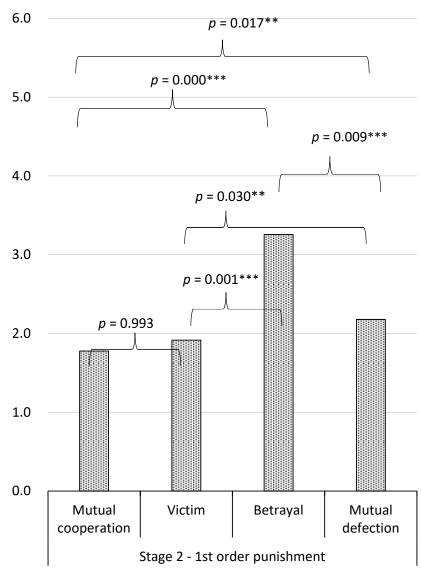


(iii) Higher-Order treatment

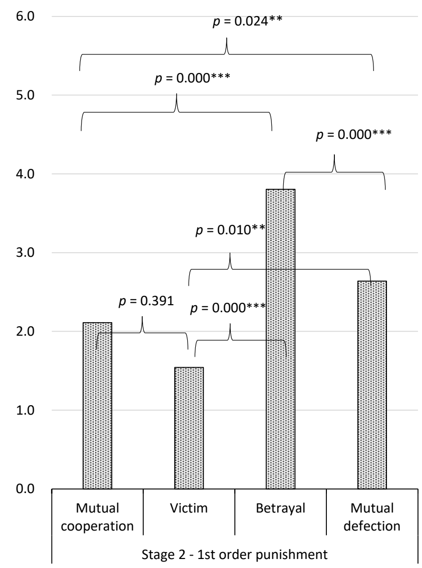
(B1) Punishment Frequency



(i) Baseline treatment



(ii) Trio treatment



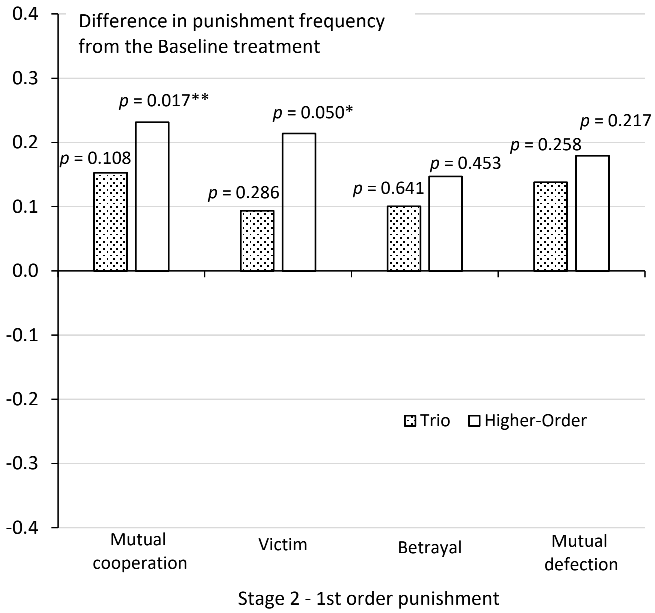
(iii) Higher-Order treatment

(B2) Avg. Per-third-party Punishment Points Given

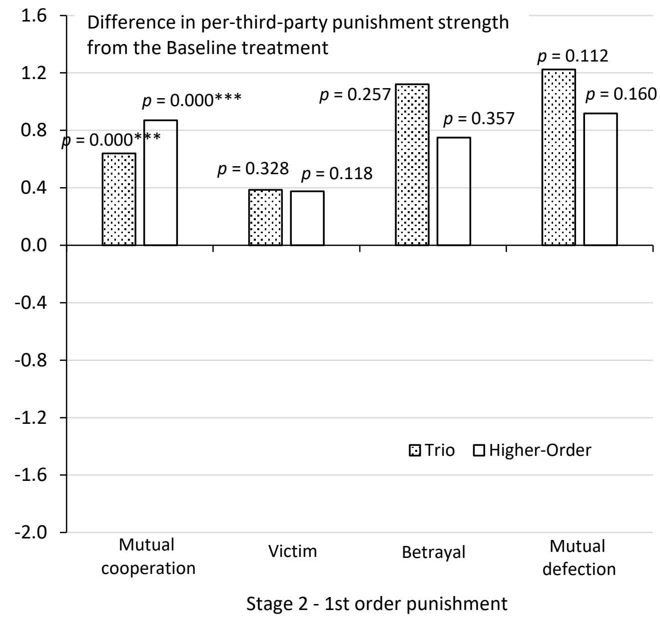
B. Beliefs

Notes: Average values in the figures are constructed based on session averages. *p*-values (two-sided) on the figures were in principle based on regression results (Probit regressions for punishment frequency, and Tobit regressions for punishment points given); robust standard errors are clustered at the subject level – see Appendix Tables C.14 and C.15 for the detail. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 7: *Group Size Effects on (First-Order) Third-Party Punishment in India*

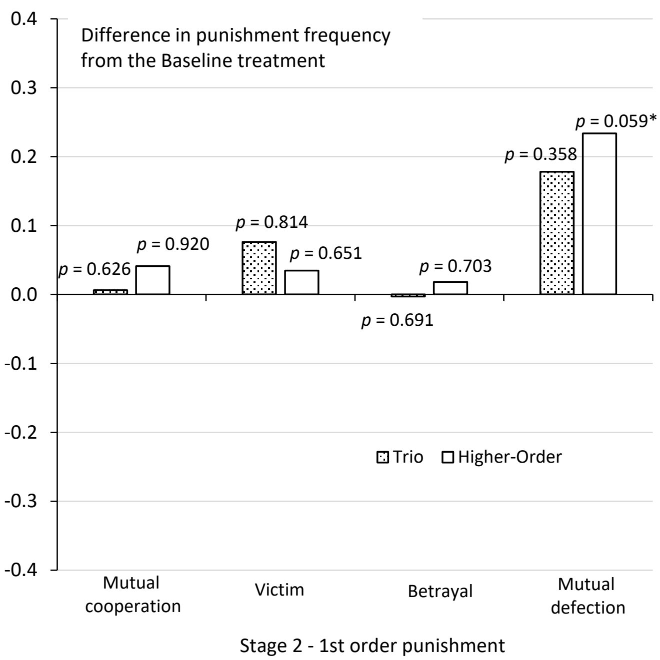


(i) Punishment Frequency

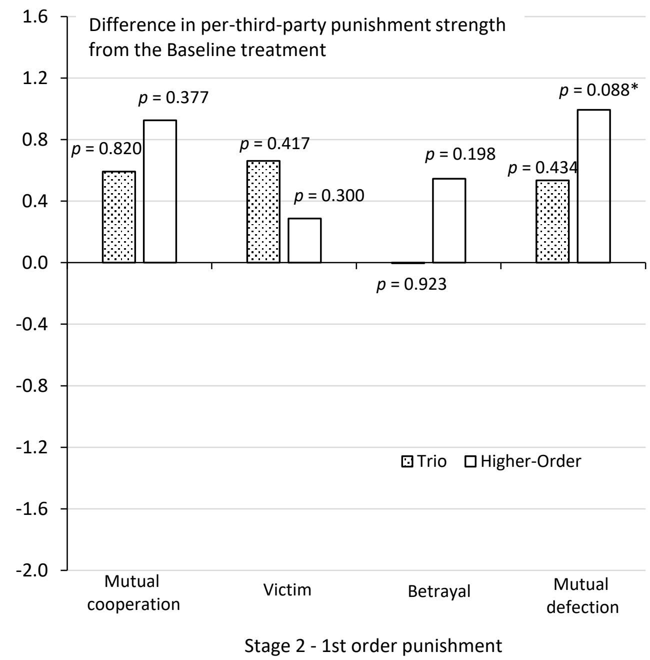


(ii) Avg. per-third-party punishment points given

A. Actual Decisions



(i) Punishment Frequency



(ii) Avg. per-third-party punishment points given

B. Belief

Notes: Average values in the figures are constructed based on session averages. *p*-values (two-sided) on the figures were in principle based on regression results (Probit regressions for punishment frequency, and Tobit regressions for punishment points given); robust standard errors are clustered at the subject level – see Appendix Tables C.18 and C.26 for the detail. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Similar tendencies hold in terms of punishment strength (panel A.ii of Figure 7). Although in general these increases are not statistically significant, in one scenario ("mutual cooperation") the positive group size effect is significant at the 5% level. The clear absence of a negative group size effect can be seen also from the punishment-belief ratios in India.[35] This ratio was lowest in the Baseline treatment regardless of which first-stage outcome is considered (Table 4).

The no (or at most positive) group size effect helps to enforce cooperation norms in a group setting, because third parties on average inflict punishment on defectors more strongly than they inflict punishment on cooperators.

Table 4: *First-order Punishment as a Percentage of Belief in India*

	A. Punishment Frequency				**B. Avg Per-Third-Party Punishment Points Given**			
Treatment	mutual coop.	victim	betrayal	mutual defect.	mutual coop.	victim	betrayal	mutual defect.
(a) Baseline	0.0%	12.0%	45.8%	30.6%	0.0%	23.9%	34.4%	21.9%
(b) Trio	31.0%	28.4%	53.4%	41.3%	35.9%	35.7%	68.8%	72.6%
(c) Higher-Order	47.3%	59.8%	56.9%	39.6%	41.2%	43.8%	49.1%	48.4%
[two-sided *p*-values for one-sample Wilcoxon signed ranks tests using group-level data:]								
H_0: (a) = 100%	0.000***	0.002***	0.001***	0.002***	0.000***	0.012***	0.001***	0.000***
H_0: (b) = 100%	0.000***	0.000***	0.018**	0.001***	0.002***	0.005***	0.184	0.044**
H_0: (c) = 100%	0.004***	0.008***	0.005***	0.001***	0.079*	0.024**	0.015**	0.110

Notes: For each treatment / scenario, the percentage values in the upper panel are constructed as the average actual per third party punishment frequency or strength among the third parties, divided by the average belief about per third party punishment frequency or strength among the PD players, multiplied by 100. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Figure 8 reports the payoff matrices in the stage game when reductions due to punishment are subtracted from the PD players' payoffs. The normalized fear and greed values are both lower in the Trio and Higher-Order treatments than in the Baseline treatment. Despite the stronger per-third-party punishment and greater number of third parties in the Trio and Higher-Order treatments than in the Baseline treatment, defection was the most materially beneficial strategy in all three treatments, because the punishment levels are low and not well-targeted (as evidenced by frequent anti-social punishment in these two treatments) in India. In particular, in the Higher-Order treatment, the incentive structure remained a prisoner's dilemma where defection was the strictly dominant strategy.

Figure 8: *Payoff Matrices in the Experiment after including Third Parties' Punishment in India*

P2

	C	D

P2

	C	D

P2

	C	D

[35] Subjects' actual punishment decisions were significantly milder than the prevailing beliefs (Table 4). However, unlike third-party punishment, imperfect conditionality on prevailing beliefs was not detected for cooperation in India. The averaged realized (believed) cooperation rates were 47.4% (45.8%), 54.8% (50.9%), and 57.5% (54.5%) in the Baseline, Trio and Higher-Order treatments, respectively. The same patterns were detected also for the UK (see footnote 29).

P1	C	72.00$^{\#1}$ (0.000)	23.05$^{\#3}$ (0.947)
	D	**84.21**$^{\#2}$ (1.315)	**38.74**$^{\#4}$ (0.737)

Two-sided p for (#1) = (#2) = 0.000***
Two-sided p for (#3) = (#4) = 0.000***

Fear (normalized) = 0.256
Greed (normalized) = 0.200

(i) Baseline

C	66.86$^{\#1}$ (1.818)	17.71$^{\#3}$ (2.170)
D	**67.71**$^{\#2}$ (4.088)	**24.86**$^{\#4}$ (3.600)

Two-sided p for (#1) = (#2) = 0.689
Two-sided p for (#3) = (#4) = 0.013***

Fear (normalized) = 0.143
Greed (normalized) = 0.017

(ii) Trio

C	63.90$^{\#1}$ (2.100)	17.70$^{\#3}$ (1.767)
D	**71.50**$^{\#2}$ (2.458)	**28.90**$^{\#4}$ (2.434)

Two-sided p for (#1) = (#2) = 0.011**
Two-sided p for (#3) = (#4) = 0.001***

Fear (normalized) = 0.208
Greed (normalized) = 0.141

(iii) Higher-Order

Note: See the detailed notes to Figure 4.

This pattern for the India sample is in clear contrast to the UK sample, where in the Higher-Order treatment incentive structure becomes a stag-hunt game with mutual cooperation as an equilibrium outcome (Figure 4). Section 6.3 examines why third parties in the UK were able to coordinate better with each other than those in India.

Result 4 (Punishment patterns in India):

(i) *Third parties' first-order punishment is significantly more frequent and is stronger in "betrayal" than in any other scenario in all three treatments, consistent with both Hypothesis 1.b (social preferences) and Hypothesis 2.a (norm conformity).*

(ii) *Consistent with Hypothesis 2.f (arguments in theoretical biology and anthropology), third-party punishment activities are weaker in India than in the UK. Unlike in the UK (unlike Result 1.ii), the presence of fellow third parties (although insignificantly in most cases) encourage third parties to engage punitive activities in Stage 2.*

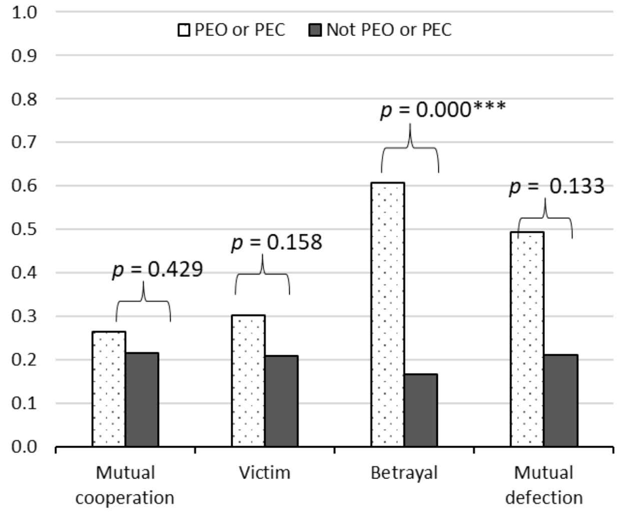
(iii) *Unlike Result 2, defection is materially a more beneficial strategy than cooperation in all three treatments.*

6.2. Higher-Order Punishment in India

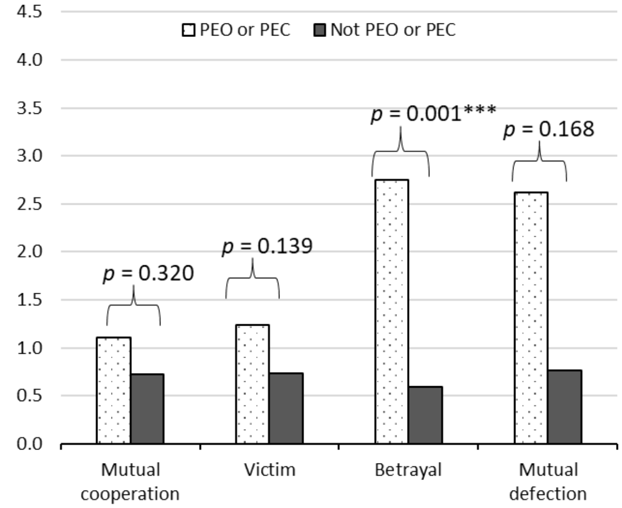
In addition to the less efficient effects of first-order punishment on the primary cooperation problem (Figure 8), the patterns of higher-order punishments are less socially desirable in India than in the UK, consistent with Hypothesis 2.f.

In India, the PEO is salient in the Higher-Order treatment, as in the UK. Specifically, 48% and 32% of defectors were punished in the second stage in the "betrayal" and "mutual defection" scenarios, respectively (Panel A1.iii of Figure 6). Individual-level data reveal that there are 159 and 94 cases where third-party player *j* pro-socially punished a defector less than third-party player *i* in "betrayal" or "mutual defection," respectively. In 97 and 42 out of the cases (i.e., 61% and 45%), *i* costly punished *j* in the third stage. The punishment frequency in PEO is much stronger than the other form of punishment in "betrayal" and "mutual defection;" however, it is significant only in "betrayal" due to the small sample size (Panel A.i of Figure 9). Qualitatively the same behavioral patterns are detected when average per-third-party punishment points given, rather than frequency, is considered (Panel A.iii of Figure 9).

Figure 9: *Higher-order Punishment in India*

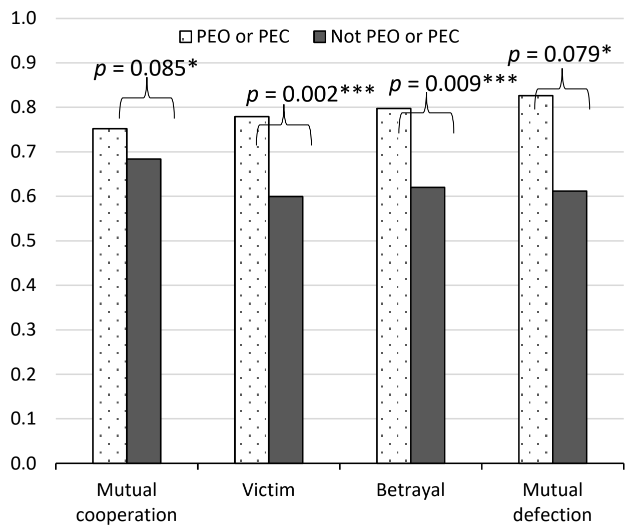


(i) Punishment Frequency

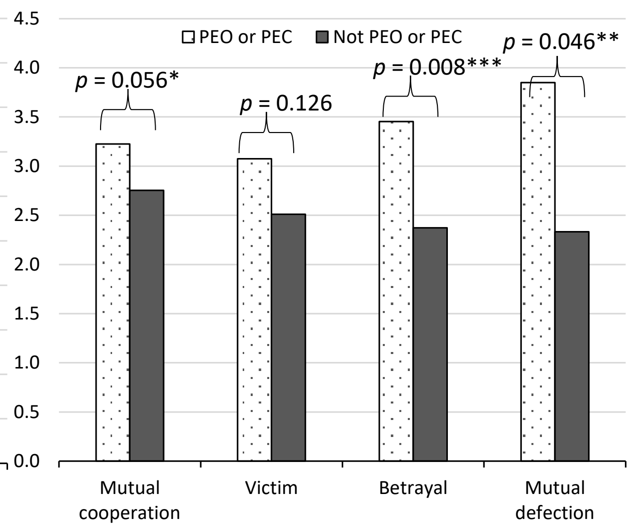


(ii) Avg. per-third-party punishment points given

A. Actual Decisions



(i) Punishment Frequency



(ii) Avg. per-third-party punishment points given

B. Belief

Note: Average values in the figures are constructed based on session averages. Higher-order punishment from i to j when j pro-socially punished a defector less than i in "betrayal" or "mutual defection," and when j anti-socially punished a cooperator more than i in "mutual cooperation" and "victim" are called, respectively, the PEO and PEC. The p-value in each bar shows the result to test the null that the frequency (strength) in PEO or PEC is the same as higher-order punishments in all the other forms; robust standard errors are clustered at the subject level – see Appendix Tables C.20 and C.27 for the detail. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In contrast, the PEC does not stand out. In India, 23% and 26% of cooperators were punished in the second stage in the "mutual cooperation" and "victim" scenarios, respectively (Panel A1.iii of Figure 6). There are 646 and 672 cases where third-party player *j* anti-socially punished a cooperator more than third-party player *i* in "mutual cooperation" and "victim," respectively; and in 166 and 200 out of the cases (i.e., 26% and 30%), *i* costly punished *j* in the third stage. The likelihood of PEC is only somewhat higher than the other form of punishment in these two scenarios, and the former is not significantly different from the latter (Panel A.i of Figure 9). This could explain why higher-order punishments do not improve incentive structures through the spread of anti-social punishment.[36]

6.3. Cross-societal Difference in Punitive Tendencies

Why do different normative behaviors prevail across the two research sites? One possible explanation is that third parties' personal punishment preferences differ. Following Enke (2019), the personal norm for third-party punishment is computed as the difference between a subject's stated willingness to engage in third-party punishment and their stated willingness to engage in direct punishment (see the notes to Table 3 for the underlying survey questions used to construct the two measures).

Related to personal norm is people's inclination to conform to social norms. Krupka and Weber (2013) argue that the extent to which decisions are deemed socially appropriate depends on the context, which in turn drives social norm compliance. In their model, norm conformity is individual-specific and enters the utility function additively:

$$u_i(a_k) = V\big(\pi_i(a_k)\big) + \gamma N(a_k),$$

where a_k is a specific action, $V(.)$ is i's utility from monetary payoff, $N(.)$ is the degree to which action a_k is collectively perceived as appropriate, and γ indicates the relative importance of adherence to social norms in i's utility function. Adherence to a cooperative punishment norm is conditional on the empirical expectation that most other people cooperate (Bicchieri, 2017). Thus, it is interesting to consider the predictive power of third parties' beliefs about the percentage of cooperators in the groups that they do not belong to (descriptive norm), which was elicited in Stage 1 of the experiment. The effects of subjects' beliefs about cooperation may differ between India and the UK, as $N(.)$ and γ could both depend on the cultural and institutional backgrounds of the subjects.

In addition to normative beliefs, Enke (2019, Table I) discussed five domains of moral beliefs that characterize societies in terms of kinship tightness: in-group favoritism, religion, moral values, moral emotions and emotion/value. The present study elicited these moral beliefs from the subjects in the post-experiment questionnaire to study how they may affect punishment behaviors.[37] A regression analysis is

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[36] Similar to the analysis in footnote 33, an additional analysis was performed by using the restricted dataset of "reasonable scenarios" in India. The regression results can be found in Appendix Tables C.33 and C.35. Consistent with the results from the full set of data, the PEO is salient, but the PEC does not stand out, in India.

[37] *In-group favoritism* is measured as the difference between in- and out-group trust, based on World Values Survey questions about trust in: [in-group] family, neighborhood, and people you know personally; [out-group] people you meet for the first time, people of another religion, and people of another nationality (a higher value indicates greater

conducted to explore how subjects' personal and descriptive norms, and the five domains of moral beliefs affects third parties' first-order punishment decisions of defectors in the three treatments. Table 5 reports the regression results separately for India and the UK, which provide several nuanced individual-level insights on the preceding results.

Table 5: *Determinants of Cross-societal Difference in First-Order Punishment of Defectors*

(A) Frequency of first-order punishment given to PD players in "betrayal" and "mutual defection"

	UK (Newcastle)			India (Sonipat)		
	Baseline	Trio	Higher-Order	Baseline	Trio	Higher-Order
(a) Personal norm#1	0.058**	0.030	-0.001	0.002	0.035	0.052**
	(0.021)	(0.022)	(0.027)	(0.047)	(0.022)	(0.024)
(b) Belief about cooperation#2	0.823**	0.271	-0.375	0.385	0.190	0.161
	(0.356)	(0.235)	(0.291)	(0.236)	(0.238)	(0.223)
(c) In-group favoritism	0.224***	-0.058	-0.017	-0.097	0.081	0.194*
	(0.066)	(0.104)	(0.142)	(0.138)	(0.098)	(0.110)
(d) Moral values	-0.006	-0.001	-0.003	0.020***	0.002	-0.003
	(0.004)	(0.009)	(0.008)	(0.005)	(0.009)	(0.008)
(e) Religious beliefs	0.029	0.033*	-0.000	0.018	0.026	0.024
	(0.021)	(0.018)	(0.019)	(0.014)	(0.023)	(0.020)
(f) Moral emotions	-0.013	-0.006	-0.006	0.002	-0.004	-0.001
	(0.014)	(0.009)	(0.008)	(0.010)	(0.006)	(0.007)
(g) Emotion/value	-0.020	0.026*	0.016	0.100***	-0.007	-0.008
	(0.032)	(0.015)	(0.017)	(0.010)	(0.021)	(0.012)
Constant	-0.120	-0.069	1.088	-1.677*	0.695	1.746
	(0.822)	(0.705)	(0.679)	(0.849)	(1.101)	(1.150)
Observations	42	100	86	36	116	104
R-squared	0.485	0.328	0.207	0.612	0.174	0.231

(B) Punishment strength (punishment points given) per third-party player in "betrayal" and "mutual defection"

	UK (Newcastle)			India (Sonipat)		
	Baseline	Trio	Higher-Order	Baseline	Trio	Higher-Order
(a) Personal norm#1	0.254*	0.192*	0.110	-0.192	0.394**	0.249**
	(0.144)	(0.113)	(0.190)	(0.221)	(0.149)	(0.121)
(b) Belief about cooperation#2	6.489***	1.516	-1.918	3.085**	0.571	1.352
	(1.752)	(1.072)	(1.956)	(1.207)	(1.776)	(1.393)
(c) In-group favoritism	1.065***	-0.384	0.145	-0.074	0.479	0.837
	(0.290)	(0.492)	(1.050)	(0.611)	(0.773)	(0.542)
(d) Moral values	0.009	0.028	-0.008	0.093***	0.028	-0.037
	(0.039)	(0.037)	(0.038)	(0.023)	(0.061)	(0.045)
(e) Religious beliefs	0.173	0.217**	-0.041	0.124*	0.155	0.164
	(0.125)	(0.083)	(0.104)	(0.069)	(0.175)	(0.112)
(f) Moral emotions	-0.151*	0.007	0.012	0.002	-0.042	-0.003
	(0.087)	(0.036)	(0.061)	(0.040)	(0.041)	(0.034)

trust of in-groups). *Moral values* are measured as the relative importance of universal over communal moral values based on responses to the Moral Foundations Questionnaire (a higher value indicates greater weight on universal values). *Religious beliefs* are measured using the following question from the World Values Survey: "How important is God in your life?" (a higher value indicates more important). *Moral emotions* are measured as the relative strength of emotions of guilt versus shame based on responses to the Test of Self-Conscious Affect (a higher value indicates greater strength of reaction to guilt). *Emotion/value* is measured as the moral relevance of purity / disgust based on responses to the Moral Foundations Questionnaire (a higher value indicates more relevant).

(g) Emotion/value	-0.155	0.148**	0.066	0.313***	0.009	-0.151**
	(0.156)	(0.061)	(0.116)	(0.061)	(0.144)	(0.064)
Constant	0.630	-0.415	1.965	-3.283	-1.399	5.072
	(4.487)	(2.402)	(4.454)	(4.049)	(7.232)	(5.712)
Observations	42	100	86	36	116	104
R-squared	0.374	0.353	0.130	0.618	0.212	0.228

Notes: OLS regressions with robust standard errors clustered by subject ID in parentheses. The dependent variable in panel A is an indicator variable for a third-party player *i*'s decision to first-order punish. The dependent variable in panel B is a third-party player *i*'s punishment points given to a PD player. The control variables include a dummy for female, age, economic major, number of siblings, income rank and the Raven's test score. OLS models were used because probit/tobit regression models with the full set of variables did not converge in the Baseline treatment due to small sample size. [#1] This variable is the difference between *i*'s stated attitude to third-party punishment and their stated attitude to direct punishment (see the notes to Table 3 for the survey questions underlying the two measures). [#2] This variable is third parties' beliefs about the percentage of cooperators in the groups that they do not belong to. Variables (c)-(g) are defined in footnote 37.

First, personal and descriptive norms may partly explain cross-societal differences in third-party punishment. In the UK, subjects' personal willingness to engage in third-party relative to direct punishment and their beliefs about the cooperation of others are positive and significant behavioral predictors of first-order punishment in the Baseline treatment only. These normative channels appear fragile when multiple third parties decide independently in a group, which may contribute to the negative group size effect observed in this treatment. In India, a qualitatively similar - but weaker - effect is found for beliefs about cooperation (the coefficient on this variable is not significant for punishment frequency, and the size of the coefficient is smaller than in the UK for punishment strength). On the other hand, personal attitudes toward third-party punishment are a highly significant predictor of punishment strength in the Higher-Order treatment only. Why these normative channels interact differently among the treatments across research sites remains an open question. One possible explanation is that the awareness of other third parties triggers pro-social emotions that strengthen third parties' punishment of defectors, such as pride (e.g., Bowles and Gintis, 2005), in some cultures but not in others.

Second, which domain of moral systems drives third-party punishment exhibits cross-societal differences. In the UK, in-group favoritism is a strong positive predictor of punishment frequency and strength in the Baseline treatment. This variable has no significant effect on punishment strength or frequency in the Baseline treatment in India. In contrast, in India, moral values and emotion/value are both strong positive predictors of third-party punitive activities in the Baseline treatment. In both the countries, the effects of these domains are weaker with than without third-party peers. This observation suggests that other factors (material calculations in the UK; punitive inclinations in India) may play a more important role in driving punishment in the Trio and Higher-Order treatments.

As discussed in Section 5 and in this section, higher-order punishment was better targeted in the UK than in India. As a result, higher-order punishment transformed the incentive structure in the primary cooperation problem to a stag-hunt game in the UK (Section 5.1). Determinants of the cross-societal differences can again be examined using a regression approach. The results are summarized in Appendix Tables C.22 and C.23. For higher-order punishment of PEC ("mutual cooperation" and "victim" scenarios), the main findings display some similarity to the first-order punishment case in that personal norms have stronger predictive power for cooperation-conducive higher-order punishment in India;

descriptive norms (based on the PD players' higher-order belief elicitation in Stage 3) have strong predictive power for cooperation-conducive higher-order punishment in both societies. For cooperation-conducive higher-order punishment of PEO ("betrayal" and "mutual defection" scenarios), descriptive norms also have significant predictive power in the UK, together with religious beliefs and emotion/value, whereas none of these predictors are significant in India.

7. Conclusions

Situations in which multiple (uninvolved) third parties encounter a norm violation are observed across contemporary societies. As third-party punishment is a second-order public good, existing theory emphasizes the role of second-order punishment in disciplining first-order punishment in such situations: i.e., punishment of the failure to sanction a defector (e.g., Hadfield and Weingast, 2013; Axelrod, 1986; Henrich, 2004; Henrich and Boyd, 2001) or punishment for committing an unjustified punishment act (e.g., Kamei and Putterman, 2015). However, to date, there is minimal experimental research on third parties' punitive tendencies and the welfare consequences of third-party punishment when there are multiple third parties per group. Further, there is no previous research that experimentally studies third parties' higher-order punishment activities.

The present study aimed to investigate the (first-order and second-order) punishment tendencies of third parties and their potential impact on social welfare when multiple third parties are present. For this purpose, the study conducted experiments in India (Sonipat) and the UK (Newcastle). The two societies were selected based on Enke's (2019) ancestral kinship tightness index: the UK with a low score indicating relatively loose ancestral kinship ties, and India with a high score indicating relatively tight ancestral kinship ties, as cultures could affect punitive tendencies.

The experiment results first uncovered punishment patterns of third parties that are consistent with earlier experiments: In both societies, third parties punished a defector who exploited his/her matched cooperator in "betrayal" more frequently and strongly than in any other scenario.

However, there was a clear contrast in the group size effect between the two societies. On the one hand, third-party punishment of a defector in "betrayal" was less frequent and weaker when having multiple third parties per group in the Trio treatment than a single third party in the UK. Due to this negative group size effect, while aggregate punishment changed defection from being the strictly dominant strategy to the weakly dominant strategy of the game, it was not strong enough to make mutual cooperation an equilibrium for the PD players. The treatment with higher-order punishment opportunities revealed that (a) both third parties' failure to sanction a defector and commission of anti-social punishment attracted more frequent and stronger second-order punishment than in any other first-order punishment scenario; and (b) the per-third-party first-order punishment of a defector in "betrayal" was imposed at such a strong level that aggregate punishment transformed the incentive structure in the primary cooperation problem to a stag-hunt game in which mutual cooperation is a payoff dominant Nash Equilibrium outcome.

On the other hand, third parties' inclination to punish per se was small, and the negative group size effect was not observed in India. As their overall punishment levels were low and second-order punishments were less disciplined than in the UK, despite the increased number of third parties, aggregate punishment remained too weak to transform the incentive structure of the prisoner's dilemma in India.

Overall, these punitive patterns are consistent with a model of norm conformity for the UK and do not contradict such a model for India. Subjects' responses in the post-experiment survey provide suggestive evidence that this contrast in first-order and second-order punishments may be driven by cross-societal differences in personal punishment preferences and inclinations to adhere to social norms.

To summarize, in the study of third-party punishment, researchers may wish to consider the effects of norms, culture and historical backgrounds in determining contemporary patterns of sanction enforcement.

Lastly, it should be noted that while the experimental result is clear, this research is only the first step in exploring the role of higher-order enforcement among multiple third parties. For instance, this study adopted a one-shot design to isolate punishment preferences as cleanly as possible. However, a drawback of using this setup is the difficulty in assessing social desirability, because it does not allow for measurement of long-term gains of third-party punishment and higher-order enforcement. These long-term gains may be much larger relative to the short-term gains evaluated based on the welfare calculations (performed in Figures 4 and 8) because punishment may not be necessary in the long run once cooperation is stabilized in a society. An investigation of dynamic patterns of higher-order enforcement and a complete form of social desirability analysis remains for further research.

Another area that is worthwhile investigating is the conditions under which higher-order enforcement disciplines third-party punishment or alternative institutions that do the same. While the effects of higher-order enforcement were different between the UK and India, specific causes behind the difference remain unclear. To answer this, it would be meaningful to collect systematic data on injunctive norms in both countries that can be used as the basis for the theory of norm conformity. Such investigations would provide insights on institutions that could discipline punitive norms in either country. Human cooperative and punitive tendencies are known to differ markedly by country (Hermann *et al.*, 2008). Hence, more experiments are needed to establish the generalizability of these findings in other countries and contexts.

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References

Acemoglu, Daron, and Matthew O. Jackson. 2017. Social norms and the enforcement of laws. *Journal of the European Economic Association* 15(2), 245-295.

Acemoglu, Daron, and Alexander Wolitzky. 2020. Sustaining cooperation: Community enforcement versus specialized enforcement. *Journal of the European Economic Association* 18(2), 1078-1122.

Acemoglu, Daron, and Alexander Wolitzky. 2021. A theory of equality before the law. *Economic Journal* 131(636), pp.1429-1465.

Ahn, T.K., Elinor Ostrom, David Schmidt, Robert Shupp, and James Walker. 2001. Cooperation in PD Games: Fear, greed, and history of play. *Public Choice* 106, 137-155.

Akerlof, George. 1997. Social Distance and Social Decisions. *Econometrica* 65, 1005-1027.

Alesina, Alberto, and Paola Giuliano. 2013. Family Ties. *Handbook of Economic Growth* 2, 177.

Ambrus, Attila, and Ben Greiner. 2019. Individual, dictator, and democratic punishment in public good games with perfect and imperfect observability. *Journal of Public Economics*, 178, 104053.

Andreoni, James, and Laura K. Gee. 2012. Gun for hire: Delegated enforcement and peer punishment in public goods provision. *Journal of Public Economics*, 96(11-12), 1036-1046.

Axelrod, Robert. 1986. An Evolutionary Approach to Norms. *American Political Science Review* 80(4), 1095-1111.

Bénabou, Roland, and Jean Tirole. 2006. Incentives and Prosocial Behavior. American Economic Review, 96(5), 1652–1678.

Bernhard, Helen, Ernst Fehr, and Urs Fischbacher. 2006. Group Affiliation and Altruistic Norm Enforcement. *American Economic Review* 96(2), 217-221.

Bernheim, Douglas. 1994. A Theory of Conformity. *Journal of Political Economy* 102, 841-877.

Bicchieri, Cristina. 2017. *Norms in the Wild: How to Diagnose, Measure, and Change Social Norms*. Oxford University Press.

Bock, Olaf, Ingmar Baetge, and Andreas Nicklisch. 2014. *hroot*: Hamburg Registration and Organization Online Tool. *European Economic Review* 71, 117-120.

Bolle, Friedel, Jonathan Tan, and Daniel Zizzo. 2014. Vendettas. *American Economic Journal: Microeconomics* 6(2), 93-130.

Bolton, Gary E., and Axel Ockenfels. 2000. ERC: A theory of equity, reciprocity, and competition. *American Economic Review* 91(1), 166-193.

Bowles, Samuel, and Herbert Gintis. 2005. Prosocial emotions, In *The Economy as a Complex. Evolving System III: Essays in Honor of Kenneth Arrow* (eds: Blume, L., Durlauf, S.), Oxford University Press: Oxford, UK; pp. 337–367.

Boyd, Robert, and Peter Richerson. 1992. Punishment Allows the Evolution of Cooperation (or Anything Else) in Sizable Groups. *Ethology and Sociobiology* 13(3), 171-195.

Boyd, Robert, and Peter Richerson. 2009. Culture and the Evolution of Human Cooperation. *Philosophical Transactions of the Royal Society B: Biological Sciences* 364(1533), 3281-3288.

Boyd, Robert, and Peter Richerson. 2010. Transmission Coupling Mechanisms: Cultural Group Selection. *Philosophical Transactions of the Royal Society B: Biological Sciences* 365(1559), 3787-3795.

Chen, Daniel, Schonger, Martin, and Chris Wickens. 2016. oTree - An open-source platform for laboratory, online and field experiments. *Journal of Behavioral and Experimental Finance* 9, 88-97.

Cinyabuguma, Matthias, Talbot Page, and Louis Putterman. 2006. Can second-order punishment deter perverse punishment? *Experimental Economics* 9, 265-279.

Dal Bó, Pedro, Andrew Foster, and Louis Putterman. 2010. Institutions and behavior: Experimental evidence on the effects of democracy. *American Economic Review* 100(5), 2205-2229.

Dal Bó, Pedro., Guillaume Fréchette, and Jeongbin Kim. 2021. The Determinants of Efficient Behavior in Coordination Games. *Games and Economic Behavior* 130, 352-68.

Denant-Boemont, Laurent, David Masclet, and Charles Noussair, 2007. Punishment, Counterpunishment and Sanction Enforcement in a Social Dilemma Experiment. *Economic Theory* 33, 145-167.

Dixit, Avinash. 2003. Trade expansion and contract enforcement. *Journal of Political Economy* 111(6), 1293-1317.

Dufwenberg, Martin, and Georg Kirchsteiger, 2004. A theory of sequential reciprocity. *Games and Economic Behavior* 47, 268-298.

Enke, Benjamin. 2018. Replication Data for: 'Kinship, Cooperation, and the Evolution of Moral Systems'", https://doi.org/10.7910/DVN/JX1OIU, Harvard Dataverse, V1.

Enke, Benjamin. 2019. Kinship Systems, Cooperation and the Evolution of Culture. *Quarterly Journal of Economics* 134(2), 953-1019.

Ertan, Arhan, Talbot Page, and Louis Putterman. 2009. Who to punish? Individual Decisions and Majority Rule in Mitigating the Free Rider Problem. *European Economic Review* 53, 495-511.

Fehr, Ernst, and Urs Fischbacher. 2004. Third-Party Punishment and Social Norms. *Evolution and Human Behavior* 25(2), 63-87.

Fehr, Ernst, and Simon Gächter. 2000. Cooperation and Punishment in Public Goods Experiments. *American Economic Review* 90(4), 980-994.

Fehr, Ernst, and Simon Gächter. 2002. Altruistic Punishment in Humans. *Nature* 415(6868), 137-140.

Fehr, Ernst, and Klaus Schmidt, 1999. A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114(3), 817-868.

Fehr, Ernst, and Klaus Schmidt. 2006. The Economics of Fairness, Reciprocity and Altruism—Experimental Evidence and New Theories. In *Handbook of the Economics of Giving, Altruism and Reciprocity*, edited by S.-G. Kolm and J. M. Ythier, pp. 615-91. North Holland.

Fehr, Ernst, and Klaus Schmidt, 2010. On inequity aversion: A reply to Binmore and Shaked. *Journal of Economic Behavior & Organization* 73(1), 101-108.

Fehr, Ernst, and Tony Williams. 2018. Social Norms, Endogenous Sorting and the Culture of Cooperation. IZA Discussion Papers 11457.

Fischbacher, Urs, Simon Gächter, and Ernst Fehr. 2001. Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters* 71(3): 397-404.

Fischbacher, Urs, and Simon Gächter, 2010. Social Preferences, Beliefs, and the Dynamics of Free Riding in Public Goods Experiments. *American Economic Review* 100(1), 541-56.

Fu, Tingting, Yunan Ji, Kenju Kamei, and Louis Putterman. 2017. Punishment Can Support Cooperation Even When Punishable. *Economics Letters* 154, 84-87.

Gelfand, Michele J *et al.* 2011. Differences between tight and loose cultures: A 33-nation study. *Science* 332(6033), 1100-1104.

Giuliano, Paola, and Nathan Nunn. 2018. Ancestral Characteristics of Modern Populations. *Economic History of Developing Regions* 33(1), 1-17.

Greif, Avner. 1993. Contract Enforceability and Economic Institutions in Early Trade: The Maghribi Traders' Coalition. *American Economic Review* 83(3) 525-548.

Hadfield, Gillian, and Barry Weingast. 2013. Law Without the State: Legal Attributes and the Coordination of Decentralized Collective Punishment. *Journal of Law and Courts* 1(1), 3-34.

Harrington, Jesse R., and Michele J. Gelfand. 2014. Tightness–looseness across the 50 united states. *Proceedings of the National Academy of Sciences* 111(22), 7990-7995.

Harsanyi, John, and Reinhard Selten. 1988. A General Theory of Equilibrium Selection in Games. *MIT Press Classics*.

Hechter, Michael. 1987. Principles of Group Solidarity. University of California Press: Berkeley.

Henrich, Joseph. 2004. Cultural Group Selection, Coevolutionary Processes and Large-Scale Cooperation. *Journal of Economic Behavior & Organization* 53(1), 3-35.

Henrich, Joseph, and Robert Boyd. 2001. Why People Punish Defectors: Weak Conformist Transmission Can Stabilize Costly Enforcement of Norms in Cooperative Dilemmas. *Journal of Theoretical Biology* 208, 79-89.

Henrich, Joseph *et al*. 2006. Costly Punishment Across Human Societies. *Science* 312(5781), 1767-70.

Henrich, Joseph *et al*. 2010. Markets, Religion, Community Size, and the Evolution of Fairness and Punishment. *Science* 327(5972), 1480-1484.

Henrich, Joseph. 2020. The WEIRDest people in the world: How the West became psychologically peculiar and particularly prosperous (Farrar, Straus and Giroux, New York, NY, 2020), vol. 1.

Herrmann, Benedikt, Christian Thöni, and Simon Gächter, 2008. Antisocial Punishment across Societies. *Science* 319(5868), 1362-1367.

Hopfensitz, Astrid, and Ernesto Reuben. 2009. The Importance of Emotions for the Effectiveness of Social Punishment. *Economic Journal* 119(540), 1534-1559.

Jordan, Jillian, Katherine McAuliffe, and David Rand. 2016. The Effects of Endowment Size and Strategy Method on Third Party Punishment. *Experimental Economics* 19, 741-763.

Kamei, Kenju, 2014. Conditional Punishment. *Economics Letters* 124(2), 199-202.

Kamei, Kenju. 2018. The Role of Visibility on Third Party Punishment Actions for the Enforcement of Social Norms. *Economics Letters* 171, 193-197.

Kamei, Kenju. 2020. Group Size Effect and Over-Punishment in the Case of Third Party Enforcement of Social Norms. *Journal of Economic Behavior & Organization* 175, 395-412.

Kamei, Kenju, and Louis Putterman, 2015. In Broad Daylight: Fuller Information and Higher-Order Punishment Opportunities Can Promote Cooperation. *Journal of Economic Behavior & Organization* 120, 145-159.

Kamei, Kenju, Louis Putterman, and Jean-Robert Tyran. 2015. State or Nature? Endogenous Formal versus Informal Sanctions in the Voluntary Provision of Public Goods. *Experimental Economics* 18, 38-65.

Kamei, Kenju, Louis Putterman, and Jean-Robert Tyran. 2023. Civic Engagement, the Leverage Effect and the Accountable State. *European Economic Review* 156, # 104466.

Kamei, Kenju, Louis Putterman, Katy Tabero, and Jean-Robert Tyran. 2024. Civic Engagement as a Constraint on Corruption. CESifo Working Paper Series 11597.

Kessler, Judd, and Stephen Leider. 2012. Norms and Contracting. *Management Science* 58(1), 62-77.

Kosfeld, Michael, Akira Okada, and Arno Riedl. 2009. Institution Formation in Public Goods Games. *American Economic Review* 99(4), 1335-55.

Krügel, Jan, and Nicola Maaser. 2020. Cooperation and Norm-Enforcement under Impartial vs. Competitive Sanctions. Aarhus University Economics Working Paper 2020-15.

Krupka, Erin L., and Roberto A. Weber. 2013. Identifying social norms using coordination games: Why does dictator game sharing vary?. *Journal of the European Economic Association* 11(3), 495-524.

Kurzban, Robert, Peter DeScioli, and Erin O'Brien. 2007. Audience Effects on Moralistic Punishment. *Evolution and Human Behavior* 28, 75-84.

Lergetporer, Philipp, Silvia Angerer, Daniela Glätzle-Rützler, Matthias Sutter. 2014. Third-Party Punishment Increases Cooperation in Children through (Misaligned) Expectations and Conditional Cooperation. *Proceedings of the National Academy of Sciences USA* 111, 6916-6921.

Levine, David K., and Salvatore Modica. 2016. Peer discipline and incentives within groups. *Journal of Economic Behavior & Organization* 123, 19-30.

Lieberman, Debra, and Lance Linke. 2007. The Effect of Social Category on Third Party Punishment. *Evolutionary Psychology* 5(2), 289-305.

Marcin, Isabel, Pedro Robalo, and Franziska Tausch. 2019. Institutional Endogeneity and Third-Party Punishment in Social Dilemmas. *Journal of Economic Behavior & Organization* 161, 243-264.

Markussen, Thomas, Louis Putterman, and Jean-Robert Tyran. 2014. Self-organization for collective action: An experimental study of voting on sanction regimes. *Review of Economic Studies*, 81(1), 301-324.

Marlowe, Frank *et al.* 2008. More 'Altruistic' Punishment in Larger Societies. *Proceedings of the Royal Society B* 275, 587-590.

Martin, Justin, Jillian Jordan, David Rand, Fiery Cushman, 2019. When Do We Punish People Who Don't? *Cognition* 193, 104040.

Mathew, Sarah, and Robert Boyd. 2011. Punishment Sustains Large-Scale Cooperation in Prestate Warfare. *Proceedings of the National Academy of Sciences* 108(28), 11375-11380.

McAuliffe, Katherine, Jillian Jordan, and Felix Warneken. 2015. Costly Third-Party Punishment in Young Children. *Cognition* 134, 1-10.

McMillan, John, and Christopher Woodruff. 1999a. Interfirm Relationships and Informal Credit in Vietnam. *Quarterly Journal of Economics* 114(4), 1285-1320.

McMillan, John, and Christopher Woodruff. 1999b. Dispute Prevention without Courts in Vietnam. *Journal of law, Economics, and Organization* 15(3), 637-658.

Michaeli, Moti, and Daniel Spiro. 2013. Norm Conformity across Societies. *Journal of Public Economics* 132, 51-65.

Murdock, George Peter. 1967. Ethnographic Atlas: A Summary, *Ethnology*, 6, 109–236.

Nelissen, Rob, and Marcel Zeelenberg. 2009. Moral Emotions as Determinants of Third-Party Punishment: Anger, Guilt, and the Functions of Altruistic Sanctions. *Judgment and Decision making* 4, 543-553.

Nicklisch, Andreas, Kristoffel Grechenig, and Christian Thöni. 2016. Information-sensitive Leviathans. *Journal of Public Economics* 144, 1-13.

Nikiforakis, Nikos. 2008. Punishment and Counter-punishment in Public Good Games: Can We Really Govern Ourselves? *Journal of Public Economics* 92, 91-112.

Nikiforakis, Nikos, and Dirk Engelmann, 2011. Altruistic Punishment and the Threat of Feuds. *Journal of Economic Behavior & Organization* 78(3), 319-332.

Noussair, Charles N., and Fangfang Tan. 2011. Voting on punishment systems within a heterogeneous group. *Journal of Public Economic Theory*, 13(5), 661-693.

Olson, Mancur, 1965. *The Logic of Collective Action*. Harvard University Press: Cambridge, Massachusetts.

Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

Ostrom, Elinor. 2010. Beyond markets and states: polycentric governance of complex economic systems. *American Economic Review*, *100*(3), 641-672.

Putterman, Louis, Jean-Robert Tyran, and Kenju Kamei. 2011. Public goods and voting on formal sanction schemes. *Journal of Public Economics*, 95(9-10), 1213-1222.

Rabin, Matthew. 1993. Incorporating fairness into game theory and economics. *American Economic Review*, 83, 1281-1302.

Rapoport, Anatol, and Albert Chammah. 1965. *Prisoner's dilemma*. University of Michigan Press: Ann Arbor.

Raven, John. 2000. The Raven's Progressive Matrices: Change and Stability over Culture and Time. *Cognitive Psychology* 41(1), 1-48.

Schulz, Jonathan F., Duman Bahrami-Rad, Jonathan P. Beauchamp, and Joseph Henrich. 2019. The Church, intensive kinship, and global psychological variation. *Science* 366(6466), eaau5141.

Sefton, Martin, Robert Shupp, and James Walker. 2007 The Effect of Rewards and Sanctions in the Provision of Public Goods. *Economic Inquiry*, 45, 671-90.

Sobel, Joel, 2005. Interdependent Preferences and Reciprocity. *Journal of Economic Literature* 43, 392-436.

Sharma, Smriti, and Abu Siddique. Forthcoming. Non-WEIRD Preferences. In U. Dasgupta & P. Maitra (Eds.) *Handbook of Experimental Development Economics*, Edward Elgar, forthcoming.

Sutter, Matthias, Stefan Haigner, and Martin G. Kocher. 2010. Choosing the carrot or the stick? Endogenous institutional choice in social dilemma situations. *Review of Economic Studies*, 77(4), 1540-1566.

Van Miltenburg, Nynke, Vincent Buskens, Davide Barrera, and Werner Raub. 2014. Implementing punishment and reward in the public goods game: the effect of individual and collective decision rules. *International Journal of the Commons*, 8(1), 47-78.

Supplementary Appendix

For Online Publication Only

Collective Sanction Enforcement: New Experimental Evidence from Two Societies

Kenju Kamei, Smriti Sharma, Matthew J. Walker

Appendix A: Experiment Instructions

A.1. General Instructions and Part 1

[At the onset of the experiment, the following instructions were read aloud, while the participants were also given printed copies of the instructions. The instructions at this stage were the same for all three treatments:]

Experimental Instructions

Welcome. You are now taking part in a decision-making experiment. You were randomly selected from the Experimental and Behavioural Economics Laboratory's pool of subjects to be invited to participate in this session. There will be several pauses for you to ask questions. During such a pause, please raise your hand if you want to ask a question. Apart from asking questions in this way, you must not communicate with anybody in this room or make any noise.

Depending on your decisions and the decisions of other participants, you will be able to earn money in addition to the £3 [INR 200 for the experiment sessions in India] guaranteed for your participation. During the experiment, your earnings will be calculated in points. At the end of the experiment your points will be converted to pounds sterling [Indian Rupees] at the following rate:

5 points = £1 [INR 70]

(or each point will be exchanged for 20 pence [INR 14] of real money). At the end of the experiment your total earnings obtained in the experiment and the £3 [INR 200] participation fee will be paid to you in cash [electronic payment]. Your payment will be rounded up to the nearest 10 pence [Rupees] (e.g., £9.40 if it is £9.33 [INR 550 if it is INR 544]). In case that your total earnings from the experiment are negative, you will receive the £3 [INR 200] participation fee.

The session is made up of 3 parts. In the first part you will complete the task described below.

I will describe the second part of the session after you have completed the first part.

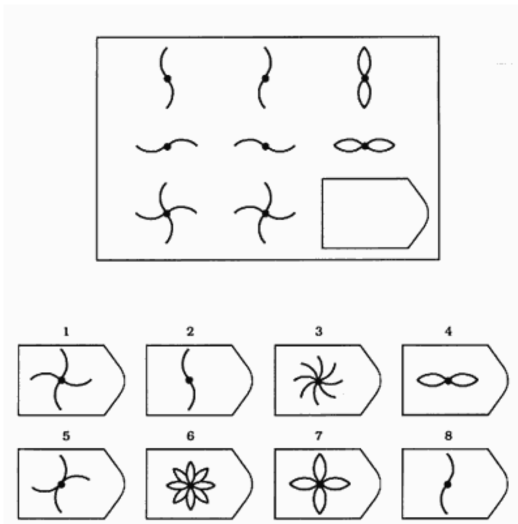
The third part of the session is a questionnaire (your responses to the questionnaire will not affect your earnings in the experiment). At the end of today's session, you will be informed of the outcome of your decisions and your total cash payment.

[Pause for questions]

Instructions for Part I

I will now describe the task which makes up the first part of the session. The task is made up of 12 questions. For every question, there is a pattern with a piece missing and a number of pieces below the pattern. You must choose which of the pieces below is the right one to complete the pattern, both along the rows and down the columns, but NOT the diagonals. You will see 8 pieces that might complete the pattern. In every case, one and only one of these pieces is the right one to complete the pattern.

For example (see pattern and pieces below):



The correct answer for this example is piece number 7.

For each question, please choose the piece that best fits the pattern. You will score 1 point for every correct answer. You will not be penalized for wrong answers. You will have 40 seconds to complete each question. The top of the screen will display the time remaining (in seconds).

[Pause for questions]

[Subjects complete Part I]

A.2. Instructions for Part 2

[Instructions for Part 2 differ by treatment. Once Part 1 is over, the following instructions were read aloud, while the participants were also given printed copies of the instructions:]

(a) Baseline Treatment:

Instructions for Part II

A. The Nature of Interactions

In this part of the session, you will be randomly assigned to a group of 3 persons. In each group, two persons will be randomly assigned the role of player A, and the third person will be assigned the role of player B. This part consists of two stages. **During this part, you will NOT communicate with any other player when making your decisions**.

Stage 1:

Two player As will interact with each other in their group. Specifically, **each player A will be given an endowment of 40 points, and then simultaneously decides whether or not to send 16 points to the other player A**. We will refer to the two player As in a group as "Player A1" and "Player A2." If Player A1 sends 16 points to Player A2, the 16 points will be tripled and becomes earnings of Player A2. Likewise, if Player A2 sends 16 points to Player A1, the 16 points will be tripled and becomes the earnings of Player A1. The possible payoffs from stage 1 are presented in the following decision matrix:

		Player A2	
		Send	Not send
Player A1	Send	(a) 72, 72	(c) 24, 88
	Not send	(b) 88, 24	(d) 40, 40

Note: The first number in each cell is Player A1's payoff, and the second number in each cell is Player A2's payoff.

Suppose that you are Player A1. There are 4 possible situations:

(a) Both you and Player A2 send 16 points to each other. In this situation, each player obtains 40 – 16 + (3 × 16) = 72 points.

(b) Player A2 sends 16 points to you, but you do not send 16 points to Player A2. In this situation, your earnings are 88 points. Player A2's earnings are 24 points.

(c) You send 16 points to Player A2, but Player A2 does not send 16 points to you. In this situation, your earnings are 24 points. Player A2's earnings are 88 points.

(d) Neither you nor Player A2 sends 16 points to each other. In this situation, you and Player A2 each obtain earnings of 40 points.

As indicated in the calculations above, your own earnings will be maximized when you do not send 16 points but Player A2 sends 16 points. However, if both players send 16 points to each other, the total earnings of the 2 players will be maximized and will be 72 × 2 points = 144 points; and each player obtains 72 points as earnings. Your earnings will be minimized if you send 16 points to Player A2 but Player A2 does not send 16 points to you.

[Pause for questions]

Stage 2:

In this stage, player Bs will be asked to decide how many points they want to reduce from the earnings of the two player As in their group.

Each player B will be given an endowment of 60 points. Each reduction point player B allocates to reduce a player A's earnings **reduces the player B's earnings by 1 point** and **reduces the player A's earnings by 3 points**. The reduction points targeted at each player A must be a multiple of 2, between zero and 10. If the Player B chooses zero as reduction points to a player A, the player A's earnings remain unchanged from Stage 1.

Specifically, each player B will be asked to make decisions for the following **four scenarios**:

(a) how many reduction points he or she would like to assign to a Player A1 who **sent** 16 points to Player A2 when Player A2 **also sent** 16 points to Player A1.

(b) how many reduction points he or she would like to assign to a Player A1 who **did not send** 16 points to Player A2 when Player A2 **sent** 16 points to Player A1.

(c) how many reduction points he or she would like to assign to a Player A1 who **sent** 16 points to Player A2 when Player A2 **did not send** 16 points to Player A1.

(d) how many reduction points he or she would like to assign to a Player A1 who **did not send** 16 points to Player A2 when Player A2 **also did not send** 16 points to Player A1.

Two of the four scenarios will be applied based on the two player As' actual sending decisions. For example, suppose that Player A1 did not send 16 points while Player A2 did. In this case, player Bs' decisions in (b) and (c) would be applied. Alternatively, suppose that both Player A1 and Player A2 did not send 16 points. In this case, player Bs' decisions in (d) would be applied twice, i.e., **to both Player As**.

Note:

Some further questions will appear on your screen during this part of the session when your role (either player A or player B) does not have a decision to make. In some cases, you will have an opportunity to add to your payoff based on the accuracy of your answers. Instruction for these will be provided to you on the computer screen.

[Pause for questions]

B. Your Earnings

If you are assigned the role of player A, your earnings for this part will be calculated as:

Your earnings in Stage 1 (= 24, 40, 72 or 88)

minus

total reduction amounts you received from player B

Total reduction amounts you received from player B are sum of reduction points from the player B in your group times 3. If the net amount becomes negative, then the payoff will be 0.

In addition, player As may receive points from stage 2 based on the accuracy of their answers to some questions that appear on the computer screen in this stage.

If you are assigned the role of player B, your earnings for this part will be calculated as:

Your endowment from Stage 2 (= 60)

minus

the sum of reduction points you assigned to player As

For instance, if a player B assigns 4 reduction points to Player A1 and 10 reduction points to the Player A2, then the player B obtains a payoff after stage 2 of 46 points (= 60 – 4 – 10).

In addition, player Bs may receive points from stage 1 based on the accuracy of their answers to some questions that appear on the computer screen in this stage.

Any questions? We will now move on to the comprehension quiz, which will appear on your computer screen. Once everyone has successfully completed this, Stage 1 will begin. During the quiz, please raise your hand if you are stuck on any question.

[Subjects complete the comprehension question – see Section A.3 of the Appendix]

[Subjects complete Part II]

[Instructions for Part III on screen]

(b) Trio Treatment:

Instructions for Part II

A. The Nature of Interactions

In this part of the session, you will be randomly assigned to a group of 5 persons. In each group, two persons will be randomly assigned the role of player A, and the rest of persons will be assigned the role of player B. Thus, the number of persons who will be assigned the role of player B is three. This part consists of two stages. **During this part, you will NOT communicate with any other player when making your decisions**.

Stage 1:

Two player As will interact with each other in their group. Specifically, **each player A will be given an endowment of 40 points, and then simultaneously decides whether or not to send 16 points to the other player A**. We will refer to the two player As in a group as "Player A1" and "Player A2." If Player A1 sends 16 points to Player A2, the 16 points will be tripled and becomes earnings of Player A2. Likewise, if Player A2 sends 16 points to Player A1, the 16 points will be tripled and becomes the earnings of Player A1. The possible payoffs from stage 1 are presented in the following decision matrix:

		Player A2	
		Send	Not send
Player A1	Send	(a) 72, 72	(c) 24, 88
	Not send	(b) 88, 24	(d) 40, 40

Note: The first number in each cell is Player A1's payoff, and the second number in each cell is Player A2's payoff

Suppose that you are Player A1. There are 4 possible situations:

(a) Both you and Player A2 send 16 points to each other. In this situation, each player obtains 40 – 16 + (3 × 16) = 72 points.

(b) Player A2 sends 16 points to you, but you do not send 16 points to Player A2. In this situation, your earnings are 88 points. Player A2's earnings are 24 points.

(c) You send 16 points to Player A2, but Player A2 does not send 16 points to you. In this situation, your earnings are 24 points. Player A2's earnings are 88 points.

(d) Neither you nor Player A2 sends 16 points to each other. In this situation, you and Player A2 each obtain earnings of 40 points.

As indicated in the calculations above, your own earnings <u>will be maximized</u> when you <u>do not</u> send 16 points but Player A2 <u>sends</u> 16 points. However, if <u>both</u> players <u>send</u> 16 points to each other, the <u>total earnings</u> of the 2 players <u>will be maximized</u> and will be 72 × 2 points = 144 points; and each player obtains <u>72 points</u> as earnings. Your earnings <u>will be minimized</u> if you <u>send</u> 16 points to Player A2 but Player A2 <u>does not</u> send 16 points to you.

[Pause for questions]

<u>Stage 2</u>:

In this stage, <u>player Bs will be asked to decide how many points they want to reduce from the earnings of the two player As in their group</u>. **The number of player Bs in a group is 3** and player Bs **simultaneously** make such reduction decisions.

Each player B will be given an endowment of 60 points. Each reduction point player B allocates to reduce a player A's earnings **reduces the player B's earnings by 1 point** and **reduces the player A's earnings by 3 points**. The reduction points targeted at each player A must be a multiple of 2, between zero and 10. If all three player Bs choose zero as reduction points to a player A, the player A's earnings remain unchanged from Stage 1.

Specifically, each player B will be asked to make decisions for the following **four scenarios**:

(a) how many reduction points he or she would like to assign to a Player A1 who **<u>sent</u>** 16 points to Player A2 when Player A2 **<u>also sent</u>** 16 points to Player A1.

(b) how many reduction points he or she would like to assign to a Player A1 who **<u>did not send</u>** 16 points to Player A2 when Player A2 **<u>sent</u>** 16 points to Player A1.

(c) how many reduction points he or she would like to assign to a Player A1 who **<u>sent</u>** 16 points to Player A2 when Player A2 **<u>did not send</u>** 16 points to Player A1.

(d) how many reduction points he or she would like to assign to a Player A1 who **<u>did not send</u>** 16 points to Player A2 when Player A2 **<u>also did not send</u>** 16 points to Player A1.

Two of the four scenarios will be applied based on the two player As' actual sending decisions. For example, suppose that Player A1 did not send 16 points while Player A2 did. In this case, player Bs' decisions in (b) and (c) would be applied. Alternatively, suppose that both Player A1 and Player A2 did not send 16 points. In this case, player Bs' decisions in (d) would be applied twice, i.e., **to both Player As**.

<u>Note</u>:

Some further questions will appear on your screen during this part of the session when your role (either player A or player B) does not have a decision to make. In some cases, you will have an opportunity to add to your payoff based on the accuracy of your answers. Instruction for these will be provided to you on the computer screen.

[Pause for questions]

B. Your Earnings

If you are assigned the role of player A, your earnings for this part will be calculated as:

Your earnings in Stage 1 (= 24, 40, 72 or 88)

minus

total reduction amounts you received from player Bs

Total reduction amounts you received from player Bs are sum of reduction points from all three player Bs in your group times 3. If the net amount becomes negative, then the payoff will be 0.

In addition, player As may receive points from stage 2 based on the accuracy of their answers to some questions that appear on the computer screen in this stage.

If you are assigned the role of player B, your earnings for this part will be calculated as:

Your endowment from Stage 2 (= 60)

minus

the sum of reduction points you assigned to player As

For instance, if a player B assigns 4 reduction points to Player A1 and 10 reduction points to the Player A2, then the player B obtains a payoff after stage 2 of 46 points (= 60 – 4 – 10).

In addition, player Bs may receive points from stage 1 based on the accuracy of their answers to some questions that appear on the computer screen in this stage.

Any questions? We will now move on to the comprehension quiz, which will appear on your computer screen. Once everyone has successfully completed this, Stage 1 will begin. During the quiz, please raise your hand if you are stuck on any question.

[Subjects complete the comprehension question – see Section A.3 of the Appendix]

[Subjects complete Part II]

[Instructions for Part III on screen]

(c) Higher-Order Treatment:

Instructions for Part II

A. Nature of Interactions

In this part of the session, you will be randomly assigned to a group of 5 persons. In each group, two persons will be randomly assigned the role of player A, and the rest of persons will be assigned the role of player B. Thus, the number of persons who will be assigned the role of player B is three. This part consists of three stages. **During this part, you will NOT communicate with any other player when making your decisions**.

Stage 1:

Two player As will interact with each other in their group. Specifically, **each player A will be given an endowment of 40 points, and then simultaneously decides whether or not to send 16 points to the other player A**. We will refer to the two player As in a group as “Player A1” and “Player A2.” If Player A1 sends 16 points to Player A2, the 16 points will be tripled and becomes earnings of Player A2. Likewise, if Player A2 sends 16 points to Player A1, the 16 points will be tripled and becomes the earnings of Player A1. The possible payoffs from stage 1 are presented in the following decision matrix:

		Player A2	
		Send	Not send
Player A1	Send	(a) 72, 72	(c) 24, 88
	Not send	(b) 88, 24	(d) 40, 40

Note: The first number in each cell is Player A1’s payoff, and the second number in each cell is Player A2’s payoff

Suppose that you are Player A1. There are 4 possible situations:

(a) Both you and Player A2 send 16 points to each other. In this situation, each player obtains 40 – 16 + (3 × 16) = 72 points.

(b) Player A2 sends 16 points to you, but you do not send 16 points to Player A2. In this situation, your earnings are 88 points. Player A2’s earnings are 24 points.

(c) You send 16 points to Player A2, but Player A2 does not send 16 points to you. In this situation, your earnings are 24 points. Player A2’s earnings are 88 points.

(d) Neither you nor Player A2 sends 16 points to each other. In this situation, you and Player A2 each obtain earnings of 40 points.

As indicated in the calculations above, your own earnings will be maximized when you do not send 16 points but Player A2 sends 16 points. However, if both players send 16 points to each other, the total earnings of the 2 players will be maximized and will be 72 × 2 points = 144 points; and each player obtains 72 points as earnings. Your earnings will be minimized if you send 16 points to Player A2 but Player A2 does not send 16 points to you.

[Pause for questions]

Stage 2:

In this stage, player Bs will be asked to decide how many points they want to reduce from the earnings of the two player As in their group. **The number of player Bs in a group is 3** and player Bs **simultaneously** make such reduction decisions.

Each player B will be given an endowment of 60 points. Each reduction point player B allocates to reduce a player A's earnings **reduces the player B's earnings by 1 point** and **reduces the player A's earnings by 3 points**. The reduction points targeted at each player A must be a multiple of 2, between zero and 10. If all three player Bs choose zero as reduction points to a player A, the player A's earnings remain unchanged from Stage 1.

Specifically, each player B will be asked to make decisions for the following **four scenarios**:

(a) how many reduction points he or she would like to assign to a Player A1 who **sent** 16 points to Player A2 when Player A2 **also sent** 16 points to Player A1.

(b) how many reduction points he or she would like to assign to a Player A1 who **did not send** 16 points to Player A2 when Player A2 **sent** 16 points to Player A1.

(c) how many reduction points he or she would like to assign to a Player A1 who **sent** 16 points to Player A2 when Player A2 **did not send** 16 points to Player A1.

(d) how many reduction points he or she would like to assign to a Player A1 who **did not send** 16 points to Player A2 when Player A2 **also did not send** 16 points to Player A1.

Two of the four scenarios will be applied based on the two player As' actual sending decisions. For example, suppose that Player A1 did not send 16 points while Player A2 did. In this case, player Bs' decisions in (b) and (c) would be applied. Alternatively, suppose that both Player A1 and Player A2 did not send 16 points. In this case, player Bs' decisions in (d) would be applied twice, i.e., **to both Player As**.

[Pause for questions]

Stage 3:

In this stage, player Bs will be asked to decide how many points they want to reduce from the earnings of the other two player Bs in the group, based on their reduction decisions in Stage 2. The player Bs **simultaneously** make such reduction decisions (they will not be informed of the other player Bs' reduction decisions at the decision stage).

The reduction schedule in Stage 3 is the same as in Stage 2. Specifically, each reduction point player B allocates to reduce another player B's earnings **reduces his or her own earnings by 1 point** and **reduces the target's earnings by 3 points**. The reduction points targeted at each of the other player Bs must be a multiple of 2, between zero and 10.

Each player B will be asked to assign reduction points to the other player Bs in the group for **thirty randomly chosen scenarios** from stages 1 and 2. Each scenario consists of one of the four possible situations from stage 1 and a pair of player B reduction decisions from stage 2.

The thirty scenarios include the real scenarios you have in your group after Stage 2. For example, suppose that one Player A in your group did not send 16 points while the other Player A did. In this case, one scenario would include your peers' reduction decisions in (b), and another scenario would include your peers' reduction decisions in (c). Alternatively, suppose that the two Player As in your group did not send 16 points. In this case, only your peers' reduction decisions in (d) are relevant.

You will not be informed of which are the real scenarios when you make your reduction decisions in this stage. Your reduction decision in the real scenarios will affect the earnings of you and the other Player Bs. Since there are two other Player Bs in your group, your decisions will be applied to **both player Bs.**

Note:

Some further questions will appear on your screen during this part of the session when your role (either player A or player B) does not have a decision to make. In some cases, you will have an opportunity to add to your payoff based on the accuracy of your answers. Instruction for these will be provided to you on the computer screen.

[Pause for questions]

B. Your Earnings

If you are assigned the role of player A, your earnings for this part will be calculated as:

Your earnings in Stage 1 (= 24, 40, 72 or 88)

minus

total reduction amounts you received from player Bs

Total reduction amounts you received from player Bs are sum of reduction points from all three player Bs in your group times 3. If the net amount becomes negative, then the payoff will be 0.

In addition, player As may receive points from stages 2 and 3 based on the accuracy of their answers to some questions that appear on the computer screen in these stages.

If you are assigned the role of player B, your earnings for this part will be calculated as:

Your endowment from Stage 2 (= 60)

minus

(i) the sum of reduction points you assigned to player As

minus

(ii) the sum of reduction points you assigned to other player Bs

minus

(iii) total reduction amounts you received from other player Bs

Total reduction amounts you received from other player Bs (term (iii)) are the sum of reduction points assigned to you by the other two player Bs in your group times 3. If the net amount becomes negative, then the payoff will be 0.

For instance, let us refer to the three player Bs in a group as "Player B1," "Player B2" and "Player B3." If Player B1:

(i) assigns 4 reduction points to Player A1 and 10 reduction points to Player A2,

then Player B1 obtains a payoff after stage 2 of 46 points (=60 – 4 – 10). If, in stage 3, Player B1:

(ii) assigns a sum of 0 reduction points to Player B2,
assigns a sum of 8 reduction points to Player B3; and
(iii) receives total reduction amounts of 18 from Players B2 and B3,

then Player B1 obtains a final payoff of 20 points (=46 – 0 – 8 – 18).

In addition, player Bs may receive points from stage 1 based on the accuracy of their answers to some questions that appear on the computer screen in this stage.

Any questions? We will now move on to the comprehension quiz, which will appear on your computer screen. Once everyone has successfully completed this, Stage 1 will begin. During the quiz, please raise your hand if you are stuck on any question.

[Subjects complete the comprehension question – see Section A.3 of the Appendix]

[Subjects complete Part II]

[Instructions for Part III on screen]

A.3. Comprehension Questions for Part 2 Instructions

1. How many persons in each group will be assigned the role of player A? *Answer – 2.*
2. How many persons in each group will be assigned the role of player B? *Answer – 1 [3].*

Suppose that Player A1 sends 16 points to Player A2, and Player A2 does not send 16 points to Player A1.

3. What is the Stage 1 payoff of Player A1? *Answer – 24.*
4. What is the Stage 1 payoff of Player A2? *Answer – 88.*

5. How much does it cost a player B to reduce the earnings of another player by 9 points? *Answer – 3.*

Suppose that Player A1 obtains 40 points in Stage 1 and receives total reduction amounts of 18 from player B[s] in Stage 2.

6. What are Player A1's earnings? *Answer – 22.*

[Baseline/Trio treatment:]

Each player B is endowed with 60 points. Suppose that a player B assigns 6 reduction points to Player A1 and 4 reduction points to Player A2.

7. What are the player B's earnings? *Answer – 50.*

[Higher-Order treatment:]

Each player B is endowed with 60 points. Let us refer to the three player Bs in a group as "Player B1," "Player B2" and "Player B3." Suppose that Player B1:

(i) assigns 6 reduction points to Player A1 and 4 reduction points to Player A2,
(ii) assigns a sum of 10 reduction points to Player B2,
assigns a sum of 0 reduction points to Player B3; and
(iii) receives total reduction amounts of 12 from Players B2 and B3.

7. What are Player B1's earnings? *Answer – 28.*

A.4. A Screen Image in Stage 3 of the Higher-Order treatment

Third-party player's screen:

The following is a screen image for a third-party player in Stage 3 of the Higher-Order treatment. In this example, Stage 1 is a scenario of "victim."

Each third-party player will be presented with 30 scenarios from Stage 1 and 2 like this one (i.e., two PD players' decisions in Stage 1, and the third-party player's and the other two third-party players' punishment decisions in Stage 2). One scenario is a real one. You will then decide how to punish the other two third-party players in your group.

Time remaining: 00:30

Stage 3 – your role: player B.

Scenario 1 out of 30

Player A1 **sent** 16 points to Player A2, but Player A2 **did not send** 16 points to Player A1 in Stage 1.

You allocated 0 reduction points to Player A1 in Stage 2.

Another player B in your group (**Player B2**) allocated **10 reduction points** to Player A1 in Stage 2.

The third player B in your group (**Player B3**) allocated **0 reduction points** to Player A1 in Stage 2.

How many reduction points...						
...do you want to impose on **Player B2**?	○ 0	○ 2	○ 4	○ 6	○ 8	○ 10
...do you want to impose on **Player B3**?	○ 0	○ 2	○ 4	○ 6	○ 8	○ 10

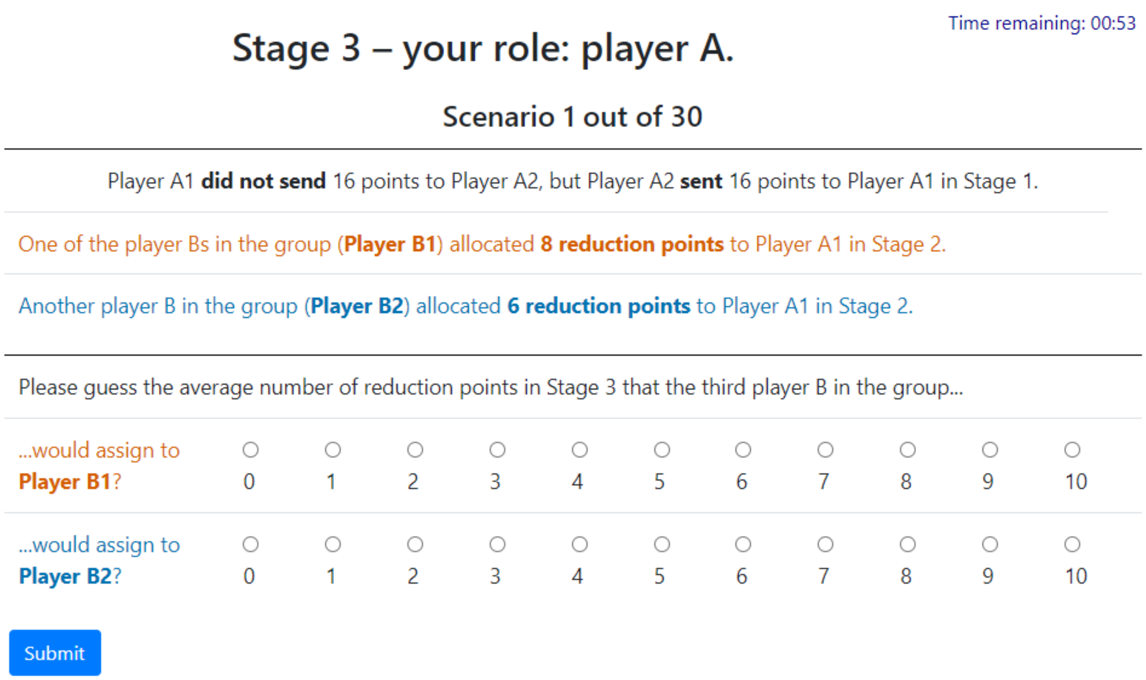
Note: i. For each reduction point you assign to a player, 3 points will be deducted from the target's earnings, and 1 point will be deducted from your earnings. ii. Players B2/B3 simultaneously decide how many reduction points to impose on you and each other.

Submit

Note: Decisions in the screen image are for illustrations only.

PD player's screen:

In Stage 3, each PD player will be presented with 30 scenarios from Stage 1 and 2 like the one below, and then will be asked about their guess on their third-party players' second-order punishment decisions. The following screenshot is one example.



Note: Decisions in the screen image are for illustrations only.

A.5. Part 3: Post-Experiment Questionnaire

The post-experiment questionnaire contained the following modules.

Global Preferences Survey

Risk preferences

Please tell me, in general, how willing or unwilling you are to take risks. Please use a scale from 0 to 10, where 0 means "completely unwilling to take risks" and a 10 means you are "very willing to take risks". You can also use any numbers between 0 and 10 to indicate where you fall on the scale, like 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

Social preferences

How well do the following statements describe you as a person? Please indicate your answer on a scale from 0 to 10. A 0 means "does not describe me at all" and a 10 means "describes me perfectly".

> *When someone does me a favor, I am willing to return it.*
>
> *If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so.*
>
> *I assume that people have only the best intentions.*

We now ask you for your willingness to act in a certain way. Please again indicate your answer on a scale from 0 to 10. A 0 means "completely unwilling to do so," and a 10 means "very willing to do so."

> *How willing are you to punish someone who treats you unfairly, even if there may be costs for you?*
>
> *How willing are you to punish someone who treats others unfairly, even if there may be costs for you?*
>
> *How willing are you to give to good causes without expecting anything in return?*

World Values Survey

Generalized trust

Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? Please indicate on a scale from 1 to 10. 10 means "most people can be trusted" and 1 means "need to be very careful".

In-/out-group trust

We are interested in how much you trust people from various groups. For each of the below, please fill in whether you trust people from this group completely, somewhat, not very much or not at all?

1. Do not trust at all
2. Do not trust very much
3. Trust somewhat
4. Trust completely

[In-group:]

- Your family
- Your neighbourhood
- People you know personally

[Out-group:]

- People you meet for the first time
- People of another religion
- People of another nationality

Religious beliefs

How important is God in your life? Please indicate on a scale from 1 to 11. 11 means "very important" and 1 means "not at all important." [or prefer not to say]

Which, if any, of the following do you believe in? Yes/No [or prefer not to say]

- God
- Life after death
- Hell
- Heaven

Confidence

Below are listed a number of organizations. For each one, please indicate how much confidence you have in them: is it a great deal of confidence, quite a lot of confidence, not very much confidence or none at all?

- The armed forces.
- The police.
- The courts.
- The government.
- Political parties.
- Parliament.

Family ties

How important would you say that family is in your life?

1. Not at all important
2. Not very important
3. Rather important
4. Very important

<u>Social norms in a community</u>

Norm adherence

Due to M. J. Gelfand et al., Differences between tight and loose cultures: A 33-nation study. Science (80-.). 332, 1100–1104 (2011).

The following statements refer to the United Kingdom as a whole. Please indicate to what extent you agree or disagree with each statement.

1. There are many social norms that people are supposed to abide by in this country.

2. In this country, there are very clear expectations for how people should act in most situations.

3. People agree upon what behaviours are appropriate versus inappropriate in most situations in this country.

4. People in this country have a great deal of freedom in deciding how they want to behave in most situations. (Reverse coded)

5. In this country, if someone acts in an inappropriate way, others will strongly disapprove.

6. People in this country almost always comply with social norms.

Moral Foundations Questionnaire[1]

Relative importance of communal over universal moral values:

First, sum responses to all questions that belong to the communal values "Ingroup" and "Authority"; then, subtract responses to all questions that belong to the universal moral values of "Fairness" and "Harm".

Moral relevance of purity and disgust:

Questions that belong to the dimension "Purity".

Big Five model

Please evaluate the following statements, to complete the sentence:

Scale: 1 ("disagree strongly") to 5 ("agree strongly")

I see myself as someone who ...

is original, comes up with new ideas

values artistic experiences

has an active imagination

does a thorough job

does things effectively and efficiently

tends to be lazy

is communicative, talkative

is outgoing, sociable

is reserved

has a forgiving nature

is considerate and kind to others

[1] Moral Foundations Questionnaire: 20-Item Short Version Item Key, July 2008, https://moralfoundations.org/questionnaires/

is sometimes somewhat rude to others

worries a lot

gets nervous easily

is relaxed, handles stress well

Test of Self-Conscious Affect

Due to Tangney J. P., Dearing R. L., Wagner P. E., Gramzow R. (2000). The Test of Self-Conscious Affect-3 (TOSCA-3). Fairfax, VA: George Mason University.

Guilt and Shame

Series of scenarios with possible emotional reactions on five-point Likert scale; the reactions designed to elicit guilt/shame are used to construct the measures.

Demographics

Age: Years. [or prefer not to say].

Gender: Male/Female/Other/Prefer not to say

Siblings: Number of.

Country of birth:

Central and Eastern Asia; Central and Western Africa; Central, South America and the Caribbean; Europe (excl. UK); Middle East and North Africa; North America; Oceania; South and Eastern Africa; South-East Asia; Southern Asia; UK.

Country of hometown: Free text.

Field of studies:

Arts and Education; Economics and Finance; Business and Management; Law and Social Sciences; Medicine and Health Sciences; Engineering and Natural Sciences; Not a Student.

Income: When you were 16 years of age, what was the income of your parents in comparison to the average income in your hometown?

Far below average; Below average; Average; Above average; Far above average.

Appendix B: Theoretical Analysis based on the Fehr-Schmidt (1999) model

Below, we summarize how the inequity-averse preference model by Fehr and Schmidt (1999) predicts the punishment behaviors of third-party players in our experiment.

The Fehr-Schmidt (1999) utility function is given as follows: for a list of *n* players' material payoffs (*x*), player *i* receives the following utility:

$$U_i(x) = x_i - \frac{\alpha_i}{n-1}\sum_{j\neq i}\max\{x_j - x_i, 0\} - \frac{\beta_i}{n-1}\sum_{j\neq i}\max\{x_i - x_j, 0\}, \tag{B1}$$

where x_i is the payoff of player *i*, $\beta_i \le \alpha_i$ and $0 \le \beta_i < 1$. α_i indicates player *i*'s aversion to disadvantageous inequality, while β_i indicates player *i*'s aversion to advantageous inequality. For simplicity, we use a continuous interval for *i*'s punishment activities, although a discrete interval {0, 2, 4, …, 10} is used as the choice space in the experiment.

B.1. *Baseline* Treatment

For the *Baseline* treatment, in which there is a single third-party player in Stage 2 ($n = 3$), the insights of the analysis are summarized as follows:

a. *Scenario CC: i* punishes a cooperator (P_{CC} = 10) iff $\alpha_i > 2$.

b. *Scenario CD/DC: i* never punishes a cooperator; *i* punishes a defector (P_{DC} = 10) iff $\alpha_i + \beta_i / 2 > 1$.

c. *Scenario DD: i* never punishes a defector.

d. Some PD players choose to cooperate with their paired PD players, driven by their inequality concern or by the threat of punishment.

(a) *i*'s Punishment Behavior in Scenario CC

Given the strategy method implementation, *i* will impose the same punishment points on two cooperators and receive the following utility in Scenario CC:

$$U_i(x) = 60 - 2P_{CC} - \alpha_i \max\{(72 - 3P_{CC}) - (60 - 2P_{CC}), 0\} - \beta_i \max\{(60 - 2P_{CC}) - (72 - 3P_{CC}), 0\}. \tag{B2}$$

where $x = (72 - 3P_{CC}, 72 - 3P_{CC}, 60 - 2P_{CC})$ and P_{CC} is punishment points assigned by *i* to a cooperator. Since $P_{CC} < 12$, we obtain:

$$U_i(x) = 60 - 12\alpha_i + (\alpha_i - 2)P_{CC}. \tag{B3}$$

Thus, equation (B3) suggests that *i* will punish a cooperator and P_{CC} = 10 (not punish a cooperator) in Scenario CC if and only if $\alpha_i > 2$ (< 2).

(b) *i*'s Punishment Behavior in Scenario CD/DC

In Scenario CD/DC, the three players' payoffs are $x = (24 - 3P_{CD}, 88 - 3P_{DC}, 60 - P_{CC} - P_{DC})$, where

P_{CD} is punishment points from *i* to the cooperator and P_{DC} is punishment points from *i* to the defector in *i*'s group. The third-party player will receive the following utility:

$$U_i(x) = 60 - P_{CD} - P_{DC}$$
$$-\frac{\alpha_i}{2}\max\{(-36 - 2P_{CD} + P_{DC}), 0\} - \frac{\alpha_i}{2}\max\{(28 + P_{CD} - 2P_{DC}), 0\} \quad \text{(B4)}$$
$$-\frac{\beta_i}{2}\max\{(36 + 2P_{CD} - P_{DC}), 0\} - \frac{\beta_i}{2}\max\{(-28 - P_{CD} + 2P_{DC}), 0\}.$$

By design, $P_{DC} \leq 10$ and so it must be the case that $28 + P_{CD} - 2P_{DC} > 0$. In this case, $36 + 2P_{CD} - P_{DC} > 0$ because $36 + 2P_{CD} - P_{DC} > 36 + 2P_{CD} - 14 - \frac{P_{CD}}{2} = 22 + \frac{3P_{CD}}{2} > 0$. Thus, equation (B4) reduces to:

$$U_i(x) = 60 - 14\alpha_i - 18\beta_i - \left(1 + \frac{\alpha_i}{2} + \beta_i\right)P_{CD} + \left(\alpha_i + \frac{\beta_i}{2} - 1\right)P_{DC}. \quad \text{(B5)}$$

Since $\frac{dU_i}{dP_{CD}} < 0$, *i* never punishes a cooperator in Scenario CD. However, *i* will punish a defector and P_{DC} = 10 (not punish a defector) in Scenario DC if and only if $\alpha_i + \beta_i/2 > 1$ (< 1).

(c) *i*'s Punishment Behavior in Scenario DD

Analogous to scenario (a) above, *i* will impose the same punishment points on two defectors and receive the following utility in Scenario DD:

$$U_i(x) = 60 - 2P_{DD} - \alpha_i \max\{(40 - 3P_{DD}) - (60 - 2P_{DD}), 0\} - \beta_i \max\{(60 - 2P_{DD}) - (40 - 3P_{DD}), 0\}. \quad \text{(B6)}$$

where $x = (40 - 3P_{DD}, 40 - 3P_{DD}, 60 - 2P_{DD})$ and P_{DD} is punishment points assigned by *i* to a defector. Since $P_{DD} \geq 0$, we obtain:

$$U_i(x) = 60 - 15\beta_i - (\beta_i + 2)P_{DD}. \quad \text{(B7)}$$

Since $\frac{dU_i}{dP_{DD}} < 0$, *i* never punishes a defector in Scenario DD.

(d) Cooperate/defect decision

Let $F(\alpha)$ denote the CDF of the distribution over disadvantageous inequality held by PD players. By the definition of a CDF, *F*(.) is an increasing function. To simplify the exposition, we assume that β = 0. Based on the preceding analysis, the expected payoffs to a PD player are given in Table B.2. If (*F*(2) – *F*(1)) > 8/15, then the social dilemma becomes a coordination game with a second equilibrium in pure strategies of mutual cooperation. Notice that if the PD player were to be averse to advantageous inequality (i.e., *β* > 0), then the threshold would be strictly lower than 8/15 and so the probability of choosing cooperation would increase.

Table B.2: *Expected payoffs to Player 1's cooperate/defect decision in the Baseline treatment under the threat of punishment.*

		Player 2	
		Send	Not send
Player 1	Send (cooperate)	(a) $F(2)(72) + (1 - F(2))(42)$	(c) 24
	Not send (defect)	(b) $F(1)(88) + (1 - F(1))(58)$	(d) 40

B.2. *Trio* Treatment

For the *Trio* treatment, in which there are three third-party players in Stage 2 (n = 5), we denote $P_{s,i}$, where the indices denote scenario $s \in \{CC, CD, DC, DD\}$ and third-party player $i \in \{1,2,3\}$. As the identities of third-party players in the experiment are anonymous, we assume the symmetric punishment situation: for any player i and scenario s, (i) $P_{s,j} = P_{s,k}$ for $j, k \neq i$, and (ii) i's belief about the punishment choice of another third-party player in each scenario P_s' is correct ($P_s' = P_{s,j}$, $j \neq i$). For ease of notation, we suppress the subscript i such that $P_{s,i} = P_s$. The symmetric equilibria are characterized as follows:

a. *Scenario CC: i* punishes a cooperator iff $\alpha_i/2 + \beta_i > 2$ and $0 < P_{CC}' \leq 12/7$; this condition implies a group size effect. The condition on social preference parameters is more restrictive, and the per third-party player punishment strength is weaker, than in the *Baseline* treatment.[2]

b. *Scenario CD/DC: i* never punishes a cooperator; *i* punishes a defector iff $\alpha_i/2 + 3\beta_i/4 > 1$ and $0 < P_{DC}' \leq 7/2$; this condition implies a group size effect. The condition on social preference parameters is more restrictive, and the per third-party player punishment strength is weaker, than in the corresponding scenario of the *Baseline* treatment; however, these conditions are less restrictive than in Scenario CC.[3]

c. *Scenario DD: i* never punishes a defector.

d. Some PD players choose to cooperate with their paired PD players, driven by their inequality concern or by the threat of punishment.

(a) *i*'s Punishment Behavior in Scenario CC

A third-party player *i*'s utility in Scenario CC is given by:

$$U_i(x) = 60 - 2P_{CC} \tag{B8}$$

[2] $4 - 2\beta_i > 2$ for all $\beta_i < 1$.
[3] $2 - \beta_i > 1$ for all $\beta_i < 1$.

$$-\frac{\alpha_i}{2}\max\{(72-3P_{CC}-6P'_{CC})-(60-2P_{CC}),0\}$$

$$-\frac{\beta_i}{2}\max\{(60-2P_{CC})-(72-3P_{CC}-6P'_{CC}),0\}$$

$$-\alpha_i\max\{P_{CC}-P'_{CC},0\}-\beta_i\max\{P'_{CC}-P_{CC},0\}.$$

where $x=(72-3P_{CC}-6P'_{CC},72-3P_{CC}-6P'_{CC},60-2P_{CC},60-2P'_{CC},60-2P'_{CC})$. Equation (B8) means we need to consider four cases to analyze *i*'s punishment behavior:

Case 1: $12-P_{CC}-6P'_{CC}\geq 0$ and $P_{CC}\geq P'_{CC}$

In this case, equation (B8) reduces to:

$$U_i(x)=60-6\alpha_i-\left(\frac{\alpha_i}{2}+2\right)P_{CC}+4\alpha_i P'_{CC}. \quad \text{(B9)}$$

Since $\frac{dU_i}{dP_{CC}}<0$, the smaller punishment *i* inflicts, the higher utility *i* receives. That is, $P_{CC}=P'_{CC}$. Note that *i*'s utility is increasing in P'_{CC} whenever *i* is averse to disadvantageous inequality.

Case 2: $12-P_{CC}-6P'_{CC}<0$ and $P_{CC}\geq P'_{CC}$

In this case, equation (B8) reduces to:

$$U_i(x)=60+6\beta_i-\left(\alpha_i+\frac{\beta_i}{2}+2\right)P_{CC}+(\alpha_i-3\beta_i)P'_{CC}. \quad \text{(B10)}$$

Since $\frac{dU_i}{dP_{CC}}<0$, equation (B10) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives. In other words, $P_{CC}=\max\{P'_{CC},12-6P'_{CC}\}$. Note that *i*'s utility is increasing in P'_{CC} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality.

Case 3: $12-P_{CC}-6P'_{CC}\geq 0$ and $P_{CC}<P'_{CC}$

In this case, equation (B8) reduces to:

$$U_i(x)=60-6\alpha_i+\left(\frac{\alpha_i}{2}+\beta_i-2\right)P_{CC}+(3\alpha_i-\beta_i)P'_{CC}. \quad \text{(B11)}$$

Thus, equation (B11) suggests that *i* will punish (not punish) a cooperator in Scenario CC if $\alpha_i/2+\beta_i>2$ (<2), up to:

$$P_{CC}=\min\{P'_{CC},12-6P'_{CC}\}.$$

Note that *i*'s utility is increasing in P'_{CC} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality.

Case 4: $12-P_{CC}-6P'_{CC}<0$ and $P_{CC}<P'_{CC}$

In this case, equation (B8) reduces to:

$$U_i(x) = 60 + 6\beta_i - \left(2 - \frac{\beta_i}{2}\right) P_{CC} - 4\beta_i P'_{CC}. \tag{B12}$$

Since $\frac{dU_i}{dP_{CC}} < 0$, the smaller punishment *i* inflicts, the higher utility *i* receives. That is,

$$P_{CC} = \max\{0, 12 - 6P'_{CC}\}.$$

Note that *i*'s utility is decreasing in P'_{CC} whenever *i* is averse to advantageous inequality.

<u>Summary</u>: These four cases can be summarized as in Figure B.1:

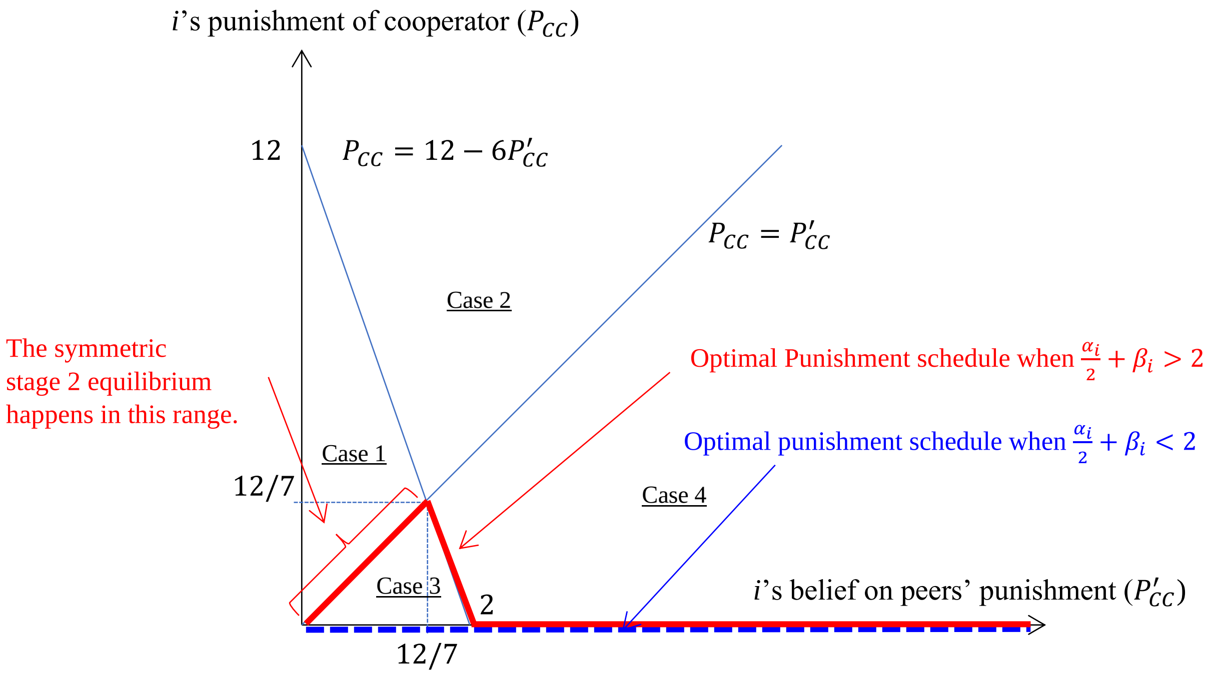


Figure B.1. *Optimal punishment schedule in Trio Scenario CC*

(b) *i*'s Punishment Behavior in Scenario CD/DC

A third-party player *i*'s utility in Scenario CD/DC is given by:

$$\begin{aligned} U_i(x) &= 60 - P_{CD} - P_{DC} \\ &- \frac{\beta_i}{4}(36 + 2P_{CD} - P_{DC} + 6P'_{CD}) \\ &- \frac{\alpha_i}{4}\max\{(28 + P_{CD} - 2P_{DC} - 6P'_{DC}), 0\} \\ &- \frac{\beta_i}{4}\max\{(-28 - P_{CD} + 2P_{DC} + 6P'_{DC}), 0\} \end{aligned} \tag{B13}$$

$$-\frac{\alpha_i}{2}\max\{(P_{CD}+P_{DC})-(P'_{CD}+P'_{DC}),0\}$$

$$-\frac{\beta_i}{2}\max\{(P'_{CD}+P'_{DC})-(P_{CD}+P_{DC}),0\}.$$

where $x = (24 - 3P_{CD} - 6P'_{CD}, 88 - 3P_{DC} - 6P'_{DC}, 60 - P_{CD} - P_{DC}, 60 - P'_{CD} - P'_{DC}, 60 - P'_{CD} - P'_{DC})$. Equation (B13) means we need to consider four cases to analyze *i*'s punishment behavior:

<u>Case 1</u>: $28 + P_{CD} - 2P_{DC} - 6P'_{DC} \geq 0$ and $(P_{CD} + P_{DC}) \geq (P'_{CD} + P'_{DC})$

In this case, equation (B13) reduces to:

$$\begin{aligned} U_i(x) &= 60 - P_{CD} - P_{DC} \\ &-\frac{\beta_i}{4}(36 + 2P_{CD} - P_{DC} + 6P'_{CD}) \\ &-\frac{\alpha_i}{4}(28 + P_{CD} - 2P_{DC} - 6P'_{DC}) \\ &-\frac{\alpha_i}{2}\big((P_{CD}+P_{DC})-(P'_{CD}+P'_{DC})\big). \end{aligned} \quad \text{(B14)}$$

which can be further simplified to:

$$U_i(x) = 60 - 9\beta_i - 7\alpha_i - \left(1 + \frac{\beta_i}{2} + \frac{3\alpha_i}{4}\right)P_{CD} - \left(1 - \frac{\beta_i}{4}\right)P_{DC} + \left(\frac{\alpha_i}{2} - \frac{3\beta_i}{2}\right)P'_{CD} + 2\alpha_i P'_{DC}. \quad \text{(B15)}$$

Since $\frac{dU_i}{dP_{CD}} < 0$ and $\frac{dU_i}{dP_{DC}} < 0$, equation (B15) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives. Note that *i*'s utility is increasing in P'_{CD} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality and is increasing in P'_{DC} whenever *i* is averse to disadvantageous inequality.

<u>Case 2</u>: $28 + P_{CD} - 2P_{DC} - 6P'_{DC} < 0$ and $(P_{CD} + P_{DC}) \geq (P'_{CD} + P'_{DC})$

In this case, equation (B13) reduces to:

$$\begin{aligned} U_i(x) &= 60 - P_{CD} - P_{DC} \\ &-\frac{\beta_i}{4}(36 + 2P_{CD} - P_{DC} + 6P'_{CD}) \\ &-\frac{\beta_i}{4}(-28 - P_{CD} + 2P_{DC} + 6P'_{DC}) \\ &-\frac{\alpha_i}{2}\big((P_{CD}+P_{DC})-(P'_{CD}+P'_{DC})\big). \end{aligned} \quad \text{(B16)}$$

which can be further simplified to:

$$U_i(x) = 60 - 2\beta_i - \left(1 + \frac{\beta_i}{4} + \frac{\alpha_i}{2}\right)(P_{CD} + P_{DC}) + \left(\frac{\alpha_i}{2} - \frac{3\beta_i}{2}\right)(P'_{CD} + P'_{DC}). \qquad \text{(B17)}$$

Since $\frac{dU_i}{dP_{CD}} < 0$ and $\frac{dU_i}{dP_{DC}} < 0$, equation (B17) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives. Note that *i*'s utility is increasing in P'_{CD} and in P'_{DC} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality.

Case 3: $28 + P_{CD} - 2P_{DC} - 6P'_{DC} \geq 0$ and $(P_{CD} + P_{DC}) < (P'_{CD} + P'_{DC})$

In this case, equation (B13) reduces to:

$$\begin{aligned} U_i(x) &= 60 - P_{CD} - P_{DC} \\ &- \frac{\beta_i}{4}(36 + 2P_{CD} - P_{DC} + 6P'_{CD}) \\ &- \frac{\alpha_i}{4}(28 + P_{CD} - 2P_{DC} - 6P'_{DC}) \\ &- \frac{\beta_i}{2}\big((P'_{CD} + P'_{DC}) - (P_{CD} + P_{DC})\big). \end{aligned} \qquad \text{(B18)}$$

which can be further simplified to:

$$U_i(x) = 60 - 9\beta_i - 7\alpha_i - \left(1 + \frac{\alpha_i}{4}\right)P_{CD} + \left(\frac{\alpha_i}{2} + \frac{3\beta_i}{4} - 1\right)P_{DC} - 2\beta_i P'_{CD} + \left(\frac{3\alpha_i}{2} - \frac{\beta_i}{2}\right)P'_{DC}. \qquad \text{(B19)}$$

Since $\frac{dU_i}{dP_{CD}} < 0$, equation (B19) suggests that the smaller punishment *i* inflicts on the cooperator, the higher utility *i* receives. Equation (B19) suggests that *i* will punish (not punish) a defector in Scenario DC if $\alpha_i/2 + 3\beta_i/4 > 1$ (< 1), up to:

$$P_{DC} = \min\{14 - 3P'_{DC}, P'_{DC}\}.$$

Note that *i*'s utility is decreasing in P'_{CD} whenever *i* is averse to advantageous inequality and is increasing in P'_{DC} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality.

Case 4: $28 + P_{CD} - 2P_{DC} - 6P'_{DC} < 0$ and $(P_{CD} + P_{DC}) < (P'_{CD} + P'_{DC})$

In this case, equation (B13) reduces to:

$$\begin{aligned} U_i(x) &= 60 - P_{CD} - P_{DC} \\ &- \frac{\beta_i}{4}(36 + 2P_{CD} - P_{DC} + 6P'_{CD}) \\ &- \frac{\beta_i}{4}(-28 - P_{CD} + 2P_{DC} + 6P'_{DC}) \end{aligned} \qquad \text{(B20)}$$

$$-\frac{\beta_i}{2}\left((P'_{CD}+P'_{DC})-(P_{CD}+P_{DC})\right).$$

which can be further simplified to:

$$U_i(x) = 60 - 2\beta_i + \left(\frac{\beta_i}{4} - 1\right)(P_{CD}+P_{DC}) - 2\beta_i(P'_{CD}+P'_{DC}). \quad \text{(B21)}$$

Since $\frac{dU_i}{dP_{CD}} < 0$ and $\frac{dU_i}{dP_{DC}} < 0$, equation (B21) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives. Note that *i*'s utility is decreasing in P'_{CD} and in P'_{DC} whenever *i* is averse to advantageous inequality.

Summary: $\frac{dU_i}{dP_{CD}} < 0$ for all four cases, which means that $P_{CD} = 0$. As any other third party *j* faces the same incentive structure as *i* and we assumed that *i*'s belief on *j*'s punishment activities are correct ($P'_s = P_{sj}, j \neq i$), $P'_{CD} = 0$. The conditions for the third party's optimal punishment schedule P_{DC} can be summarized as in Figure B.2. Third parties inflict punishment under weaker conditions in Scenario DC than in Scenario CC (7/2 > 12/7).

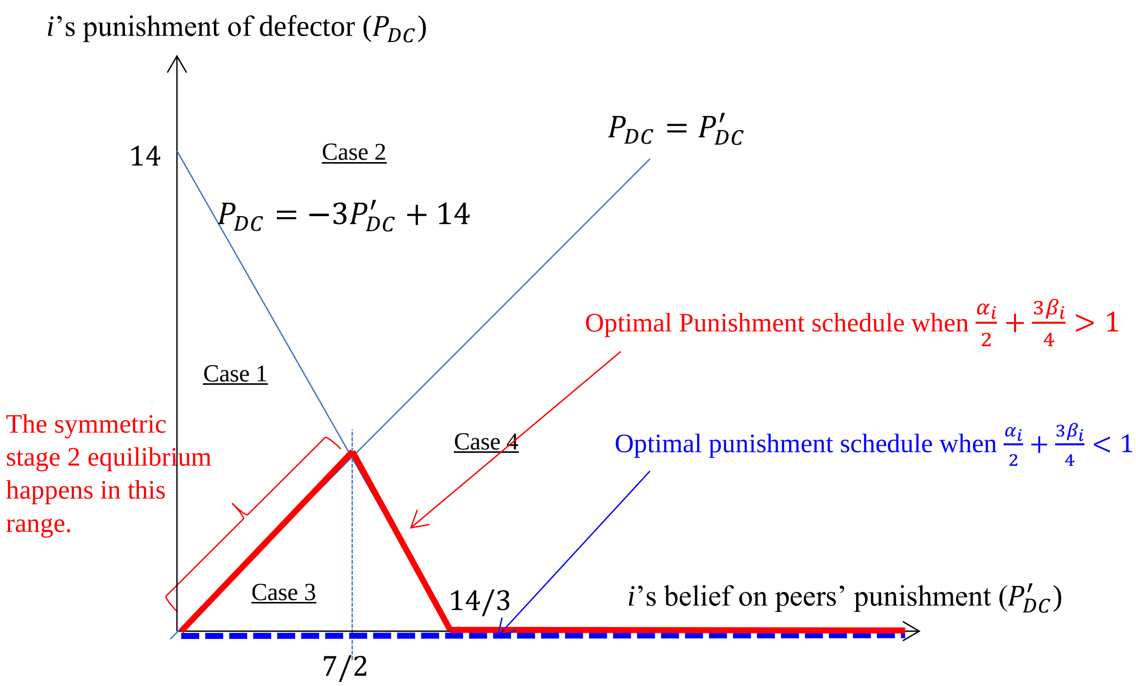


Figure B.2. *Optimal punishment schedule in Trio Scenario DC*

(c) *i*'s Punishment Behavior in Scenario DD

A third-party player *i*'s utility in Scenario DD is given by:

$$U_i(x) = 60 - 2P_{DD} \quad \text{(B22)}$$

$$-\frac{\beta_i}{2}\max\{(60-2P_{DD})-(40-3P_{DD}-6P'_{DD}),0\}$$

$$-\alpha_i \max\{P_{DD}-P'_{DD},0\} - \beta_i \max\{P'_{DD}-P_{DD},0\}.$$

where $x = (40-3P_{DD}-6P'_{DD}, 40-3P_{DD}-6P'_{DD}, 60-2P_{DD}, 60-2P'_{DD}, 60-2P'_{DD})$. Since the expression $20+P_{DD}+6P'_{DD} \geq 0$, equation (B22) means we need to consider two cases to analyze *i*'s punishment behavior:

Case 1: $P_{DD} \geq P'_{DD}$

In this case, equation (B22) reduces to:

$$U_i(x) = 60 - 10\beta_i - \left(\alpha_i + \frac{\beta_i}{2} + 2\right)P_{DD} + (\alpha_i - 3\beta_i)P'_{DD}. \qquad \text{(B23)}$$

Since $\frac{dU_i}{dP_{DD}} < 0$, equation (B23) suggests that *i* never punishes a defector in Scenario DD more than P'_{DD}. Note that *i*'s utility is increasing in P'_{DD} if *i* is sufficiently averse to disadvantageous inequality and not too averse to advantageous inequality.

Case 2: $P_{DD} < P'_{DD}$

In this case, equation (B22) reduces to:

$$U_i(x) = 60 - 10\beta_i - \left(2 - \frac{\beta_i}{2}\right)P_{DD} - 4\beta_i P'_{DD}. \qquad \text{(B24)}$$

Since $\frac{dU_i}{dP_{DD}} < 0$, equation (B24) *i* never punishes a defector in Scenario DD. Note that *i*'s utility is decreasing in P'_{DD} whenever *i* is averse to advantageous inequality.

Summary: Regardless of the beliefs that *i* holds in Scenario DD, *i* never punishes a defector.

(d) Cooperate/defect decision

Analogous to the analysis for the *Baseline* treatment, the expected payoffs to a PD player in the *Trio* treatment are given in Table B.3. As $(72 - 9{*}P_{CC}) \geq (60 - 2{*}P_{CC})$ for all $P_{CC} \leq 12/7$, the PD player remains in the region of advantageous inequality in any symmetric equilibrium of Scenario CC. Likewise, as $(88 - 9{*}P_{DC}) \geq (60 - 2{*}P_{DC})$ for all $P_{DC} \leq 7/2$, the PD player remains in the region of advantageous inequality in any symmetric equilibrium of Scenario DC. Mutual cooperation is an equilibrium outcome if $(1-F(2))P_{DC} - (1-F(4))P_{CC} > 16/9$.

Table B.3: *Expected payoffs to Player 1's cooperate/defect decision in the Trio treatment under the threat of punishment.*

		Player 2: Send	Player 2: Not send
Player 1	Send (cooperate)	(a) F(4)(72) + (1 – F(4))(72 – 9*P_{CC}), where $P_{CC} \leq 12/7$	(c) 24
	Not send (defect)	(b) F(2)(88) + (1 – F(2))(88 – 9*P_{DC}), where $P_{DC} \leq 7/2$	(d) 40

B.3. *Higher-Order* Treatment

In the *Higher-Order* treatment, there are three third-party players (n = 5) each of whom can inflict higher-order punishment on each other in Stage 3 after observing the first-order punishment decisions from Stage 2. We denote higher-order punishment by $H_{s,o,t}$, $o \neq t$, where the indices denote the third-party originator $o \in \{1,2,3\}$ and the third-party target $t \in \{1,2,3\}$ in scenario $s \in \{CC, CD, DC, DD\}$.

We search for symmetric equilibria. Specifically, we assume that for any player i and scenario s, (i) $P_{s,j} = P_{s,k} = P_s^*$ for $j, k \neq i$, (ii) $H_{s,i,j} = H_{s,i,k} = H_{s,i}$ for $j, k \neq i$, (iii) $H_{s,j,i} = H_{s,k,i} = H_{s,j,k} = H_{s,k,j}$ for $j, k \neq i$, and (iv) i's beliefs about the higher-order punishment choice of another third-party player in each scenario, H_s', are correct. For ease of notation, we suppress the subscript i such that $P_{s,i} = P_s$ and $H_{s,i} = H_s$.

We consider the possibility of cooperation-conducive or non-cooperation-conducive higher-order punishment due to the relative difference between P_s and P_s^*, which we denote as $\hat{P}_s = P_s - P_s^*$. We define higher-order punishment from i to j, $H_{s,i,j}$ where $j \neq i$, to be cooperation-conducive (non-cooperation-conducive) if $\hat{P}_s <$ ($\geq$) 0 for scenario $s \in \{CC, CD\}$, and $\hat{P}_s >$ ($\leq$) 0 for scenario $s \in \{DC, DD\}$. The symmetric equilibria are characterized as follows:

a. *Scenario CC:* i punishes a cooperator iff $\alpha_i/2 + \beta_i > 2$ and $0 < P_{CC}' \leq 12/7$; this condition implies a group size effect. The condition on social preference parameters is more restrictive, and the per third-party player punishment strength is weaker, than the corresponding conditions in the Baseline treatment. Regarding Stage 3, i never imposes higher-order punishment on another third party.

b. *Scenario CD/DC:* i never punishes a cooperator; i punishes a defector iff $\alpha_i/2 + 3\beta_i/4 > 1$ and $0 < P_{DC}' \leq 7/2$; this condition implies a group size effect. The condition on social preference parameters is more restrictive, and the per third-party player punishment strength is weaker, than the corresponding conditions in the Baseline treatment. Regarding Stage 3, i never imposes higher-order punishment on another third party.

c. *Scenario DD: i* never punishes a defector; *i* imposes higher-order punishment on another third party in Scenario DD iff: $\alpha_i/2 + \beta_i > 2$ and $0 < H'_{DD} \leq 5/4$.

d. Some PD players choose to cooperate with their paired PD players, driven by their inequality concern or by the threat of punishment.

Outside of the symmetric equilibria, cooperation-conducive or non-cooperation-conducive higher-order punishment is feasible in all scenarios.

(a) *i*'s Punishment Behavior in Scenario CC

A third-party player *i*'s utility in Scenario CC is given by:

$$
\begin{aligned}
U_i(x) &= 60 - 2P_{CC} - 4H_{CC} - 12H'_{CC} \\
&-\tfrac{\alpha_i}{2}\max\{(72 - 3P_{CC} - 6P^*_{CC}) - (60 - 2P_{CC} - 4H_{CC} - 12H'_{CC}), 0\} \\
&-\tfrac{\beta_i}{2}\max\{(60 - 2P_{CC} - 4H_{CC} - 12H'_{CC}) - (72 - 3P_{CC} - 6P^*_{CC}), 0\} \\
&-\alpha_i \max\{P_{CC} - P^*_{CC} - H_{CC} + H'_{CC}, 0\} \\
&-\beta_i \max\{P^*_{CC} - P_{CC} - H'_{CC} + H_{CC}, 0\},
\end{aligned}
\tag{B25}
$$

where $x = (72 - 3P_{CC} - 6P^*_{CC}, 72 - 3P_{CC} - 6P^*_{CC}, 60 - 2P_{CC} - 4H_{CC} - 12H'_{CC}, 60 - 2P^*_{CC} - 10H'_{CC} - 6H_{CC}, 60 - 2P^*_{CC} - 10H'_{CC} - 6H_{CC})$. Equation (B25) means we need to consider four cases to analyze *i*'s higher-order punishment behavior:

<u>Case 1</u>: $12 - P_{CC} - 6P^*_{CC} + 4H_{CC} + 12H'_{CC} \geq 0$ and $P_{CC} - H_{CC} \geq P^*_{CC} - H'_{CC}$

In this case, equation (B25) reduces to:

$$
U_i(x) = 60 - 6\alpha_i - \left(\frac{\alpha_i}{2} + 2\right)P_{CC} + 4\alpha_i P^*_{CC} - (4 + \alpha_i)H_{CC} - (12 + 7\alpha_i)H'_{CC}. \tag{B26}
$$

Since $\frac{dU_i}{dH_{CC}} < 0$, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

<u>Case 2</u>: $12 - P_{CC} - 6P^*_{CC} + 4H_{CC} + 12H'_{CC} < 0$ and $P_{CC} - H_{CC} \geq P^*_{CC} - H'_{CC}$

In this case, equation (B25) reduces to:

$$
\begin{aligned}
U_i(x) = 60 + 6\beta_i - \left(\alpha_i + \frac{\beta_i}{2} + 2\right)P_{CC} + (\alpha_i - 3\beta_i)P^*_{CC} - (4 - \alpha_i - 2\beta_i)H_{CC} \\
-(12 + \alpha_i - 6\beta_i)H'_{CC}.
\end{aligned}
\tag{B27}
$$

Equation (B27) suggests that *i* will higher-order punish (not higher-order punish) in Scenario CC if $\alpha_i/2 + \beta_i > 2$ (< 2), up to:

$$H_{CC} = \min\left\{\frac{3P^*_{CC}}{2} + \frac{P_{CC}}{4} - 3(H'_{CC}+1), H'_{CC} + \hat{P}_{CC}\right\}.$$

Conditional on the vector of punishment decisions (P^*_{CC}, P_{CC}), the arguments of the minima define the upper envelope of the higher-order punishment schedule as a function of i's beliefs about the higher-order punishment choice of another third-party player, H'_{CC}. The upper envelope is a piecewise linear function of H'_{CC}, where the slope of the first argument is negative three and the slope of the second argument is positive one. Thus, for higher-order punishment to be associated with a non-empty subset of first-order punishment vectors, we require that either of the following conditions must hold: (i) $\hat{P}_{CC} > -P^*_{CC}/2 - P_{CC}/12 + 1$ if $\hat{P}_{CC} < 0$ (i.e., if the vertical intercept of the second argument is negative in the H'_{CC}-H_{CC} plane), or (ii) $P^*_{CC}/2 + P_{CC}/12 - 1 > 0$ if $\hat{P}_{CC} \geq 0$ (i.e., if the vertical intercept of the second argument is non-negative in the H'_{CC}-H_{CC} plane).

Solving the system of inequalities for cooperation-conducive ($\hat{P}_{CC} < 0$) and non-cooperation-conducive ($\hat{P}_{CC} \geq 0$) higher-order punishment respectively, we obtain the following necessary conditions:

- Cooperation-conducive: $P_{CC} > 12/13 + 6P^*_{CC}/13$; and
- Non-cooperation-conducive: $P_{CC} > 12 - 6P^*_{CC}$.

In Figure B.3, we plot the feasible regions for higher-order punishment in (P^*_{CC}, P_{CC}) space and overlay the optimal first-order punishment schedule from the *Trio* treatment. This implies that the symmetric equilibrium still exists for $0 < P_{CC}, P^*_{CC} < 12/7$ with $H_{CC} = 0$. Outside of the symmetric equilibrium, non-cooperation-conducive or cooperation-conducive higher-order punishment is feasible.

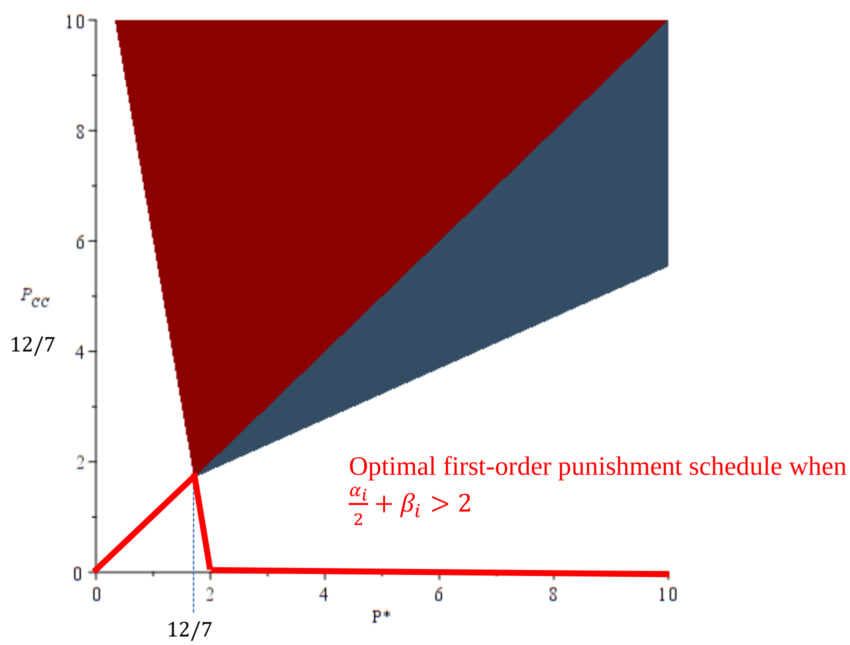


Figure B.3. *Feasible region for higher-order punishment in Scenario CC. The blue (red) region reflects cooperation-conducive (non-cooperation-conducive) punishment.*

Case 3: $12 - P_{CC} - 6P_{CC}^{*} + 4H_{CC} + 12H'_{CC} \geq 0$ and $P_{CC} - H_{CC} < P_{CC}^{*} - H'_{CC}$

In this case, equation (B25) reduces to:

$$U_i(x) = 60 - 6\alpha_i + \left(\frac{\alpha_i}{2} + \beta_i - 2\right)P_{CC} + (3\alpha_i - \beta_i)P_{CC}^{*} - (4 + 2\alpha_i + \beta_i)H_{CC} - (12 + 6\alpha_i - \beta_i)H'_{CC}. \tag{B28}$$

Since $\frac{dU_i}{dH_{CC}} < 0$, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 4: $12 - P_{CC} - 6P_{CC}^{*} + 4H_{CC} + 12H'_{CC} < 0$ and $P_{CC} - H_{CC} < P_{CC}^{*} - H'_{CC}$

In this case, equation (B25) reduces to:

$$U_i(x) = 60 + 6\beta_i - \left(2 - \frac{\beta_i}{2}\right)P_{CC} - 4\beta_i P_{CC}^{*} - (4 - \beta_i)H_{CC} - (12 - 7\beta_i)H'_{CC}. \tag{B29}$$

Since $\frac{dU_i}{dH_{CC}} < 0$, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Summary: The conditions for the third party's optimal higher-order punishment schedule H_{CC} can be summarized as in Figure B.4. Along the optimal punishment schedule, $0 < P_{CC}, P_{CC}^{*} < 2$, we have $5P_{CC}^{*}/8 - 3P_{CC}/16 - 3/4 < 0$ and $P_{CC}/12 + P_{CC}^{*}/2 - 1 \leq 0$ (i.e., the upper envelope of the higher-order punishment schedule is below the x-axis for all positive values of H'_{CC}). In sum, this means that no symmetric higher-order punishment equilibrium exists and so no higher-order punishment is predicted in Scenario CC.

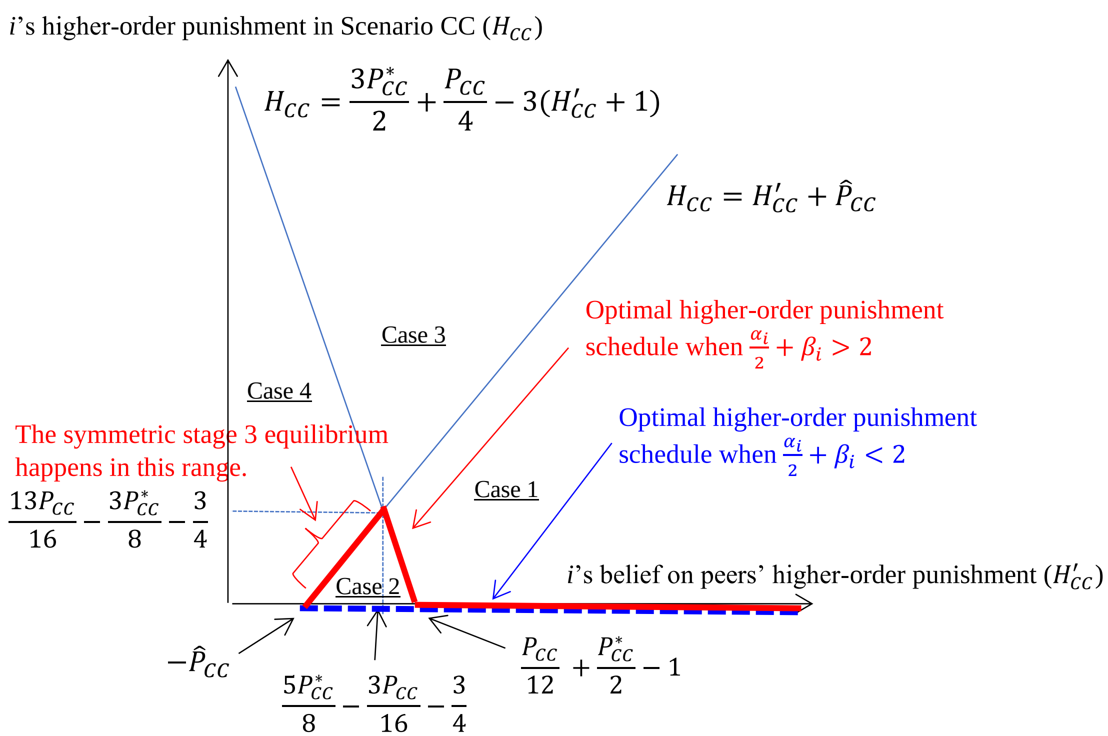


Figure B.4. *Optimal punishment schedule in Higher-Order Scenario CC*

Remark 1. The area for total higher-order punishment in the lower triangle of Scenario CC is given by:

$$\Delta_{CC} = \frac{(13P_{CC} - 6P_{CC}^{*} - 12)^2}{384}.$$

By the necessary conditions for cooperation-conducive punishment, the expression in the numerator is strictly positive, and so the total area of cooperation-conducive higher-order punishment is decreasing in P_{CC}^{*}.

(b) *i*'s Punishment Behavior in Scenario CD/DC

A third-party player *i*'s utility in Scenario CD/DC is given by:

$$\begin{aligned}
U_i(x) = {} & 60 - P_{CD} - P_{DC} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC}) \\
& -\frac{\alpha_i}{4}\max\{-36 - 2P_{CD} - 6P_{CD}^{*} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}), 0\} \\
& -\frac{\beta_i}{4}\max\{36 + 2P_{CD} + 6P_{CD}^{*} - P_{DC} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC}), 0\} \\
& -\frac{\alpha_i}{4}\max\{28 - 2P_{DC} - 6P_{DC}^{*} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}), 0\} \\
& -\frac{\beta_i}{4}\max\{-28 + 2P_{DC} + 6P_{DC}^{*} - P_{CD} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC}), 0\} \\
& -\frac{\alpha_i}{2}\max\{(P_{CD} + P_{DC}) - (P_{CD}^{*} + P_{DC}^{*}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}), 0\} \\
& -\frac{\beta_i}{2}\max\{(P_{CD}^{*} + P_{DC}^{*}) - (P_{CD} + P_{DC}) + (H_{CD} + H_{DC}) - (H'_{CD} + H'_{DC}), 0\},
\end{aligned} \tag{B30}$$

where $x = \big(24 - 3P_{CD} - 6P_{CD}^{*}, 88 - 3P_{DC} - 6P_{DC}^{*}, 60 - P_{CD} - P_{DC} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC}), 60 - P_{CD}^{*} - P_{DC}^{*} - 5(H'_{CD} + H'_{DC}) - 3(H_{CD} + H_{DC}), 60 - P_{CD}^{*} - P_{DC}^{*} - 5(H'_{CD} + H'_{DC}) - 3(H_{CD} + H_{DC})\big)$.

Equation (B30) means we need to consider eight cases to analyze *i*'s higher-order punishment behavior:

<u>Case 1</u>:

i. $-36 - 2P_{CD} - 6P_{CD}^{*} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$;

ii. $28 - 2P_{DC} - 6P_{DC}^{*} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$; and

iii. $(P_{CD} + P_{DC}) - (P_{CD}^{*} + P_{DC}^{*}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) \geq 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $-(2 + \alpha_i/2)$, and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

<u>Case 2</u>:

i. $-36 - 2P_{CD} - 6P_{CD}^{*} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$;

ii. $28 - 2P_{DC} - 6P_{DC}^* + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$; and

iii. $(P_{CD} + P_{DC}) - (P_{CD}^* + P_{DC}^*) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) \geq 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $(\beta_i/2 - 2)$. Given our assumption on β_i, this coefficient is negative and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 3:

i. $-36 - 2P_{CD} - 6P_{CD}^* + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$;

ii. $28 - 2P_{DC} - 6P_{DC}^* + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$; and

iii. $(P_{CD} + P_{DC}) - (P_{CD}^* + P_{DC}^*) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) \geq 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $(\alpha_i/2 + \beta_i - 2)$. Thus, a necessary condition for *i* to higher-order punish in Scenarios CD and DC is $\alpha_i/2 + \beta_i > 2$.

First, we consider the possibility of higher-order punishment in Scenario CD. As we are searching for symmetric equilibria, we assume that $P_{DC} = P_{DC}^*$ and $H_{DC} = H'_{DC} = H_{DC}^*$. Constraint i. is non-binding for all $0 < P_{DC}^* \leq 7/2$ (the range in which the symmetric stage 2 equilibrium happens) and so we proceed under the assumption that constraint ii. binds. In this case, *i* will higher-order punish (not higher-order punish) in Scenario CC if $\alpha_i/2 + \beta_i > 2$ (< 2), up to:

$$H_{CD} = \min\ \{-14 + 4P_{DC}^* - \tfrac{P_{CD}}{2} - 4H_{DC}^* - 3H'_{CD}, H'_{CD} + \hat{P}_{CD}\}.$$

Conditional on the vector of punishment decisions $(P_{CD}, P_{CD}^*, P_{DC}^*, H_{DC}^*)$, the arguments of the minima define the upper envelope of the higher-order punishment schedule as a function of *i*'s beliefs about the higher-order punishment choice of another third-party player, H'_{CD}. Thus, for higher-order punishment to be associated with a non-empty subset of first-order punishment vectors, we require that either of the following conditions must hold: (i) $\hat{P}_{CD} > 14/3 - 4P_{DC}^*/3 + P_{CD}/6 + 4H_{DC}^*/3$ if $\hat{P}_{CD} < 0$, or (ii) $-14/3 + 4P_{DC}^*/3 - P_{CD}/6 - 4H_{DC}^*/3 > 0$ if $\hat{P}_{CD} \geq 0$. Neither condition is satisfied for any $P_{DC}^* \leq 7/2$ and so the symmetric equilibrium for $P_{CD} = P_{CD}^* = 0$ still exists with $H_{CD} = 0$.

Second, we consider the possibility of higher-order punishment in Scenario DC, given the zero-punishment outcome in Scenario CD. Constraint i. (ii.) binds for all $P_{DC} > (<)\ 64/3 - 2P_{DC}^*$. Thus, *i* will higher-order punish (not higher-order punish) in Scenario DC if $\alpha_i/2 + \beta_i > 2$ (< 2), up to:

$$H_{DC} = \begin{cases} \min\ \{-14 + P_{DC} + 3P_{DC}^* - 3H'_{DC}, H'_{DC} + \hat{P}_{DC}\}, & if\ P_{DC} < \dfrac{64}{3} - 2P_{DC}^*; \\ \min\{18 - \dfrac{P_{DC}}{2} - 3H'_{DC}, H'_{DC} + \hat{P}_{DC}\}, & if\ P_{DC} > \dfrac{64}{3} - 2P_{DC}^*. \end{cases}$$

Conditional on the vector of punishment decisions (P_{DC}, P_{DC}^*), the arguments of the minima define the upper envelope of the higher-order punishment schedule as a function of *i*'s beliefs about the higher-order punishment choice of another third-party player, H'_{DC}. Thus, for higher-order punishment to be associated with a non-empty subset of first-order punishment vectors, we require that either of the following conditions must hold: (i) $\hat{P}_{DC} > \min\{14/3 - P_{DC}/3 - P^*_{DC}, P_{DC}/6 - 6\}$ if $\hat{P}_{DC} \leq 0$, or (ii) $\min\{P_{DC}/3 + P^*_{DC} - 14/3, 6 - P_{DC}/6\} > 0$ if $\hat{P}_{DC} > 0$.

Solving the system of inequalities for cooperation-conducive ($\hat{P}_{DC} > 0$) and non-cooperation-conducive ($\hat{P}_{DC} \leq 0$) higher-order punishment respectively, we obtain the following necessary conditions:

- Cooperation-conducive: $P_{DC} > 14 - 3P^*_{DC}$; and
- Non-cooperation-conducive: $P_{DC} > \min\{7/2, -36/5 + 6P^*_{DC}/5\}$.

In Figure B.5, we plot the feasible regions for higher-order punishment in (P^*_{DC}, P_{DC}) space and overlay the optimal first-order punishment schedule from the *Trio* treatment. This implies that the symmetric equilibrium still exists for $0 < P_{DC}, P^*_{DC} < 7/2$ with $H_{DC} = 0$. Outside of the symmetric equilibrium, non-cooperation-conducive or cooperation-conducive higher-order punishment is feasible.

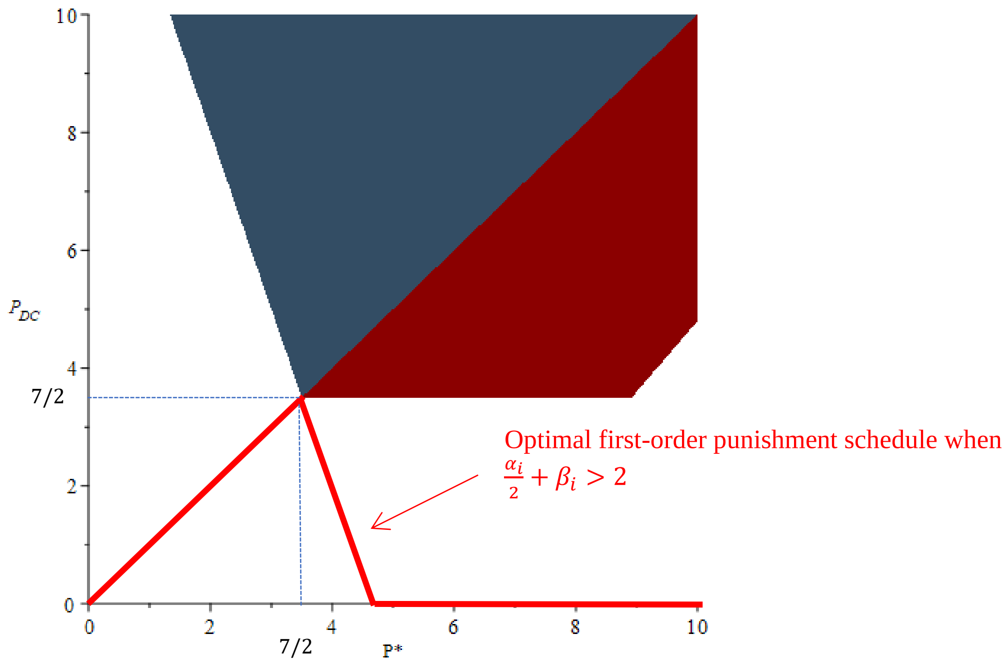


Figure B.5. *Feasible region for higher-order punishment in Scenario CC. The blue (red) region reflects cooperation-conducive (non- cooperation-conducive) punishment.*

<u>Case 4</u>:

i. $-36 - 2P_{CD} - 6P^*_{CD} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$;

ii. $28 - 2P_{DC} - 6P^*_{DC} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$; and

iii. $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) < 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $(\beta_i/2 - 2)$. Given our assumption on β_i, this coefficient is negative and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 5:

i. $-36 - 2P_{CD} - 6P^*_{CD} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$;

ii. $28 - 2P_{DC} - 6P^*_{DC} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$; and

iii. $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) \geq 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $(\beta_i/2 - 2)$. Given our assumption on β_i, this coefficient is negative and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 6:

i. $-36 - 2P_{CD} - 6P^*_{CD} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$;

ii. $28 - 2P_{DC} - 6P^*_{DC} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$; and

iii. $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) < 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $-(2 + \alpha_i/2)$, and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 7:

i. $-36 - 2P_{CD} - 6P^*_{CD} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) < 0$;

ii. $28 - 2P_{DC} - 6P^*_{DC} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$; and

iii. $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) < 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $-(2 + \alpha_i/2)$, and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Case 8:

i. $-36 - 2P_{CD} - 6P^*_{CD} + P_{DC} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$;

ii. $28 - 2P_{DC} - 6P^*_{DC} + P_{CD} + 2(H_{CD} + H_{DC}) + 6(H'_{CD} + H'_{DC}) \geq 0$; and

iii. $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) < 0$.

From equation (B30), the coefficient on each of H_{CD} and H_{DC} in this case is $-(2 + \alpha_i + \beta_i/2)$, and so the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Summary: In the symmetric equilibrium, $P_{CD} = P^*_{CD} = 0$ and no higher-order punishment is predicted in

Scenario CD. The conditions for the third party's optimal higher-order punishment schedule H_{DC} can be summarized as in Figure B.6. Along the optimal punishment schedule, $0 < P_{DC}, P_{DC}^* < 7/2$, we have $\min\{P_{DC}^*/4 - 3P_{DC}/8 + 9/2, P_{DC}^* - 7/2\} < 0$, $\min\{P_{DC}/3 + P_{DC}^* - 14/3, 6 - P_{DC}/6\} < 0$. In sum, this means that no symmetric higher-order punishment equilibrium exists and so no higher-order punishment is predicted in Scenario DC.

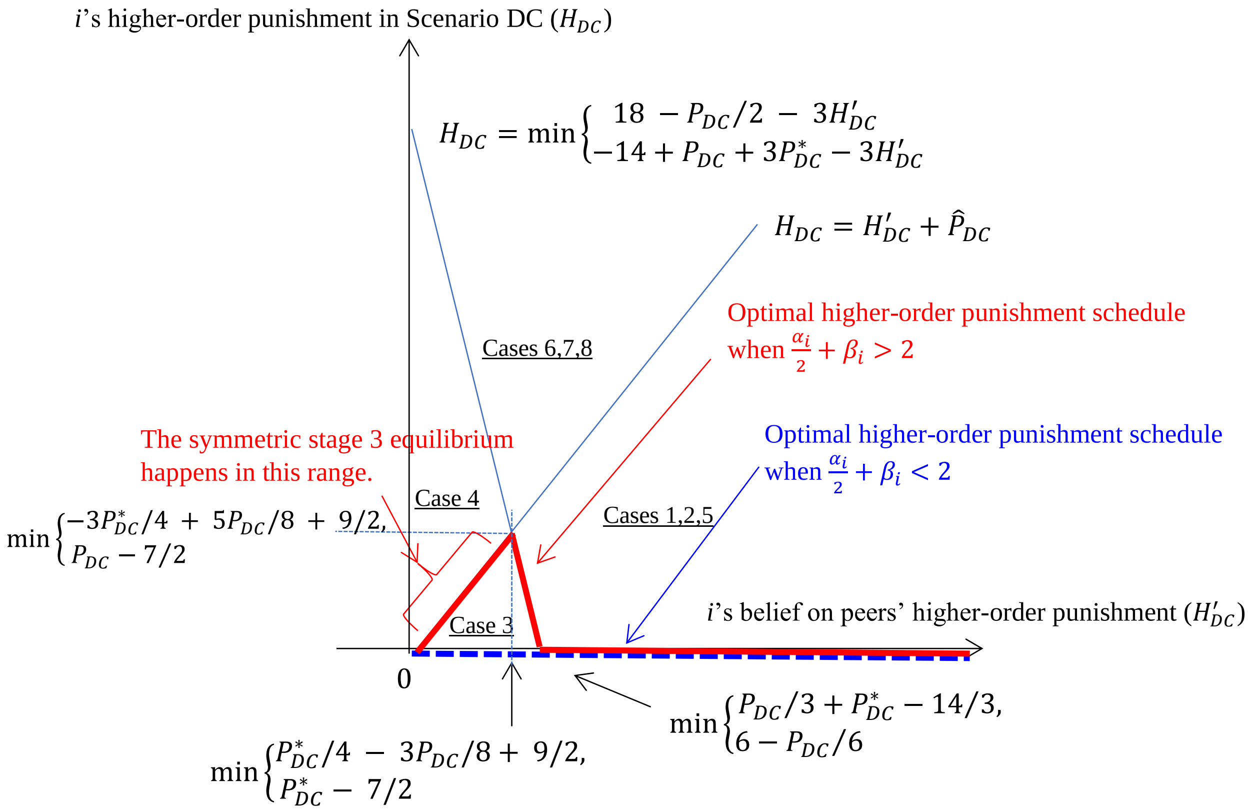


Figure B.6. *Optimal punishment schedule in Higher-Order Scenario DC*

Remark 2. The area for total higher-order punishment in the lower triangle of Scenario CD is given by:

$$\Delta_{CD} = \frac{(6P_{CD}^* - 5P_{CD} + 28 - 8P_{DC}^* + 8H_{DC}^*)^2}{96}.$$

The expression in the numerator is strictly positive for any cooperation-conducive punishment ($P_{CD} < P_{CD}^*$) when $P_{DC}^* \leq 7/2$, in which case the total area of cooperation-conducive higher-order punishment is increasing in P_{CD}^*.

Remark 3. The area for total higher-order punishment in the lower triangle of Scenario DC is given by:

$$\Delta_{DC} = \min\begin{cases} \frac{(36 + 5P_{DC} - 6P_{DC}^*)^2}{96} \\ \frac{(2P_{DC} - 7)^2}{6} \end{cases}.$$

The numerator in the first case is strictly positive for any cooperation-conducive punishment ($P_{DC} > P^*_{DC}$) because $P^*_{DC} < 36$, and so the total area of cooperation-conducive higher-order punishment is increasing as P^*_{DC} falls.

(c) *i*'s Punishment Behavior in Scenario DD

A third-party player *i*'s utility in Scenario DD is given by:

$$
\begin{aligned}
U_i(x) &= 60 - 2P_{DD} - 4H_{DD} - 12H'_{DD} \\
&- \tfrac{\alpha_i}{2}\max\{(40 - 3P_{DD} - 6P^*_{DD}) - (60 - 2P_{DD} - 4H_{DD} - 12H'_{DD}), 0\} \\
&- \tfrac{\beta_i}{2}\max\{(60 - 2P_{DD} - 4H_{DD} - 12H'_{DD}) - (40 - 3P_{DD} - 6P^*_{DD}), 0\} \\
&- \alpha_i \max\{P_{DD} - P^*_{DD} - H_{DD} + H'_{DD}, 0\} \\
&- \beta_i \max\{P^*_{DD} - P_{DD} - H'_{DD} + H_{DD}, 0\},
\end{aligned} \tag{B31}
$$

where $x = (40 - 3P_{DD} - 6P^*_{DD}, 40 - 3P_{DD} - 6P^*_{DD}, 60 - 2P_{DD} - 4H_{DD} - 12H'_{DD}, 60 - 2P^*_{DD} - 10H'_{DD} - 6H_{DD}, 60 - 2P^*_{DD} - 10H'_{DD} - 6H_{DD})$. Mirroring the analysis of Scenario CC, we obtain four cases from equation (B31):

Case 1: $4H_{DD} + 12H'_{DD} - P_{DD} - 6P^*_{DD} - 20 \geq 0$ and $P_{DD} - H_{DD} \geq P^*_{DD} - H'_{DD}$

Case 2: $4H_{DD} + 12H'_{DD} - P_{DD} - 6P^*_{DD} - 20 < 0$ and $P_{DD} - H_{DD} \geq P^*_{DD} - H'_{DD}$

Case 3: $4H_{DD} + 12H'_{DD} - P_{DD} - 6P^*_{DD} - 20 \geq 0$ and $P_{DD} - H_{DD} < P^*_{DD} - H'_{DD}$

Case 4: $4H_{DD} + 12H'_{DD} - P_{DD} - 6P^*_{DD} - 20 < 0$ and $P_{DD} - H_{DD} < P^*_{DD} - H'_{DD}$

It follows directly from our analysis of Scenario CC that, for cases 1, 3 and 4, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.[4] We thus confine our analysis to case 2.

Case 2: $4H_{DD} + 12H'_{DD} - P_{DD} - 6P^*_{DD} - 20 < 0$ and $P_{DD} - H_{DD} \geq P^*_{DD} - H'_{DD}$

In this case, equation (B31) reduces to:

$$
\begin{aligned}
U_i(x) = 60 - 10\beta_i - \left(\alpha_i + \frac{\beta_i}{2} + 2\right)P_{DD} + (\alpha_i - 3\beta_i)P^*_{DD} - (4 - \alpha_i - 2\beta_i)H_{DD} \\
-(12 + \alpha_i - 6\beta_i)H'_{DD}.
\end{aligned} \tag{B32}
$$

Equation (B32) suggests that *i* will higher-order punish (not higher-order punish) in Scenario DD if $\alpha_i/2 + \beta_i > 2$ (< 2), up to:

$$H_{DD} = \min\ \{5 + \tfrac{3P^*_{DD}}{2} + \tfrac{P_{DD}}{4} - 3H'_{DD}, H'_{DD} + \hat{P}_{DD}\}.$$

[4] The coefficients on H_{DD} are the same.

Conditional on the vector of punishment decisions (P^*_{DD}, P_{DD}), the arguments of the minima define the upper envelope of the higher-order punishment schedule as a function of i's beliefs about the higher-order punishment choice of another third-party player, H'_{DD}. Thus, for higher-order punishment to be associated with a non-empty subset of first-order punishment vectors, we require that either of the following conditions must hold: (i) $\hat{P}_{DD} > -P^*_{DD}/2 - P_{DD}/12 - 5/3$ if $\hat{P}_{DD} \leq 0$, or (ii) $P^*_{DD}/2 + P_{DD}/12 + 5/3 > 0$ if $\hat{P}_{DD} > 0$.

The condition (ii) for cooperation-conducive ($\hat{P}_{DD} > 0$) higher-order punishment is always satisfied. Solving the system of inequalities for non-cooperation-conducive ($\hat{P}_{DD} \leq 0$) higher-order punishment, we obtain the necessary condition that $P_{DD} > 6P^*_{DD}/13 - 20/13$. In Figure B.7, we plot the feasible regions for higher-order punishment in (P^*_{DD}, P_{DD}) space. To check whether positive first-order punishment of a defector can be optimal in a symmetric equilibrium with higher-order punishment possibilities, we differentiate equation (B32) with respect to P_{DD}

- $\frac{dU_i}{dP_{DD}}(P_{DD} = P^*_{DD}, H_{DD} = H'_{DD}) = -2 - \alpha_i - \beta_i/2 < 0.$

Here, the restrictions $P_{DD} = P^*_{DD}$ and $H_{DD} = H'_{DD}$ do not affect the derivative as the coefficient of P_{DD} does not have P^*_{DD}. Thus, the smaller punishment *i* inflicts, the higher utility *i* receives. The maximum higher-order punishment value in any symmetric stage 3 equilibrium is 5/4. Then, from our constraints, $P_{DD} \geq 0$ and so *i* never punishes a defector in Scenario DD in any symmetric equilibrium with higher-order punishment possibilities.

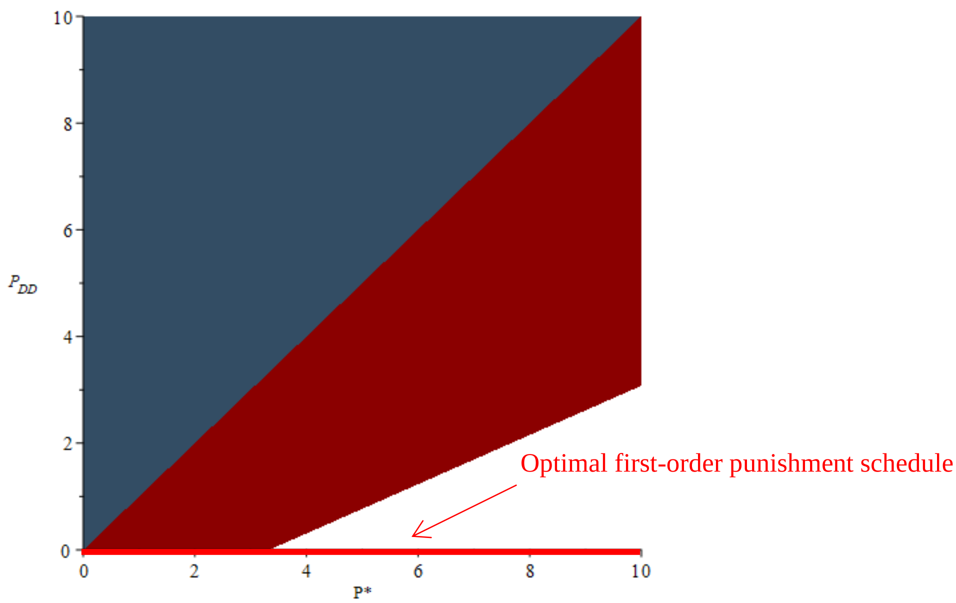


Figure B.7. *Feasible region for higher-order punishment in Scenario DD. The blue (red) region reflects cooperation-conducive (non-cooperation-conducive) punishment.*

<u>Summary</u>: Given $P_{DD} = P^*_{DD} = 0$, the conditions for the third party's optimal higher-order punishment schedule H_{CC} can be summarized as in Figure B.8.

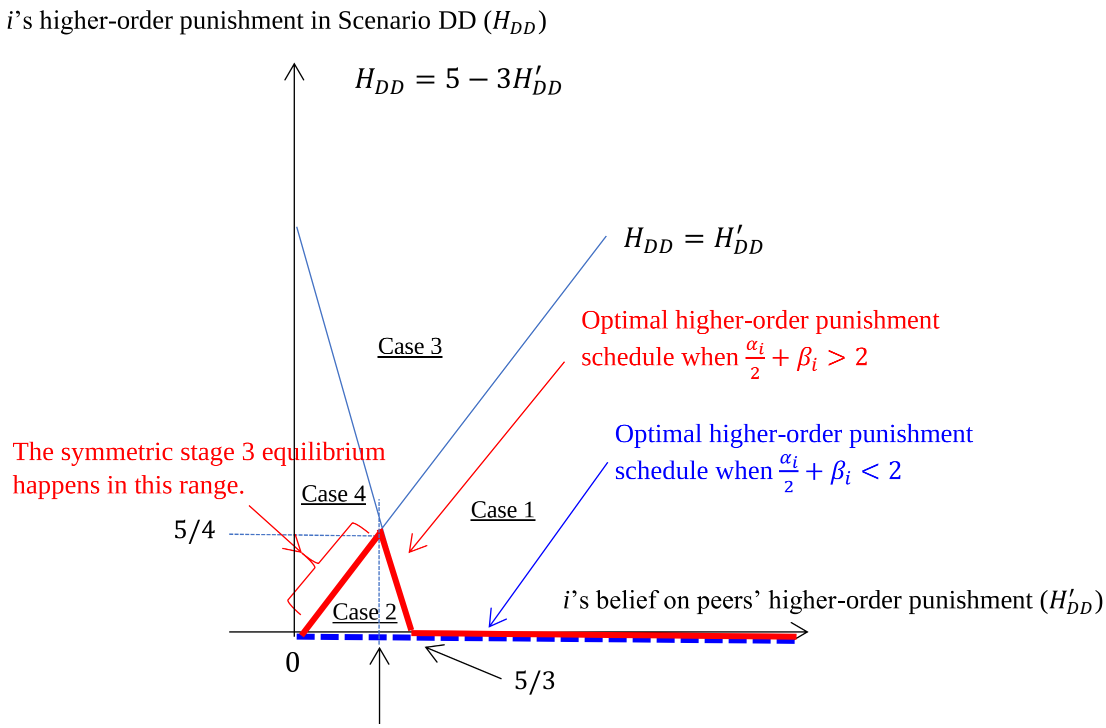


Figure B.8. *Optimal punishment schedule in Higher-Order Scenario DD*

Remark 4. The area for total higher-order punishment in the lower triangle of Scenario DD is given by:

$$\Delta_{DD} = \frac{(13P_{DD} - 6P^*_{DD} + 20)^2}{384}.$$

The expression in the numerator is strictly positive for any cooperation-conducive punishment ($P_{DD} > P^*_{DD}$) and so the total area of cooperation-conducive higher-order punishment is increasing as P^*_{DD} falls.

(d) Cooperate/defect decision

As the introduction of higher-order punishment opportunities does not influence predicted behaviors in stages 1 or 2, this analysis is unchanged from the *Trio* treatment.

B.4. *Trio* Treatment (alternative reference group for payoff comparisons)

For the *Trio* treatment, in which there are three third-party players in Stage 2 and the reference group for payoff comparisons includes *Third parties only*, no third-party punishment is predicted in any scenario. The details are as follows.

(a) *i*'s Punishment Behavior in Scenario CC

A third-party player i's utility in Scenario CC is given by:

$$U_i(x) = 60 - 2P_{CC}$$

$$-2\alpha_i \max\{P_{CC} - P'_{CC}, 0\} \tag{B33}$$

$$-2\beta_i \max\{P'_{CC} - P_{CC}, 0\}.$$

where $x = (60 - 2P_{CC}, 60 - 2P'_{CC}, 60 - 2P'_{CC})$. Equation (B33) means we need to consider two cases to analyze *i*'s punishment behavior:

Case 1: $P_{CC} \geq P'_{CC}$

In this case, equation (B33) reduces to:

$$U_i(x) = 60 - (2\alpha_i + 2)P_{CC} + 2\alpha_i P'_{CC}. \tag{B34}$$

Since $\frac{dU_i}{dP_{CC}} < 0$, the smaller punishment *i* inflicts, the higher utility *i* receives. That is, $P_{CC} = P'_{CC}$.

Case 2: $P_{CC} < P'_{CC}$

In this case, equation (B33) reduces to:

$$U_i(x) = 60 + (2\beta_i - 2)P_{CC} - 2\beta_i P'_{CC}. \tag{B35}$$

Thus, equation (B35) suggests that *i* will not punish a cooperator in Scenario CC as $\beta_i < 1$.

Summary: No third-party punishment is predicted in Scenario CC.

(b) *i*'s Punishment Behavior in Scenario CD/DC

A third-party player *i*'s utility in Scenario CD/DC is given by:

$$U_i(x) = 60 - P_{CD} - P_{DC}$$

$$-\alpha_i \max\{(P_{CD} + P_{DC}) - (P'_{CD} + P'_{DC}), 0\} \tag{B36}$$

$$-\beta_i \max\{(P'_{CD} + P'_{DC}) - (P_{CD} + P_{DC}), 0\}.$$

where $x = (60 - P_{CD} - P_{DC}, 60 - P'_{CD} - P'_{DC}, 60 - P'_{CD} - P'_{DC})$. Equation (B36) means we need to consider two cases to analyze *i*'s punishment behavior:

Case 1: $(P_{CD} + P_{DC}) \geq (P'_{CD} + P'_{DC})$

In this case, equation (B36) reduces to:

$$U_i(x) = 60 - (1 + \alpha_i)(P_{CD} + P_{DC}) + \alpha_i(P'_{CD} + P'_{DC}). \tag{B37}$$

As $\alpha_i \geq 0$, $\frac{dU_i}{dP_{CD}} < 0$ and $\frac{dU_i}{dP_{DC}} < 0$, hence equation (B37) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives.

Case 2: $(P_{CD} + P_{DC}) < (P'_{CD} + P'_{DC})$

In this case, equation (B36) reduces to:

$$U_i(x) = 60 - (1 - \beta_i)(P_{CD} + P_{DC}) - \beta_i(P'_{CD} + P'_{DC}). \quad \text{(B38)}$$

As $\beta_i < 1$, $\frac{dU_i}{dP_{CD}} < 0$ and $\frac{dU_i}{dP_{DC}} < 0$, hence equation (B38) suggests that the smaller punishment *i* inflicts, the higher utility *i* receives.

Summary: No third-party punishment is predicted in Scenario CD or DC.

(c) *i*'s Punishment Behavior in Scenario DD

The analysis is identical to Scenario CC after substituting the scenario.

Summary: No third-party punishment is predicted in Scenario DD.

B.5. *Higher-Order* Treatment (alternative reference group for payoff comparisons)

For the *Higher-Order* treatment, in which there are three third-party players in Stage 2 and the reference group for payoff comparisons includes *Third parties only*, we again consider the possibility of cooperation-conducive or non-cooperation-conducive higher-order punishment due to the relative difference between P_s and P_s^*, which we denote as $\hat{P}_s = P_s - P_s^*$. There exist symmetric equilibria involving higher-order punishment in all scenarios if and only if $\alpha_i > 2$. Outside of the symmetric equilibria, third parties are more likely to higher-order punish a third party's failure to punish a norm violator, which is non-cooperation-conducive in Scenarios CC and CD and cooperation-conducive in Scenarios DC and DD. The details are as follows.

(a) *i*'s Punishment Behavior in Scenario CC

A third-party player *i*'s utility in Scenario CC is given by:

$$\begin{aligned} &U_i(x) = 60 - 2P_{CC} - 4H_{CC} - 12H'_{CC} \\ &-2\alpha_i \max\{P_{CC} - P^*_{CC} - H_{CC} + H'_{CC}, 0\} \quad \text{(B39)} \\ &-2\beta_i \max\{P^*_{CC} - P_{CC} - H'_{CC} + H_{CC}, 0\}, \end{aligned}$$

where $x = (60 - 2P_{CC} - 4H_{CC} - 12H'_{CC}, 60 - 2P^*_{CC} - 10H'_{CC} - 6H_{CC}, 60 - 2P^*_{CC} - 10H'_{CC} - 6H_{CC})$. Equation (B39) means we need to consider two cases to analyze *i*'s higher-order punishment behavior:

Case 1: $P_{CC} - H_{CC} \geq P^*_{CC} - H'_{CC}$

In this case, equation (B39) reduces to:

$$U_i(x) = 60 - (2\alpha_i + 2)P_{CC} + 2\alpha_i P^*_{CC} + (2\alpha_i - 4)H_{CC} - (12 + 2\alpha_i)H'_{CC}. \quad \text{(B40)}$$

Equation (B40) suggests that *i* will higher-order punish (not higher-order punish) in Scenario CC only if $\alpha_i > 2$ (< 2), up to:

$$H_{CC} = H'_{CC} + \hat{P}_{CC}.$$

This implies that if *i* is very averse to disadvantageous inequality, then the symmetric equilibrium in which $P_{CC,i} = 0$ for all *i* and $H_{CC} = 0$ exists, but that a range of other symmetric equilibria also exist in which $P_{CC,i} = 0$ and $H_{CC} = H'_{CC} > 0$. Further, outside of the symmetric equilibria, higher-order punishment is more likely to be non-cooperation-conducive (i.e., if $\hat{P}_{CC} > 0$).

Case 2: $P_{CC} - H_{CC} < P^*_{CC} - H'_{CC}$

In this case, equation (B39) reduces to:

$$U_i(x) = 60 - (2 - 2\beta_i)P_{CC} - 2\beta_i P^*_{CC} - (4 + 2\beta_i)H_{CC} - (12 - 2\beta_i)H'_{CC}. \quad \text{(B41)}$$

Since $\frac{dU_i}{dH_{CC}} < 0$, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

Summary: A continuum of symmetric higher-order punishment equilibria exist in Scenario CC if and only if $\alpha_i > 2$.

(b) *i*'s Punishment Behavior in Scenario CD/DC

A third-party player *i*'s utility in Scenario CD/DC is given by:

$$U_i(x) = 60 - P_{CD} - P_{DC} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC})$$

$$-\alpha_i \max\{(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}), 0\} \quad \text{(B42)}$$

$$-\beta_i \max\{(P^*_{CD} + P^*_{DC}) - (P_{CD} + P_{DC}) + (H_{CD} + H_{DC}) - (H'_{CD} + H'_{DC}), 0\},$$

where $x = \big(60 - P_{CD} - P_{DC} - 2(H_{CD} + H_{DC}) - 6(H'_{CD} + H'_{DC}), 60 - P^*_{CD} - P^*_{DC} - 5(H'_{CD} + H'_{DC}) - 3(H_{CD} + H_{DC}), 60 - P^*_{CD} - P^*_{DC} - 5(H'_{CD} + H'_{DC}) - 3(H_{CD} + H_{DC})\big)$. Equation (B42) means we need to consider two cases to analyze *i*'s higher-order punishment behavior:

Case 1: $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) \geq 0$

In this case, equation (B42) reduces to:

$$U_i(x) = 60 - (1 + \alpha_i)(P_{CD} + P_{DC}) + \alpha_i(P^*_{CD} + P^*_{DC}) + (\alpha_i - 2)(H_{CD} + H_{DC}) - (6 + \alpha_i)(H'_{CD} + H'_{DC}). \quad \text{(B43)}$$

First, we consider the possibility of higher-order punishment in Scenario CD. As we are searching for symmetric equilibria, we assume that $P_{DC} = P^*_{DC}$ and $H_{DC} = H'_{DC} = H^*_{DC}$. Equation (B43) suggests that *i* will higher-order punish (not higher-order punish) in Scenario CD only if $\alpha_i > 2$ (< 2), up to:

$$H_{CD} = H'_{CD} + \hat{P}_{CD}.$$

This implies that if *i* is very averse to disadvantageous inequality, then the symmetric equilibrium in which $P_{CD,i} = 0$ for all *i* and $H_{CD} = 0$ exists, but that a range of other symmetric equilibria also exist in which $P_{CD,i} = 0$ for all *i* and $H_{CD} = H'_{CD} > 0$. Further, outside of the symmetric equilibria, higher-order punishment is more likely to be non-cooperation-conducive (i.e., if $\hat{P}_{CC} > 0$).

Second, we consider the possibility of higher-order punishment in Scenario DC. As we are searching for symmetric equilibria, we assume that $P_{CD} = P^*_{CD}$ and $H_{CD} = H'_{CD} = H^*_{CD}$. Equation (B43) suggests that *i* will higher-order punish (not higher-order punish) in Scenario DC only if $\alpha_i > 2$ (< 2), up to:

$$H_{DC} = H'_{DC} + \hat{P}_{DC}.$$

This implies that if *i* is very averse to disadvantageous inequality, then the symmetric equilibrium in which $P_{DC,i} = 0$ for all *i* and $H_{DC} = 0$ exists, but that a range of other symmetric equilibria also exist in which $P_{DC,i} = 0$ for all *i* and $H_{DC} = H'_{DC} > 0$. Further, outside of the symmetric equilibria, higher-order punishment is more likely to be cooperation-conducive (i.e., if $\hat{P}_{DC} > 0$).

<u>Case 2</u>: $(P_{CD} + P_{DC}) - (P^*_{CD} + P^*_{DC}) + (H'_{CD} + H'_{DC}) - (H_{CD} + H_{DC}) < 0$

In this case, equation (B42) reduces to:

$$U_i(x) = 60 - (1 - \beta_i)(P_{CD} + P_{DC}) - \beta_i(P^*_{CD} + P^*_{DC}) - (\beta_i + 2)(H_{CD} + H_{DC}) - (6 - \beta_i)(H'_{CD} + H'_{DC}). \tag{B44}$$

Since $\frac{dU_i}{dH_{CD}} < 0$ and $\frac{dU_i}{dH_{DC}} < 0$, the smaller higher-order punishment *i* inflicts, the higher utility *i* receives.

<u>Summary</u>: A continuum of symmetric higher-order punishment equilibria exist in Scenario CD and DC if and only if $\alpha_i > 2$.

(c) *i*'s Punishment Behavior in Scenario DD

The analysis is identical to Scenario CC after substituting the scenario. Outside of the symmetric equilibria, higher-order punishment is more likely to be cooperation-conducive (i.e., if $\hat{P}_{DD} > 0$).

<u>Summary</u>: A continuum of symmetric higher-order punishment equilibria exist in Scenario DD if and only if $\alpha_i > 2$.

Appendix C: Additional Figures and Tables

(a) Contains OS data © Crown copyright and database right (2023); (b) Made with Natural Earth.

(a) UK (Newcastle) (b) India (Sonipat)

Figure C. 1: *Selection of the Two Societies*

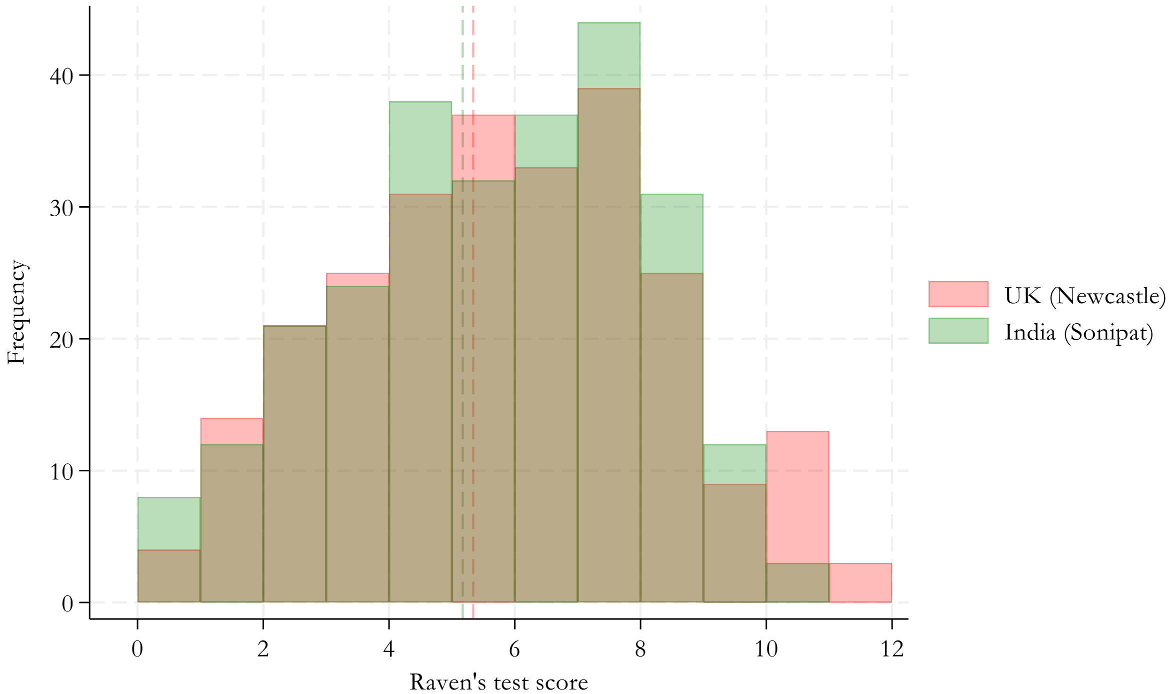


Figure C. 2: *Raven's Progressive Matrices Test Score Distributions*

Notes: Raven's test score means the number of correct answers in the task. The vertical lines are placed at the mean scores, 5.34 for the Newcastle sample and 5.17 for the Sonipat sample. The standard deviations of the scores are 2.53 for the Newcastle sample and 2.38 for the Sonipat sample. The average Raven's test scores are not significantly different between the two locations with two-sided p = 0.646 (Mann-Whitney test).

Table C.1: *Cross-Societal Subject Pool Characteristics.*

	Newcastle			Sonipat			
	n	mean	sd.	n	mean	sd.	Diff
Panel A: Attitudes							
Positive reciprocity	239	8.80	1.42	262	8.92	1.68	0.125
Trust intentions	239	4.72	2.40	262	4.63	2.92	-0.090
Generalized trust	239	5.50	2.19	262	4.49	2.29	-1.014***
Trust in-group	239	3.20	0.37	262	3.12	0.47	-0.078*
Trust out-group	239	2.68	0.46	262	2.43	0.58	-0.249***
Communal vs. universal values (z-score)	239	0.07	0.96	262	-0.06	1.03	-0.132
Moral purity and disgust	239	10.56	4.12	262	9.85	4.36	-0.714
Guilt	239	45.20	5.44	261	45.13	6.33	-0.070
Shame	239	33.90	6.77	261	32.81	8.15	-1.087
Third-party vs. direct punishment (z-score)	239	0.09	0.89	262	-0.08	1.06	-0.164**
Charitable giving	239	7.40	2.07	262	7.41	2.42	0.011
Importance of God	239	3.92	3.30	262	5.49	3.43	1.572***
Family ties	239	3.67	0.58	262	3.65	0.60	-0.024
Risk preference	239	6.29	2.08	262	6.38	2.16	0.089
Norm adherence	239	4.09	0.65	262	4.40	0.80	0.312***
Confidence in institutions	239	2.26	0.49	262	2.18	0.53	-0.082
Panel B: Demographics and Raven's test score							
Female	237	0.49	0.50	261	0.43	0.50	-0.057
Econ major	237	0.30	0.46	259	0.30	0.46	-0.007
Age	225	21.48	3.55	243	20.44	5.27	-1.036*
Num. siblings	232	1.72	1.33	256	1.23	1.44	-0.481***
Relative income at 16	237	3.22	0.94	258	3.34	1.09	0.122
Raven's test score	254	5.34	2.53	262	5.17	2.38	-0.167
Panel C: Big 5 personality traits							
Openness	239	3.71	0.79	262	4.07	0.79	0.360***
Conscientiousness	239	3.54	0.77	262	3.32	0.77	-0.222***
Extraversion	239	3.47	0.88	262	3.22	1.01	-0.257***
Agreeableness	239	3.82	0.71	262	3.68	0.79	-0.133**
Neuroticism	239	3.51	1.02	262	3.48	1.00	-0.034

Notes: Table shows averages pooled across treatments. The Diff column is the coefficient of a linear regression of the variable of interest on the study location. Stars indicate whether this difference is significant. *** p<0.01, ** p<0.05, * p<0.1

Table C.2: *Across-Scenario Difference in Frequency of First-Order Punishment by Treatment in the UK*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	1.998***	1.406***	1.527***	1.513***	1.594***	1.829***
	(0.394)	(0.289)	(0.304)	(0.347)	(0.256)	(0.460)
Mutual defection	0.860***	0.866***	0.983***	0.778**	0.672***	1.391***
	(0.293)	(0.277)	(0.314)	(0.320)	(0.257)	(0.342)
Victim	0.194	-0.175	0.417	-0.000	-0.165	0.042
	(0.469)	(0.221)	(0.313)	(0.246)	(0.276)	(0.322)
Constant	-1.658	-2.704*	-2.187	-0.200	0.167	-3.171*
	(1.482)	(1.643)	(1.946)	(2.328)	(1.391)	(1.695)
Observations	84	176	200	132	172	116
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-43.01	-91.59	-93.33	-69.69	-90.64	-51.68
Pseudo R2	0.260	0.189	0.219	0.148	0.231	0.296
H_0: Betrayal = Mutual defection (Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
Chi-squared-stat.	9.875	4.024	8.858	6.325	17.916	1.211
p-value (two-sided)	0.002	0.045	0.003	0.012	0.000	0.271

Notes: Probit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is an indicator for a third-party player *i*'s decision (or a PD player's beliefs about a third-party player *i*'s decision) to first-order punish. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.3: *Across-Scenario Difference in Strength of First-Order Punishment by Treatment in the UK*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	6.941***	4.619***	7.328***	3.838***	5.854***	4.257***
	(1.972)	(0.631)	(1.599)	(0.843)	(0.918)	(0.661)
Mutual defection	3.203***	2.013***	4.087***	1.792*	2.429**	2.474***
	(1.004)	(0.608)	(1.400)	(1.016)	(0.968)	(0.648)
Victim	1.083	-0.072	1.972	-0.386	-0.602	-0.016
	(1.781)	(0.703)	(1.416)	(0.794)	(1.163)	(0.875)
Constant	-6.023	-3.096	-9.350	0.103	-1.524	-6.204
	(4.735)	(4.072)	(8.370)	(6.632)	(5.753)	(3.905)
Observations	84	176	200	132	172	116
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-131	-340.4	-217.1	-270.7	-257.7	-216.8
Pseudo R2	0.102	0.0805	0.113	0.0526	0.0958	0.101
H_0: Betrayal = Mutual defection (Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
F-stat.	6.595	26.286	14.905	13.185	25.389	15.072
p-value (two-sided)	0.012	0.000	0.000	0.000	0.000	0.000

Notes: Tobit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is a third-party player *i*'s punishment points (or a PD player's beliefs about a third-party player *i*'s punishment points) given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.4: *Across-Scenario Difference in Frequency of First-Order Punishment by Treatment in the UK (excluding Economics majors)*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	2.273***	1.059***	1.581***	1.321***	2.015***	1.754***
	(0.460)	(0.298)	(0.400)	(0.345)	(0.325)	(0.531)
Mutual defection	1.384***	0.453	0.870**	0.738**	1.192***	1.501***
	(0.499)	(0.294)	(0.421)	(0.365)	(0.273)	(0.436)
Victim	-0.223	-0.153	0.691	0.002	0.031	0.339
	(0.653)	(0.263)	(0.500)	(0.216)	(0.317)	(0.362)
Constant	5.674***	-1.569	-1.063	-0.853	-0.064	-2.214
	(1.403)	(1.998)	(2.719)	(3.023)	(1.496)	(2.166)
Observations	48	132	124	96	128	80
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-20.70	-71.56	-49.04	-51.44	-62.95	-36.85
Pseudo R2	0.371	0.141	0.307	0.125	0.286	0.280
H_0: Betrayal = Mutual defection (Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
Chi-squared-stat.	3.381	3.981	7.833	3.973	10.605	0.352
p-value (two-sided)	0.066	0.046	0.005	0.046	0.001	0.553

Notes: Probit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is an indicator for a third-party player *i*'s decision (or a PD player's beliefs about a third-party player *i*'s decision) to first-order punish. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.5: *Across-Scenario Difference in Strength of First-Order Punishment by Treatment in the UK (excluding Economics majors)*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	4.796***	3.898***	5.972***	3.296***	7.101***	4.002***
	(1.737)	(0.758)	(1.584)	(1.001)	(1.091)	(0.712)
Mutual defection	3.100***	1.300*	2.631*	1.045	4.279***	2.842***
	(1.089)	(0.739)	(1.438)	(0.927)	(1.025)	(0.830)
Victim	-0.389	0.003	2.825*	-0.481	0.583	0.922
	(1.636)	(0.851)	(1.681)	(0.726)	(1.188)	(1.071)
Constant	8.337***	-2.440	-0.355	3.574	-3.318	-3.899
	(2.954)	(5.323)	(9.494)	(8.729)	(5.744)	(4.790)
Observations	48	132	124	96	128	80
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-75.27	-265.5	-118.5	-198.8	-191.3	-148.1
Pseudo R2	0.150	0.0604	0.141	0.0482	0.124	0.0954
H_0: Betrayal = Mutual defection						
(Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
F-stat.	3.742	14.029	10.554	24.991	31.249	4.179
p-value (two-sided)	0.060	0.000	0.002	0.000	0.000	0.045

Notes: Tobit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is a third-party player *i*'s punishment points (or a PD player's beliefs about a third-party player *i*'s punishment points) given to a PD player. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.6: *Across-Scenario Difference in Frequency of First-Order Punishment by Treatment in the UK (excluding Economics, and Business and Management majors)*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	2.186***	1.321***	1.683***	1.459***	1.800***	1.921***
	(0.449)	(0.353)	(0.420)	(0.389)	(0.378)	(0.628)
Mutual defection	1.229**	0.529	0.901**	0.842**	1.081***	1.660***
	(0.503)	(0.355)	(0.438)	(0.423)	(0.323)	(0.530)
Victim	-0.250	-0.089	0.721	-0.004	-0.412	0.468
	(0.693)	(0.301)	(0.517)	(0.263)	(0.340)	(0.434)
Constant	6.765***	-0.336	-1.128	1.453	2.033	-0.079
	(2.185)	(1.941)	(2.598)	(3.160)	(1.699)	(2.507)
Observations	44	116	116	80	100	60
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-19.22	-58.24	-45.96	-43.86	-46.14	-28.47
Pseudo R2	0.361	0.206	0.327	0.163	0.329	0.301
H_0: Betrayal = Mutual defection (Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
Chi-squared-stat.	3.654	4.457	8.449	3.716	7.455	0.322
p-value (two-sided)	0.056	0.035	0.004	0.054	0.006	0.571

Notes: Probit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is an indicator for a third-party player *i*'s decision (or a PD player's beliefs about a third-party player *i*'s decision) to first-order punish. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.7: *Across-Scenario Difference in Strength of First-Order Punishment by Treatment in the UK (excluding Economics, and Business and Management majors)*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	4.634**	4.068***	6.007***	3.986***	5.872***	4.669***
	(1.863)	(0.843)	(1.586)	(1.176)	(1.002)	(1.071)
Mutual defection	2.938**	1.467*	2.597*	1.425	3.485***	3.162**
	(1.147)	(0.830)	(1.422)	(1.146)	(0.951)	(1.238)
Victim	-0.417	0.135	2.845*	-0.460	-1.009	1.241
	(1.744)	(0.968)	(1.664)	(0.931)	(1.140)	(1.433)
Constant	8.742*	-0.270	-0.573	11.610	4.848	2.334
	(4.873)	(5.389)	(8.781)	(9.692)	(5.049)	(4.319)
Observations	44	116	116	80	100	60
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-70.83	-230.6	-115.8	-155.4	-140.3	-99.24
Pseudo R2	0.135	0.0720	0.145	0.0637	0.166	0.128
H_0: Betrayal = Mutual defection (Do third parties punish defectors differently between "betrayal" and "mutual defection" in the UK?)						
F-stat.	2.970	10.965	10.807	29.063	27.750	9.495
p-value (two-sided)	0.093	0.001	0.001	0.000	0.000	0.003

Notes: Tobit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is a third-party player *i*'s punishment points (or a PD player's beliefs about a third-party player *i*'s punishment points) given to a PD player. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.8: *Across-Treatment Differences in First-Order Punishment by Scenario in the UK.*

Dependent var.	PD players' decision to cooperate	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
		Scenario							
		I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
Trio	0.314	-0.498	-1.881	-1.211***	-3.398***	-0.409	-2.136	-0.689**	-2.287**
	(0.326)	(0.397)	(1.853)	(0.398)	(1.280)	(0.366)	(1.802)	(0.343)	(1.079)
Higher-Order	0.128	0.099	0.959	-0.366	-0.949	-0.261	-1.372	-0.314	-0.844
	(0.342)	(0.379)	(1.813)	(0.407)	(1.199)	(0.365)	(1.798)	(0.338)	(1.072)
Constant	0.740	-0.922	-2.349	0.119	-1.709	-0.287	-1.938	-2.747**	-8.346**
	(1.163)	(1.204)	(6.003)	(1.240)	(4.246)	(1.177)	(5.732)	(1.195)	(3.740)
Observations	106	114	114	114	114	114	114	114	114
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-58.07	-50.91	-92.84	-63.29	-243.7	-57.25	-108.3	-70.84	-172.4
Pseudo R2	0.0663	0.0652	0.0405	0.110	0.0234	0.0243	0.0111	0.0906	0.0310

Notes: Columns (1), (2a), (3a), (4a) and (5a) are Probit regressions. The dependent variable is the PD players' decision to cooperate (col. 1) or the third parties' decision to first-order punish (cols. 2a, 3a, 4a and 5a). Columns (2b), (3b), (4b) and (5b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1

Table C.9: *Across-Treatment Differences in First-Order Punishment by Scenario in the UK (excluding Economics majors).*

Dependent var.	PD players' decision to cooperate	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
		Scenario							
		I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
Trio	0.695	-1.095**	-3.944**	-1.869***	-3.951***	-0.138	-0.521	-1.516***	-4.413***
	(0.440)	(0.546)	(1.871)	(0.586)	(1.294)	(0.472)	(2.247)	(0.516)	(1.127)
Higher-Order	0.202	-0.495	-1.670	-0.556	-0.354	-0.168	-0.492	-0.599	-1.140
	(0.452)	(0.456)	(1.618)	(0.583)	(1.112)	(0.466)	(2.245)	(0.474)	(0.960)
Constant	-0.902	0.279	-0.766	2.339	2.734	-0.717	-4.237	-1.263	-0.862
	(1.391)	(1.496)	(5.437)	(1.539)	(4.707)	(1.755)	(8.713)	(1.549)	(3.453)
Observations	77	75	75	75	75	75	75	75	75
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-33.97	-32.06	-56.14	-37	-157.1	-36.75	-71.76	-43.37	-114.1
Pseudo R2	0.164	0.0730	0.0420	0.200	0.0434	0.0546	0.0281	0.165	0.0740

Notes: Columns (1), (2a), (3a), (4a) and (5a) are Probit regressions. The dependent variable is the PD players' decision to cooperate (col. 1) or the third parties' decision to first-order punish (cols. 2a, 3a, 4a and 5a). Columns (2b), (3b), (4b) and (5b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.10: *Across-Treatment Differences in First-Order Punishment by Scenario in the UK (excluding Economics, and Business and Management majors).*

Dependent var.	PD players' decision to cooperate	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
		Scenario							
		I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
Trio	0.568	-1.194**	-4.063**	-1.631***	-3.578**	-0.189	-0.607	-1.278**	-4.137***
	(0.445)	(0.579)	(1.827)	(0.599)	(1.439)	(0.499)	(2.106)	(0.534)	(1.226)
Higher-Order	0.135	-0.380	-1.148	-0.613	-0.542	-0.252	-0.806	-0.441	-0.974
	(0.504)	(0.484)	(1.598)	(0.603)	(1.317)	(0.496)	(2.177)	(0.500)	(1.085)
Constant	0.461	0.092	-1.395	1.915	2.385	-0.038	-0.379	-1.539	-0.825
	(1.556)	(1.487)	(5.243)	(1.514)	(5.100)	(1.860)	(8.518)	(1.589)	(3.553)
Observations	64	65	65	65	65	65	65	65	65
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-30.24	-29.67	-53.52	-34.45	-135.5	-31.59	-60.88	-38.01	-99.02
Pseudo R2	0.132	0.0877	0.0516	0.158	0.0333	0.0673	0.0407	0.155	0.0681

Notes: Columns (1), (2a), (3a), (4a) and (5a) are Probit regressions. The dependent variable is the PD players' decision to cooperate (col. 1) or the third parties' decision to first-order punish (cols. 2a, 3a, 4a and 5a). Columns (2b), (3b), (4b) and (5b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.11: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in the UK.*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.808***	3.181***	1.189***	5.512***	0.589**	2.207*	0.612*	3.511*
	(0.223)	(0.841)	(0.229)	(1.094)	(0.296)	(1.187)	(0.319)	(1.872)
Constant	-0.160	0.172	-0.511	-4.112	0.331	1.246	-0.836	-4.898
	(1.390)	(5.651)	(1.525)	(6.923)	(1.470)	(6.015)	(1.552)	(7.428)
Observations	638	638	642	642	636	636	664	664
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-400.7	-984.9	-325.5	-780.5	-407.4	-975.3	-343.1	-745.8
Pseudo R2	0.0775	0.0336	0.186	0.0903	0.0561	0.0245	0.131	0.0686

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim" are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1

Table C.12: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in the UK (excluding Economics majors).*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	1.055***	4.272***	1.398***	6.816***	0.642*	2.231*	0.682*	4.525*
	(0.253)	(0.893)	(0.253)	(1.082)	(0.335)	(1.305)	(0.351)	(2.413)
Constant	-0.638	-2.127	-2.052	-10.694	-0.078	-0.323	-1.422	-8.537
	(1.437)	(5.377)	(1.544)	(6.557)	(1.476)	(6.024)	(1.642)	(8.868)
Observations	468	468	464	464	486	486	502	502
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-283	-710.3	-208.3	-490.9	-312.9	-753.7	-259	-520.9
Pseudo R2	0.113	0.0515	0.227	0.117	0.0544	0.0183	0.0697	0.0450

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim" are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.13: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in the UK (excluding Economics, and Business and Management majors).*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.996***	3.996***	1.551***	8.203***	0.810*	3.386*	0.607	4.413*
	(0.325)	(1.087)	(0.304)	(1.019)	(0.445)	(1.860)	(0.410)	(2.626)
Constant	1.373	5.772	-1.215	-6.339	1.215	6.286	0.021	0.391
	(1.439)	(5.818)	(1.964)	(9.502)	(1.713)	(7.132)	(1.917)	(10.684)
Observations	354	354	366	366	386	386	394	394
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-194.2	-489.3	-136.9	-314.2	-216.5	-529.6	-182.4	-355
Pseudo R2	0.180	0.0861	0.283	0.166	0.153	0.0709	0.0946	0.0744

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim" are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.14: *Across-Scenario Difference in Frequency of First-Order Punishment by Treatment in India*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	1.108***	1.003***	1.013***	0.918***	0.823***	1.162***
	(0.299)	(0.245)	(0.234)	(0.248)	(0.192)	(0.253)
Mutual defection		0.242	0.571**	0.620***	0.330*	0.823***
		(0.178)	(0.230)	(0.209)	(0.196)	(0.221)
Victim		-0.159	-0.003	0.067	0.131	-0.070
		(0.229)	(0.269)	(0.178)	(0.220)	(0.199)
Constant	0.495	-0.959	0.241	1.941	3.350	0.239
	(4.446)	(1.920)	(2.651)	(2.040)	(2.660)	(0.769)
Observations	36[#1]	136	232	160	208	148
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-14.40	-79.57	-116.2	-96.61	-113.6	-79.68
Pseudo R2	0.245	0.147	0.143	0.106	0.120	0.180
H_0: Betrayal = Mutual defection						
(Do third parties punish defectors differently between "betrayal" and "mutual defection" in India?)						
Chi-squared-stat.	13.761	11.673	8.323	1.811	8.205	3.665
p-value (two-sided)	0.000	0.001	0.004	0.178	0.004	0.056

Notes: Probit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is an indicator for a third-party player *i*'s decision (or a PD player's beliefs about a third-party player *i*'s decision) to first-order punish.

[#1] 38 observations are dropped because there is no punishment in the Mutual cooperation or Victim scenarios of the Baseline treatment after including controls; in Figure 6 panel (A1i), we therefore use Fisher's exact test for the statistical comparisons. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score.

*** p<0.01, ** p<0.05, * p<0.1

Table C.15: *Across-Scenario Difference in Strength of First-Order Punishment by Treatment in India*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	23.542***	2.867***	8.131***	2.347***	3.862***	3.018***
	(3.739)	(0.763)	(2.400)	(0.604)	(0.950)	(0.688)
Mutual defection	19.464***	0.854	5.237**	1.129**	1.837*	1.568**
	(3.164)	(0.579)	(2.299)	(0.469)	(0.987)	(0.688)
Victim	0.000	-0.661	0.475	0.005	0.231	-0.617
	(.)	(0.588)	(2.218)	(0.536)	(0.985)	(0.717)
Constant	-17.418	-6.769	-5.698	1.974	10.175	0.773
	(17.707)	(5.129)	(20.861)	(7.314)	(11.584)	(2.103)
Observations	72	136	232	160	208	148
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-30.81	-236.6	-264.9	-303.5	-256.1	-286.4
Pseudo R2	0.264	0.0560	0.0550	0.0450	0.0496	0.0637
H_0: Betrayal = Mutual defection						
(Do third parties punish defectors differently between “betrayal” and “mutual defection” in India?)						
F-stat.	7.808	6.917	7.025	7.048	6.558	17.167
p-value (two-sided)	0.007	0.010	0.009	0.009	0.011	0.000

Notes: Tobit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is a third-party player *i*'s punishment points (or a PD player's beliefs about a third-party player *i*'s punishment points) given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.16: *Across-Scenario Difference in Frequency of First-Order Punishment by Treatment in India (excluding Economics majors)*[5]

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	1.073***	1.125***	0.835***	0.959***	0.784***	1.982***
	(0.383)	(0.323)	(0.270)	(0.312)	(0.223)	(0.494)
Mutual defection		0.218	0.564**	0.654**	0.163	1.431***
		(0.218)	(0.252)	(0.261)	(0.171)	(0.469)
Victim		-0.122	0.002	0.001	0.170	-0.565**
		(0.303)	(0.305)	(0.222)	(0.240)	(0.253)
Constant	-1.641	-0.302	0.911	0.751	1.899	13.135***
	(4.629)	(2.193)	(2.952)	(2.386)	(2.983)	(3.359)
Observations	28[#1]	96	168	120	140	92
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-10.73	-56.95	-87.75	-70.79	-85.37	-33.59
Pseudo R2	0.183	0.134	0.142	0.119	0.0855	0.397
H_0: Betrayal = Mutual defection						
(Do third parties punish defectors differently between "betrayal" and "mutual defection" in India?)						
Chi-squared-stat.	7.827	9.381	2.787	1.122	9.721	3.263
p-value (two-sided)	0.005	0.002	0.095	0.290	0.002	0.071

Notes: Probit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is an indicator for a third-party player *i*'s decision (or a PD player's beliefs about a third-party player *i*'s decision) to first-order punish. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. [#1] 28 observations are dropped because there is no punishment in the Mutual cooperation or Victim scenarios of the Baseline treatment. *** p<0.01, ** p<0.05, * p<0.1

[5] Only one subject reported studying Business and Management as their academic major in the India sample. Hence, we do not report specifications with this additional exclusion in India.

Table C.17: *Across-Scenario Difference in Strength of First-Order Punishment by Treatment in India (excluding Economics majors)*

	Baseline		Trio		Higher-Order	
Dependent variable	Decisions	Beliefs	Decisions	Beliefs	Decisions	Beliefs
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Betrayal	26.650***	2.864***	6.216***	2.658***	2.882***	3.302***
	(3.140)	(0.726)	(2.178)	(0.784)	(0.667)	(0.855)
Mutual defection	21.785***	0.878	4.403**	1.178*	0.979	2.098**
	(3.679)	(0.779)	(2.099)	(0.609)	(0.624)	(0.822)
Victim	0.000	-0.393	0.122	-0.213	0.347	-1.906***
	(.)	(0.771)	(2.134)	(0.702)	(0.867)	(0.722)
Constant	-29.740	-3.251	-3.426	-2.949	4.443	25.234***
	(21.113)	(4.907)	(20.418)	(9.832)	(11.177)	(5.999)
Observations	56	96	168	120	140	92
Control	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-20.95	-161.9	-208.6	-232.9	-197.1	-175.8
Pseudo R2	0.248	0.0752	0.0504	0.0470	0.0402	0.122
H_0: Betrayal = Mutual defection						
(Do third parties punish defectors differently between “betrayal” and “mutual defection” in India?)						
F-stat.	9.659	5.815	2.745	6.302	8.742	7.712
p-value (two-sided)	0.003	0.018	0.099	0.013	0.004	0.007

Notes: Tobit regressions with robust standard errors in parentheses clustered by subject ID. The dependent variable is a third-party player *i*’s punishment points (or a PD player’s beliefs about a third-party player *i*’s punishment points) given to a PD player. The control variables include a dummy for female, age, number of siblings, income rank and the Raven’s test score. *** p<0.01, ** p<0.05, * p<0.1

Table C.18: *Across-Treatment Differences in First-Order Punishment by Scenario in India.*

Dependent var.	PD players' decision to cooperate	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
		Scenario							
		I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
Trio	0.164	-0.233	24.983***	0.389	3.213	-0.322	29.979***	0.732	6.772*
	(0.313)	(0.323)	(2.656)	(0.381)	(2.130)	(0.299)	(7.049)	(0.471)	(3.589)
Higher-Order	0.286		25.897***	0.327	2.193		30.835***	0.697	5.828*
	(0.317)		(2.614)	(0.381)	(1.956)		(6.381)	(0.455)	(3.413)
Constant	-3.167*	1.494	-14.398	2.209	2.159	2.392	-20.406	0.240	-12.898
	(1.869)	(2.606)	(12.656)	(2.062)	(10.883)	(2.366)	(13.338)	(2.006)	(16.034)
Observations	111	110[#1]	128	128	128	110[#1]	128	128	128
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-71.74	-45.80	-89.92	-83.68	-216.3	-49.43	-97.33	-71.90	-155.7
Pseudo R2	0.0632	0.122	0.0945	0.0508	0.0153	0.102	0.0752	0.0545	0.0254

Notes: Columns (1), (2a), (3a), (4a) and (5a) are Probit regressions. The dependent variable is the PD players' decision to cooperate (col. 1) or the third parties' decision to first-order punish (cols. 2a, 3a, 4a and 5a). Columns (2b), (3b), (4b) and (5b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. [#1] 18 observations are dropped because there is no punishment in the Mutual cooperation or Victim scenarios of the Baseline treatment after including controls; in Figure 7 panel (A1i), we therefore use Fisher's exact test for the statistical comparisons. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1.

Table C.19: *Across-Treatment Differences in First-Order Punishment by Scenario in India (excluding Economics majors).*

Dependent var.	PD players' decision to cooperate	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
		Scenario							
		I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)
Trio	0.480	-0.323	22.790***	0.569	3.933	-0.346	23.559***	1.311**	9.138**
	(0.382)	(0.346)	(2.751)	(0.460)	(2.451)	(0.329)	(5.105)	(0.613)	(4.075)
Higher-Order	0.585		23.926***	0.732	3.429		24.393***	1.141*	7.510*
	(0.405)		(2.610)	(0.455)	(2.148)		(4.575)	(0.591)	(3.900)
Constant	-9.310***	1.143	-14.978	1.164	-4.034	2.433	-15.747	-0.421	-15.601
	(2.692)	(2.815)	(12.932)	(2.280)	(11.156)	(2.697)	(12.516)	(2.324)	(15.799)
Observations	77	77#1	91	91	91	77#1	91	91	91
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-44.88	-39.49	-78.04	-57.78	-158.3	-40.82	-82.41	-50.15	-117.3
Pseudo R2	0.141	0.0568	0.0688	0.0819	0.0191	0.0746	0.0760	0.107	0.0450

Notes: Columns (1), (2a), (3a), (4a) and (5a) are Probit regressions. The dependent variable is the PD players' decision to cooperate (col. 1) or the third parties' decision to first-order punish (cols. 2a, 3a, 4a and 5a). Columns (2b), (3b), (4b) and (5b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. #1 14 observations are dropped because there is no punishment in the Mutual cooperation or Victim scenarios of the Baseline treatment. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1.

Table C.20: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in India.*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.192	1.618	1.256***	6.772***	0.254	1.706	0.612	4.906
	(0.242)	(1.624)	(0.271)	(1.936)	(0.180)	(1.152)	(0.407)	(3.557)
Constant	2.769	9.352	1.030	0.624	0.054	-1.218	-2.555	-15.368
	(2.745)	(14.901)	(2.565)	(13.223)	(2.524)	(12.525)	(2.145)	(11.794)
Observations	734	734	820	820	798	798	768	768
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-401.7	-830.5	-363.3	-796.5	-443	-914	-382.3	-761.5
Pseudo R2	0.0546	0.0252	0.186	0.0900	0.0451	0.0196	0.0669	0.0368

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1

Table C.21: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in India (excluding Economics majors).*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.263	1.628	1.039***	4.700***	0.097	0.580	0.163	0.531
	(0.242)	(1.122)	(0.294)	(1.436)	(0.198)	(0.993)	(0.363)	(1.565)
Constant	0.908	1.935	0.416	-0.432	-1.457	-6.276	-3.271	-13.136
	(2.903)	(12.928)	(2.661)	(12.242)	(2.529)	(11.166)	(2.382)	(10.451)
Observations	474	474	548	548	554	554	524	524
Loglikelihood	-273.9	-574.1	-288.4	-624.9	-330.5	-696.9	-286.5	-586.8
Pseudo R2	0.0508	0.0243	0.114	0.0558	0.0324	0.0155	0.0580	0.0252

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. The control variables include a dummy for female, age, number of siblings, income rank and the Raven's test score. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1

Table C.22: *Determinants of Cross-societal Difference in Higher-Order Punishment of Punishment Enforcement for Omission (PEO).*

(a) *"Cooperation-conducive" higher-order punishment.*

Dependent var.	Punishment frequency		Punishment strength	
	UK (Newcastle)	India (Sonipat)	UK (Newcastle)	India (Sonipat)
	(1)	(2)	(3)	(4)
(a) Personal norm[#1]	0.023	-0.146	0.327	-0.195
	(0.090)	(0.102)	(0.280)	(0.482)
(b) Higher-order belief (descriptive norm)[#2]	0.226**	0.060	0.846***	0.596
	(0.091)	(0.120)	(0.304)	(0.576)
(c) In-group favoritism	-0.267	-0.394	-0.474	-2.473
	(0.553)	(0.463)	(1.678)	(2.065)
(d) Moral values	0.016	-0.025	0.084	-0.064
	(0.018)	(0.026)	(0.054)	(0.108)
(e) Religious beliefs	-0.136**	-0.004	-0.547***	-0.195
	(0.061)	(0.066)	(0.149)	(0.374)
(g) Moral emotions	0.031	0.019	0.185*	0.020
	(0.033)	(0.028)	(0.098)	(0.151)
(g) Emotion/value	0.187***	-0.076	0.593***	-0.202
	(0.048)	(0.049)	(0.144)	(0.192)
Constant	2.448	-5.896**	8.083	-34.245*
	(1.777)	(2.894)	(6.024)	(18.060)
Observations	290	228	290	228
Control	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) are Probit regressions and the dependent variable is an indicator variable for a third-party player *i*'s decision to higher-order punish another third-party player *j*. Columns (3) and (4) are Tobit regressions and the dependent variable is a third-party player *i*'s punishment points given to another third-party player *j*. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* punished a defector less than *i* in "betrayal" or "mutual defection" are called "cooperation-conducive" higher-order punishment. The control variables include a dummy for female, age, economic major, number of siblings, income rank and the Raven's test score. [#1] This variable is the difference between *i*'s stated attitudes to third-party punish and to peer-to-peer punish. [#2] This variable is PD players' beliefs about the average number of higher-order punishment points given to another third-party player in a scenario in Stage 3, where a scenario is defined by the outcome of Stages 1 and 2; the variable is aggregated for each scenario separately within each society (UK and India).

(b) *"Non-cooperation-conducive" higher-order punishment*

Dependent var.	Punishment frequency		Punishment strength	
	UK (Newcastle)	India (Sonipat)	UK (Newcastle)	India (Sonipat)
	(1)	(2)	(3)	(4)
(a) Personal norm[#1]	0.043	0.068	0.233	0.253
	(0.053)	(0.062)	(0.209)	(0.324)
(b) Higher-order belief (descriptive norm)[#2]	0.142*	0.111**	0.539	0.864***
	(0.073)	(0.045)	(0.334)	(0.260)
(c) In-group favoritism	-0.628**	0.689**	-2.395*	3.459***
	(0.308)	(0.269)	(1.367)	(1.193)
(d) Moral values	0.018	0.032	0.045	0.140
	(0.013)	(0.026)	(0.054)	(0.126)
(e) Religious beliefs	0.024	0.129**	0.037	0.701**
	(0.045)	(0.063)	(0.187)	(0.342)
(g) Moral emotions	0.008	-0.038**	0.032	-0.171*
	(0.021)	(0.019)	(0.082)	(0.098)
(g) Emotion/value	0.107**	0.010	0.345*	0.016
	(0.044)	(0.051)	(0.177)	(0.252)
Constant	0.015	-0.063	0.272	-0.785
	(1.623)	(2.666)	(6.335)	(13.527)
Observations	1,016	1,360	1,016	1,360
Control	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) are Probit regressions and the dependent variable is an indicator variable for a third-party player *i*'s decision to higher-order punish another third-party player *j*. Columns (3) and (4) are Tobit regressions and the dependent variable is a third-party player *i*'s punishment points given to another third-party player *j*. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* punished a defector more than or equal to *i* in "betrayal" or "mutual defection" are called "non-cooperation-conducive" higher-order punishment. The control variables include a dummy for female, age, economic major, number of siblings, income rank and the Raven's test score. [#1] This variable is the difference between *i*'s stated attitudes to third-party punish and to peer-to-peer punish. [#2] This variable is PD players' beliefs about the average number of higher-order punishment points given to another third-party player in a scenario in Stage 3, where a scenario is defined by the outcome of Stages 1 and 2; the variable is aggregated for each scenario separately within each society (UK and India).

Table C.23: *Determinants of Cross-societal Difference in Higher-Order Punishment of Punishment Enforcement for Commission (PEC).*

(a) *"Cooperation-conducive" higher-order punishment.*

Dependent var.	Punishment frequency		Punishment strength	
	UK (Newcastle)	India (Sonipat)	UK (Newcastle)	India (Sonipat)
	(1)	(2)	(3)	(4)
(a) Personal norm[#1]	-0.051	0.177**	0.046	0.920**
	(0.066)	(0.071)	(0.233)	(0.448)
(b) Higher-order belief (descriptive norm)[#2]	0.098***	0.238***	0.444***	1.432***
	(0.035)	(0.055)	(0.125)	(0.401)
(c) In-group favoritism	-0.367	0.555*	-1.166	2.465
	(0.370)	(0.296)	(1.352)	(1.716)
(d) Moral values	0.013	0.014	0.035	0.054
	(0.017)	(0.023)	(0.057)	(0.133)
(e) Religious beliefs	0.033	0.102*	0.008	0.625
	(0.048)	(0.058)	(0.158)	(0.388)
(g) Moral emotions	0.001	-0.001	0.017	0.078
	(0.018)	(0.020)	(0.066)	(0.131)
(g) Emotion/value	0.080*	-0.009	0.373**	-0.055
	(0.047)	(0.041)	(0.166)	(0.216)
Constant	0.845	0.199	5.076	-1.689
	(1.708)	(2.761)	(5.894)	(14.050)
Observations	931	1,160	931	1,160
Control	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) are Probit regressions and the dependent variable is an indicator variable for a third-party player *i*'s decision to higher-order punish another third-party player *j*. Columns (3) and (4) are Tobit regressions and the dependent variable is a third-party player *i*'s punishment points given to another third-party player *j*. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* punished a cooperator more than *i* in "mutual cooperation" or "victim" are called "cooperation-conducive" higher-order punishment. The control variables include a dummy for female, age, economic major, number of siblings, income rank and the Raven's test score. [#1] This variable is the difference between *i*'s stated attitudes to third-party punish and to peer-to-peer punish. [#2] This variable is PD players' beliefs about the average number of higher-order punishment points given to another third-party player in a scenario in Stage 3, where a scenario is defined by the outcome of Stages 1 and 2; the variable is aggregated for each scenario separately within each society (UK and India).

(b) *"Non-cooperation-conducive" higher-order punishment*

Dependent var.	Punishment frequency		Punishment strength	
	UK (Newcastle)	India (Sonipat)	UK (Newcastle)	India (Sonipat)
	(1)	(2)	(3)	(4)
(a) Personal norm[#1]	0.153**	-0.119	0.698*	-0.649*
	(0.075)	(0.083)	(0.380)	(0.377)
(b) Higher-order belief (descriptive norm)[#2]	0.314*	0.180	1.267*	0.767
	(0.174)	(0.127)	(0.685)	(0.537)
(c) In-group favoritism	0.126	0.765**	1.217	3.537**
	(0.380)	(0.323)	(1.936)	(1.395)
(d) Moral values	-0.009	0.006	-0.032	0.028
	(0.013)	(0.024)	(0.067)	(0.108)
(e) Religious beliefs	-0.036	0.085	-0.122	0.528*
	(0.043)	(0.058)	(0.223)	(0.309)
(g) Moral emotions	-0.005	-0.032	0.003	-0.171
	(0.020)	(0.023)	(0.100)	(0.110)
(g) Emotion/value	-0.004	-0.073	-0.182	-0.313*
	(0.039)	(0.049)	(0.213)	(0.178)
Constant	-1.703	-0.106	-11.404	-3.847
	(1.641)	(3.358)	(8.413)	(15.551)
Observations	343	372	343	372
Control	Yes	Yes	Yes	Yes

Notes: Columns (1) and (2) are Probit regressions and the dependent variable is an indicator variable for a third-party player *i*'s decision to higher-order punish another third-party player *j*. Columns (3) and (4) are Tobit regressions and the dependent variable is a third-party player *i*'s punishment points given to another third-party player *j*. Robust standard errors in parentheses clustered by subject ID. Higher-order punishment from *i* to *j* when *j* punished a cooperator less than or equal to *i* in "mutual cooperation" or "victim" are called "non-cooperation-conducive" higher-order punishment. The control variables include a dummy for female, age, economic major, number of siblings, income rank and the Raven's test score.[#1] This variable is the difference between *i*'s stated attitudes to third-party punish and to peer-to-peer punish. [#2] This variable is PD players' beliefs about the average number of higher-order punishment points given to another third-party player in a scenario in Stage 3, where a scenario is defined by the outcome of Stages 1 and 2; the variable is aggregated for each scenario separately within each society (UK and India).

Table C.24: *Across-Treatment Difference in Beliefs about First-Order Punishment in the UK.*

(A) Frequency of cooperation and first-order punishment given to PD players

Data:	Beliefs about PD players' decision to cooperate		Beliefs about third parties' decision to first-order punish							
			Scenario							
			I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Trio	0.080	0.088	-0.070	0.108	0.360	0.156	0.164	0.187	-0.016	0.012
	(0.153)	(0.164)	(0.280)	(0.300)	(0.422)	(0.434)	(0.281)	(0.309)	(0.313)	(0.351)
Higher-Order	0.036	-0.053	-0.199	-0.146	0.179	0.079	-0.035	-0.070	0.118	0.279
	(0.153)	(0.160)	(0.277)	(0.314)	(0.388)	(0.457)	(0.278)	(0.328)	(0.315)	(0.389)
Constant	0.231*	-1.014*	-0.000	-1.429	1.233***	-0.953	-0.164	-2.002*	0.781***	-1.126
	(0.121)	(0.543)	(0.186)	(1.245)	(0.247)	(1.596)	(0.186)	(1.186)	(0.208)	(1.360)
Observations	134	114	120	106	120	106	120	106	120	106
Control	No	Yes	No	Yes	No	Yes[#1]	No	Yes	No	Yes
Loglikelihood	-89.59	-74.64	-82.65	-69.82	-34.03	-26.82	-82.31	-66.16	-61.31	-46.03
Pseudo R2	0.000407	0.0201	0.00319	0.0495	0.0112	0.0544	0.00323	0.0958	0.00165	0.103

(B) Punishment strength per third-party player

Dependent variable:	Beliefs about a third-party player's punishment points given to a PD player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trio	0.354	1.001	-0.051	-0.151	0.381	0.521	0.594	0.596
	(1.131)	(1.123)	(0.674)	(0.757)	(0.998)	(0.989)	(0.774)	(0.710)
Higher-Order	-0.497	-0.345	-0.195	-0.222	-0.456	-0.401	0.219	0.364
	(1.089)	(1.128)	(0.636)	(0.682)	(1.000)	(1.154)	(0.607)	(0.578)
Constant	-0.405	-3.849	4.544***	5.000*	-0.320	-3.877	2.061***	-1.096
	(0.708)	(4.279)	(0.461)	(2.520)	(0.741)	(3.678)	(0.437)	(2.438)
Observations	120	106	120	106	120	106	120	106
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-200.1	-179	-280.4	-245.7	-194.6	-169.9	-261.3	-226
Pseudo R2	0.00135	0.0243	0.000171	0.00821	0.00166	0.0363	0.00139	0.0242

Notes: Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, economics major ([#1] this control is excluded from panel (A) column (6) as it predicts success perfectly), age, number of siblings, income rank and Raven's test score. *** p<0.01, ** p<0.05, * p<0.1.

Table C.25: *Beliefs about Cooperation-conducive (CC) and Non-CC Higher-Order Punishment in the UK.*

(A) Frequency of higher-order punishment given to other third parties

Data:	Beliefs about third parties' decision to higher-order punish							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.954***	1.083***	0.568***	0.679***	0.783***	0.895***	-0.112	-0.345**
	(0.232)	(0.217)	(0.209)	(0.240)	(0.294)	(0.337)	(0.187)	(0.156)
Constant	0.185	-3.080	0.576***	-2.685*	0.381**	-2.525*	0.851***	-2.664
	(0.192)	(2.054)	(0.170)	(1.626)	(0.190)	(1.313)	(0.192)	(1.844)
Observations	574	452	600	468	554	434	516	386
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-264	-192.5	-302.6	-229.2	-245.9	-185.9	-261.7	-179.5
Pseudo R2	0.0946	0.162	0.0351	0.110	0.0652	0.128	0.00117	0.123

(B) Punishment strength per third-party player

Data:	Beliefs about a third-party player's punishment points given to another third-party player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	2.788***	2.875***	0.935*	1.545***	2.953***	3.357***	-0.323	-0.555
	(0.602)	(0.621)	(0.552)	(0.553)	(0.721)	(0.766)	(0.464)	(0.413)
Constant	0.668	-3.399	2.044***	-4.483	1.245**	-1.870	2.635***	-0.972
	(0.587)	(5.261)	(0.457)	(3.695)	(0.580)	(4.446)	(0.413)	(5.147)
Observations	574	452	600	468	554	434	516	386
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-1270	-995.2	-1328	-1000	-1275	-979.2	-1153	-836.2
Pseudo R2	0.0269	0.0311	0.00444	0.0297	0.0241	0.0424	0.000388	0.0182

Notes: Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables in the even-numbered columns include a dummy for female, economics major, age, number of siblings, income rank and Raven's test score. Beliefs about higher-order punishment from i to j when j pro-socially punished a defector less than the belief about i's first-order punishment in "betrayal" or "mutual defection," or when j anti-socially punished a cooperator more than the belief about i's first-order punishment in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1.

Table C.26: *Across-Treatment Difference in Beliefs about First-Order Punishment in India.*

(A) Frequency of cooperation and first-order punishment given to PD players

Data:	Beliefs about PD players' decision to cooperate		Beliefs about third parties' decision to first-order punish							
			Scenario							
			I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Trio	0.041	0.071	0.013	-0.150	-0.108	-0.145	0.139	0.073	0.365	0.287
	(0.205)	(0.224)	(0.283)	(0.308)	(0.322)	(0.366)	(0.283)	(0.312)	(0.287)	(0.313)
Higher-Order	0.118	0.084	0.070	0.031	0.035	0.139	0.074	0.142	0.608**	0.598*
	(0.205)	(0.223)	(0.286)	(0.309)	(0.333)	(0.365)	(0.287)	(0.314)	(0.298)	(0.317)
Constant	-0.013	0.892	-0.132	1.344	0.899***	0.387	-0.199	1.706	0.066	-0.233
	(0.182)	(1.119)	(0.205)	(1.847)	(0.237)	(0.593)	(0.206)	(1.810)	(0.204)	(0.559)
Observations	142	128	120	111	120	111	120	111	120	111
Control	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-98.20	-87.51	-82.73	-74.56	-58.52	-48.52	-82.45	-72.83	-75.51	-66.45
Pseudo R2	0.000914	0.0116	0.000418	0.0281	0.00189	0.122	0.00149	0.0467	0.0281	0.0595

(B) Punishment strength per third-party player

Dependent variable:	Beliefs about a third-party player's punishment points given to a PD player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trio	0.972	0.287	0.014	-0.084	1.195	0.907	0.949	0.706
	(1.231)	(1.257)	(0.817)	(0.864)	(1.117)	(1.112)	(0.897)	(0.899)
Higher-Order	1.368	1.074	0.649	1.026	0.633	1.143	1.782*	1.568*
	(1.224)	(1.210)	(0.786)	(0.792)	(1.107)	(1.098)	(0.920)	(0.911)
Constant	-1.298	1.682	2.896***	2.614	-1.105	4.841*	0.393	0.131
	(0.928)	(2.692)	(0.580)	(1.602)	(0.874)	(2.863)	(0.690)	(1.456)
Observations	120	111	120	111	120	111	120	111
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-204	-188.8	-275.4	-247.4	-196.8	-175.7	-241.4	-220.8
Pseudo R2	0.00293	0.0130	0.00160	0.0225	0.00288	0.0304	0.00827	0.0331

Notes: Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables in the even-numbered columns include a dummy for female, economics major, age, number of siblings, income rank and Raven's test score. *** p<0.01, ** p<0.05, * p<0.1.

Table C.27: *Beliefs about Cooperation-conducive (CC) and Non-CC Higher-Order Punishment in India.*

(A) Frequency of higher-order punishment given to other third parties

Data:	Beliefs about third parties' decision to higher-order punish							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.239	0.433*	0.427**	0.507***	0.504**	0.668***	0.631**	0.511*
	(0.238)	(0.251)	(0.210)	(0.196)	(0.198)	(0.220)	(0.268)	(0.291)
Constant	0.449**	1.039	0.327**	0.657	0.292	0.666	0.266	1.128
	(0.191)	(0.733)	(0.163)	(0.805)	(0.182)	(0.584)	(0.181)	(0.712)
Observations	606	570	596	550	594	552	604	548
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-352.6	-303	-365.2	-318.2	-329.6	-273.3	-377.2	-324.9
Pseudo R2	0.00612	0.0804	0.0191	0.0455	0.0242	0.103	0.0300	0.0673

(B) Punishment strength per third-party player

Data:	Beliefs about a third-party player's punishment points given to another third-party player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.807	1.390*	1.488**	1.634***	0.870	1.140	2.192***	1.960**
	(0.760)	(0.724)	(0.636)	(0.615)	(0.748)	(0.744)	(0.838)	(0.980)
Constant	1.891***	3.018*	1.422**	2.165	1.835**	2.760*	1.185*	3.001
	(0.675)	(1.632)	(0.607)	(2.308)	(0.742)	(1.644)	(0.672)	(2.062)
Observations	606	570	596	550	594	552	604	548
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-1357	-1259	-1287	-1180	-1339	-1240	-1276	-1135
Pseudo R2	0.00183	0.0155	0.00622	0.0255	0.00181	0.0122	0.0100	0.0391

Notes: Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables in the even-numbered columns include a dummy for female, economics major, age, number of siblings, income rank and Raven's test score. Beliefs about higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than the belief about *i*'s first-order punishment in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than the belief about *i*'s first-order punishment in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1.

Table C.28: *Do third parties punish to equalize payoffs of defectors and cooperators?*

	UK (Newcastle)			India (Sonipat)		
	Baseline	Trio	Higher-Order	Baseline	Trio	Higher-Order
Victim	21.391	12.056	14.263	23.053	10.619	12.750
	(1.182)	(0.597)	(0.716)	(0.947)	(0.782)	(0.511)
Betrayal	76.261	53.667	51.474	84.211	61.667	59.550
	(1.977)	(1.225)	(1.176)	(1.315)	(1.263)	(1.001)
H_0: Victim = Betrayal						
p-value[#1]	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The numbers in the payoff matrices indicate the average payoff of PD players in the "betrayal" and "victim" scenarios implied by a third party's punishment decision and – in the Trio and Higher-Order treatments – the average beliefs among PD players about the punishment decisions of other third parties under the assumption that a third party believes that the other third parties punish as the beliefs indicated. Standard errors are presented underneath in parentheses. [#1]Two-sided Wilcoxon signed-rank test.

Table C.29: *Cross-Societal Difference in First-Order Punishment in Baseline Treatment.*

Dependent var.	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Var.	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
India (Sonipat) dummy	#2	-16.319***	-1.606***	-3.741**	#3	-23.278***	-1.592***	-4.545***
		(2.793)	(0.501)	(1.531)		(6.820)	(0.588)	(1.589)
Constant	-1.115	-4.356	0.716	-1.770	9.708	25.553	-3.670*	-4.778
	(3.045)	(8.357)	(1.797)	(4.603)	(7.859)	(20.534)	(1.920)	(4.931)
Observations	21#1	39	39	39	21#1	39	39	39
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to first-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. #1 18 observations are dropped because there is no punishment in India in the Mutual cooperation or Victim scenarios of the Baseline treatment after including controls; #2 Two-sided Fisher's exact test $p = 0.053$; #3 Two-sided Fisher's exact test $p = 0.105$. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1.

Table C.30: *Cross-Societal Difference in First-Order Punishment in Trio Treatment.*

Dependent var.	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Var.	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
India (Sonipat) dummy	0.442	2.477	-0.037	0.240	-0.148	-0.450	0.007	1.536
	(0.342)	(1.895)	(0.259)	(1.464)	(0.299)	(2.094)	(0.258)	(1.638)
Constant	-2.179	-8.313	1.041	2.474	1.932	13.773	-1.753	-14.335
	(2.437)	(13.735)	(1.828)	(10.757)	(2.245)	(15.156)	(1.855)	(12.036)
Observations	108	108	108	108	108	108	108	108
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to first-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1.

Table C.31: *Cross-Societal Difference in First-Order Punishment in Higher-Order Treatment.*

Dependent var.	(a) Third parties' decision to first-order punish; (b) A third-party player's punishment points given to a PD player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Var.	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
India (Sonipat) dummy	-0.088	-0.392	-0.906***	-2.621**	0.279	0.620	-0.407	-1.063
	(0.328)	(1.644)	(0.331)	(1.173)	(0.336)	(1.368)	(0.298)	(1.265)
Constant	0.536	4.827	1.868	2.450	-1.057	-4.363	0.434	-0.401
	(1.461)	(7.625)	(1.487)	(4.661)	(1.490)	(5.712)	(1.434)	(5.680)
Observations	95	95	95	95	95	95	95	95
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to first-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points given to a PD player. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Robust standard errors in parentheses clustered by subject ID. *** p<0.01, ** p<0.05, * p<0.1.

Table C.32: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in the UK (only scenarios that were realized as an actual outcome from Stages 1 and 2).*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.570**	2.297**	1.287***	6.041***	0.613**	2.585**	1.453***	5.641***
	(0.272)	(1.090)	(0.234)	(1.132)	(0.302)	(1.202)	(0.277)	(1.297)
Constant	-0.154	0.705	-0.636	-5.106	-1.237	-5.132	-1.394	-8.955
	(1.351)	(6.176)	(1.526)	(6.661)	(1.652)	(7.170)	(1.955)	(8.028)
Observations	208	208	412	412	280	280	148	148
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-119.1	-250.9	-213.5	-528.4	-169.5	-370.8	-66.17	-158.8
Pseudo R2	0.0660	0.0418	0.194	0.0927	0.0513	0.0223	0.250	0.106

Notes: Based on scenarios from Stages 1 and 2 that were realized as an actual outcome in at least one group. Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim" are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1

Table C.33: *Cooperation-conducive (CC) versus Non-CC Higher-Order Punishment in India (only scenarios that were realized as an actual outcome from Stages 1 and 2).*

Dependent var.	(a) Third parties' decision to higher-order punish; (b) A third-party player's punishment points given to another third-party player.							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CC	0.229	1.881	1.367***	7.325***	0.136	0.942	0.985**	6.148*
	(0.285)	(2.119)	(0.266)	(1.851)	(0.167)	(0.969)	(0.405)	(3.178)
Constant	1.439	0.424	-0.478	-7.450	-2.230	-13.320	-8.256***	-46.186**
	(2.652)	(14.698)	(2.137)	(10.662)	(2.149)	(12.490)	(2.981)	(21.866)
Observations	218	218	528	528	364	364	160	160
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loglikelihood	-109	-210.9	-225	-502.8	-188.1	-369.3	-54.85	-108
Pseudo R2	0.0410	0.0181	0.218	0.112	0.0434	0.0155	0.189	0.0982

Notes: Based on scenarios from Stages 1 and 2 that were realized as an actual outcome in at least one group. Columns (1a), (2a), (3a) and (4a) are Probit regressions and the dependent variable is the third parties' decision to higher-order punish. Columns (1b), (2b), (3b) and (4b) are Tobit regressions and the dependent variable is a third-party player's punishment points another third-party player. Robust standard errors in parentheses clustered by subject ID. The control variables include a dummy for female, economics major, age, number of siblings, income rank and the Raven's test score. Higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than *i* in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than *i* in "mutual cooperation" and "victim", are called "Cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1.

Table C.34: *Beliefs about Cooperation-conducive (CC) and Non-CC Higher-Order Punishment in the UK (only scenarios that were realized as an actual outcome from Stages 1 and 2).*

(A) Frequency of higher-order punishment given to other third parties

Data:	Beliefs about third parties' decision to higher-order punish							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.634**	0.715**	0.602***	0.723***	0.688**	0.936***	-0.072	-0.436
	(0.298)	(0.334)	(0.226)	(0.250)	(0.281)	(0.332)	(0.297)	(0.317)
Constant	-0.014	-4.135	0.494***	-1.285	0.280	-1.857	0.485*	-3.632*
	(0.228)	(2.608)	(0.177)	(1.654)	(0.198)	(1.586)	(0.264)	(1.994)
Observations	162	132	388	300	220	178	104	78
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-104.3	-76.84	-190.2	-137.7	-124.9	-90.17	-65.69	-41.46
Pseudo R2	0.0440	0.136	0.0429	0.136	0.0523	0.168	0.000603	0.176

(B) Punishment strength per third-party player

Data:	Beliefs about a third-party player's punishment points given to another third-party player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	1.702**	1.918***	1.056*	1.437**	2.153***	2.716***	0.221	-0.870
	(0.682)	(0.707)	(0.574)	(0.572)	(0.820)	(0.967)	(0.602)	(0.786)
Constant	0.033	-8.212	1.892***	-2.635	1.007*	-2.758	1.136**	-6.724
	(0.666)	(7.491)	(0.469)	(3.406)	(0.572)	(4.689)	(0.534)	(5.543)
Observations	162	132	388	300	220	178	104	78
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-299.9	-240.5	-849.7	-642.4	-464.4	-370.9	-202.1	-144.7
Pseudo R2	0.0150	0.0373	0.00629	0.0297	0.0207	0.0355	0.000325	0.0573

Notes: Based on scenarios from Stages 1 and 2 that were realized as an actual outcome in at least one group. Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables in the even-numbered columns include a dummy for female, economics major, age, number of siblings, income rank and Raven's test score. Beliefs about higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than the belief about *i*'s first-order punishment in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than the belief about *i*'s first-order punishment in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1.

Table C.35: *Beliefs about Cooperation-conducive (CC) and Non-CC Higher-Order Punishment in India (only scenarios that were realized as an actual outcome from Stages 1 and 2).*

(A) Frequency of higher-order punishment given to other third parties

Data:	Beliefs about third parties' decision to higher-order punish							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.284	0.590**	0.542**	0.613***	0.511**	0.711***	0.774**	0.827**
	(0.272)	(0.270)	(0.225)	(0.203)	(0.242)	(0.255)	(0.350)	(0.388)
Constant	0.187	1.311*	0.174	0.190	0.243	0.284	-0.074	13.951***
	(0.200)	(0.695)	(0.179)	(0.844)	(0.208)	(0.558)	(0.230)	(4.486)
Observations	170	166	378	348	232	210	130	118
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-112.1	-95.69	-232.5	-203.8	-137.8	-116.9	-81.32	-64.28
Pseudo R2	0.00886	0.132	0.0336	0.0547	0.0300	0.0886	0.0660	0.190

(B) Punishment strength per third-party player

Data:	Beliefs about a third-party player's punishment points given to another third-party player							
	Scenario							
	I. "mutual cooperation"		II. "betrayal"		III. "victim"		IV. "mutual defection"	
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CC	0.163	0.800	2.331***	2.269***	0.189	0.714	3.555***	3.572***
	(0.847)	(0.672)	(0.662)	(0.690)	(0.672)	(0.594)	(1.061)	(1.274)
Constant	0.954	2.894*	0.662	0.037	1.611**	1.209	-0.431	34.565***
	(0.716)	(1.615)	(0.637)	(2.451)	(0.724)	(1.377)	(0.783)	(11.657)
Observations	170	166	378	348	232	210	130	118
Control	No	Yes	No	Yes	No	Yes	No	Yes
Loglikelihood	-333.4	-312.6	-795.8	-730.2	-485.7	-425	-253.4	-218.3
Pseudo R2	0.000104	0.0364	0.0169	0.0339	0.000172	0.0141	0.0419	0.0851

Notes: Based on scenarios from Stages 1 and 2 that were realized as an actual outcome in at least one group. Panel (A) [B] are Probit [Tobit] regressions with robust standard errors in parentheses clustered by subject ID. The control variables in the even-numbered columns include a dummy for female, economics major, age, number of siblings, income rank and Raven's test score. Beliefs about higher-order punishment from *i* to *j* when *j* pro-socially punished a defector less than the belief about *i*'s first-order punishment in "betrayal" or "mutual defection," or when *j* anti-socially punished a cooperator more than the belief about *i*'s first-order punishment in "mutual cooperation" and "victim", are called "cooperation-conducive" higher-order punishment. In all other cases, higher-order punishment is referred to as "non-cooperation-conducive." *** p<0.01, ** p<0.05, * p<0.1