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**Article**

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Editorial

# Recent Advances in Experimental Studies of Social Dilemma Games

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**Abstract:** I provide a broad overview of the findings reported in the articles submitted for this special volume on experimental studies of social dilemma problems. I start by providing a synopsis of where current research stands on this topic. Then I go on to discuss the specific papers and how those papers extend our knowledge in this area and add value to the current state of the art.

**Keywords:** experiments; social dilemma games; voluntary contributions; public goods; common pool resource extraction

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## 1. Introduction

A wide range of situations in life can be thought of as social dilemmas which pose tension between cooperation and self-interest. Such situations range from voting; to contributions to charities and public goods; to managing common pool resources; to even tackling global warming and climate change. In all these situations individuals face a trade-off: cooperation makes everyone better off, but as long as enough others cooperate in order to achieve the goal, then individual self-interest suggests free-riding on the cooperation of others. If enough participants give in to this inherent incentive for free-riding then sustaining cooperation is infeasible.<sup>1</sup>

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<sup>1</sup> Joseph Heller captures the logic behind free-riding eloquently in the following passages from his book *Catch-22*.

*Sharing a tent with a man who was crazy wasn't easy but Nately didn't care. He was crazy, too, and had gone every free day to work on the officers' club that Yossarian had not helped build . . . . Actually, there were many officers' clubs that Yossarian had not helped build, but he was the proudest of the one on Pianosa. It was a sturdy and complex monument to his powers of determination. Yossarian never went there to help until it was finished; then he went there often, so pleased was he with the large, fine, rambling shingled building. It was truly a splendid structure, and Yossarian throbbed with a mighty sense of accomplishment each time he gazed at it and reflected that none of the work that had gone into it was his.*

A little later in the book, Heller goes on to explain how this line of thinking leads to the unravelling of cooperation. This is represented in the following conversation between the book's protagonist Yossarian and Major Major Major Major, whose first, middle and last names are Major and who also holds the rank of major.

*"Suppose we let you pick your missions and fly milk runs," Major Major said. "That way you can fly the four missions and not run any risks."*

*"I don't want to fly milk runs. I don't want to be in the war anymore."*

*"Would you like to see our country lose?" Major Major asked.*

*"We won't lose. We've got more men, more money and more material. There are ten million people in uniform who can replace me. Some people are getting killed and a lot more are making money and having fun. Let somebody else get killed."*

*"But suppose everybody on our side felt that way."*

*"Then I'd certainly be a damned fool to feel any other way. Wouldn't I?"*

Researchers in the area have tended to focus on two types of social dilemma games. One of these is the voluntary contributions mechanism. Here, members of a group are provided with an initial endowment and have the choice of contributing to a public good that generates benefits for all group members regardless of whether they contributed or not. The social optimum in these games is for all members to contribute their entire endowment to the public good with the attendant benefits being distributed equally among all group members. The self-interested or individually rational course of action, of course, is to contribute nothing and free-ride on others' contribution. Free-riding is the dominant strategy Nash equilibrium in one-shot plays of the game as well as the subgame perfect outcome in repeated plays.

The second version of a social dilemma studied by researchers is the common pool resource extraction problem which simulates harvesting common resources such as logging or fishing. Here, the social optimum is for every player to abide by their pre-assigned quota for harvesting, while the self-interested action is to engage in over-extraction of the resource. In the Nash equilibrium of this game, everyone extracts more than their quota and the resource is depleted. Given the prevalence of such dilemmas in most spheres of human interaction, the problem has drawn the attention of researchers not only in economics but across different disciplines in the social sciences. Bohm (1972, 1983) [1,2] and Marwell and Ames (1979, 1980, 1981) [3–5] undertook some of the earliest experimental work in this area. Notable early contributions from economists include Andreoni (1988, 1990, 1995) [6–8], Isaac and Walker (1988a, 1988b) [9,10], and Isaac, McCue and Plott (1985) [11]. Noteworthy early studies from other social sciences include Dawes, McTavish and Shaklee (1977) [12], Dawes (1980) [13], Dawes, Orbell, Simmons and van de Kragt (1986) [14], Ostrom (1990) [15], Ostrom, Gardner and Walker (1994) [16], Ostrom, Walker and Gardner (1992) [17] and Yamagishi (1986, 1988) [18,19].

It is, by now, well-documented across the social sciences that humans are willing to engage in far-more cooperation than the self-interested model would suggest. The strong Nash equilibrium prediction of complete free-riding or over-extraction is seldom borne out with typically much greater levels of cooperation than predicted. Such cooperation manifests itself in at least two ways. First, humans cooperate more than expected even in one-off interactions, which rules out the possibility of future benefits to co-operative behavior. In fact, a plurality, if not a majority of subjects are conditional cooperators whose degree of co-operation is positively correlated with their beliefs about their peers. Those who expect their peers to co-operate do so; while those who are pessimistic about their peers' level of co-operation end up free-riding.

Second, not only are humans willing to cooperate, they are also willing to engage in "altruistic punishment" in the sense that they are willing to forego money to inflict punishment on violators of cooperative norms; not only in repeated plays but even in one-off interactions with no possibility of such punishments yielding future benefits. This tendency has been labelled as "strong reciprocity". See, for instance, Fehr and Gächter (2000, 2002) [20,21], Gintis *et al.* (2005) [22] and Yamagishi (1986, 1988) [18,19]. In fact socio-biological explanations of human cooperation such as Hamilton's (1964) [23] theory of kin selection or Trivers's (1971) [24] theory of reciprocal altruism or the concept of an evolutionary stable strategy (Maynard Smith, 1982) [25] are not able to explain large patterns of human cooperation. This is, at least partly, because they ignore the influence of culture or social norms on human behavior. Emotional dispositions such as fairness, trust and reciprocity often contribute to creating and sustaining virtuous social norms that can be passed on in the history of human societies. (Axelrod, 1986 [26]).

However, while it is certainly true that the level of cooperation is typically well above that predicted by a model based on individual self-interest, it is also the case that over time, as the interaction is repeated, there is a tendency for agents to reduce their level of cooperation. However, even with this decay the strong Nash equilibrium prediction of complete free riding (in the case of the public goods game) or maximal extraction (in the case of the common pool resource game), is seldom borne out. This, in turn, has led to two separate research questions. The first question is about the

nature of the game itself; how it is perceived by those playing it; what strategies do the players adopt and what leads to the decay in contributions over time. The second research agenda seeks to identify mechanisms or institutions that can sustain cooperation over time.

Early writing in experimental economics identified a number of different factors that might cause this pattern of decay. These included kindness on the part of some and confusion on the part of others (Andreoni, 1995 [6]), the “warm glow” of giving (Andreoni, 1990 [7]), a combination of learning to play the dominant strategy and strategic play by self-interested players (Andreoni, 1988 [8]) and decision errors of various types (Palfrey and Prisbrey, 1997 [27]; Anderson, Goeree and Holt, 1998 [28]). Recent research, however, has honed in on two possible explanations for declining contributions. Both of these rely on the presence of “conditional cooperators”, whose contributions are positively correlated to their beliefs about the contributions of other group members (see Fischbacher *et al.*, 2001 [29]). One strand of this literature, and indeed the broader literature on social dilemma games, assumes that any population is composed of at least two types of players: cooperators and free-riders. Cooperators start out making high contributions, but over time recognize the presence of free-riders, and reduce their contributions in retaliation, leading to the oft-seen pattern of decay. See Gunthorsdottir, Houser and McCabe (2007) [30] for an example of this kind of argument.

Ambrus and Pathak (2011) [31] provide a formal theoretical model along these lines. They assume that there are two kinds of players: purely self-interested and reciprocal. The proportion of each type is common knowledge, so there is no asymmetric information about types. The main feature of the model is a reciprocity function with arguments including past and current contributions of other group members. The authors show that, if the reciprocity function obeys certain regularity conditions, then there is a unique sub-game perfect equilibrium in which contributions decline over time. In sum, this line of literature assumes that populations consist of people with different preference types.

A recent study by Chaudhuri, Paichayontvijit and Smith (2015) [32] argues that while the presence of different preference types may be sufficient for contributions to decay, this may not be necessary. These authors show that even if the majority of players are conditional co-operators with few or no free-riders, as long as there is enough heterogeneity in the prior beliefs of those conditional co-operators, contributions will still decay. This is primarily due to the fact that players adjust their contributions to converge to the group average; but those who are above the average reduce their contributions by a greater magnitude relative to those who are below the average and this inevitably leads to decaying contributions.

The other strand of the literature is based on the idea of self-serving biases. Fischbacher and Gächter (2010) [33], for example, report that a “self-serving bias” in conditional cooperation, where each agent attempts to contribute slightly less than the group average, leads to the contribution decay. Neugebauer, Perote, Schmidt, and Loos (2009) [34] provide further evidence on self-serving biases. They examine subjects’ own contributions and their beliefs about others’ contributions when subjects get feedback about others’ contributions and when they do not. Contributions decline only when feedback is provided, suggesting that behavior is adaptive when subjects get feedback. The authors report that contributions and beliefs are higher in the treatment without feedback than the one with feedback and that contributions are positively correlated with beliefs. Smith (2013) [35] extends this line of work by addressing the issue of beliefs being endogenous to contribution decisions. Using an instrumental variables approach, he estimates the causal effect of beliefs on contributions.

Given the pattern of gradual decay in cooperation levels, a second research question tries to understand what institutions or mechanisms may prevent such decay and sustain virtuous norms of cooperation over longer horizons. Axelrod (1986) [26] suggests that a social norm is essentially an implicit rule that members of society feel compelled to adhere to. One way of creating and sustaining such a norm is via internalization, where a norm becomes so entrenched in a society that violating it causes psychological discomfort. Such internalization may be achieved via punishments of norm-violators, where said punishment can be monetary or may take non-monetary forms such as expressions of disapproval, or social ostracism and exclusion. Cooperation may also be achieved via

devices that can be broadly described as *moral suasion* including exhortative advice from prior groups of players, promises of cooperation, generating feelings of community etc. Researchers have also looked at the efficacy of communication combined with the ability to punish norm violators; both in the case of groups that are formed exogenously (determined by the experimenter) or endogenously (where group members can choose who they wish to interact with). Not surprisingly, given the wide-spread appeal and interest in such topics across the social-sciences, the literature looking at aspects of this is voluminous. Ledyard (1995) [36] provides a comprehensive overview from the initial days of this work till *circa* 1995 while Chaudhuri (2011) [37] provides an update on this line of work since Ledyard (1995) [36] till around 2010.

The papers in this volume make significant contributions to our understanding of some of these questions and thereby help advance the frontiers of knowledge in this area. It is possible to informally divide the ten papers contained in this volume into three sections, with a unifying theme for each of the three. The three papers in the first section address the first research stream highlighted above; they all explore structural issues of social dilemma games, in the sense that they ask fundamental questions about the parameters of the game, subject perceptions and the strategies adopted when engaging in such social dilemmas. The next three papers all explore the second of the two above-mentioned research questions, in that they ask how we may be able to sustain cooperation in social dilemmas over the longer term. The final cluster of four papers can be thought of as innovative applications of the social dilemma paradigm to understanding a number of real-world phenomena. In Section 2 below, I provide an overview of the papers in each of those three clusters. I provide some concluding remarks in Section 3.

## 2. Overview of the Studies in This Volume

### 2.1. Papers in Section 1

In the first paper, Caleb Cox and Brock Stoddard attempt to resolve a long-standing controversy as to how levels of cooperation are affected by the framing of the underlying game and the nature of feedback provided. Received wisdom suggests that when the underlying game is framed as one involving resource extraction then we should expect less cooperation and greater free-riding (in the form of over-extraction) as opposed to a situation where the game is framed as involving contributions to a public good; in the latter case, we would expect comparatively greater levels of cooperation. Cox and Stoddard construct payoff-equivalent games where in the “give” frame subjects can choose to contribute to a public good, while in the “take” frame they choose to extract from a common pool. The authors also vary the matching mechanism, whether group membership either remains unchanged (Partners) or members are randomly re-matched from one round to the next (Strangers) as well as the nature of the feedback provided; whether subjects receive feedback only at the aggregate level or whether they can see individual decisions. Contrary to prior findings, it is not the case that, on average, there is greater cooperation in the “give” frame; if anything, on average, there is greater cooperation in the “take” frame (particularly with individual level feedback) or no strong differences. It is also not the case that individual level feedback leads to greater free-riding. However, it is certainly the case that using a “take” framing and providing more fine-grained feedback at the individual-level leads to greater variability in co-operation and more extreme behavior (in terms of both greater free-riding and full cooperation), especially when groups are fixed (Partners matching).

In the second paper of this section, Juan Camilo Cardenas, Cesar Mantilla and Rajiv Sethi provide an alternative way of analyzing how subjects make decisions in a common pool resource extraction game. As noted above, behavior of subjects in such experiments typically deviates substantially from the equilibrium prediction in that all available actions are chosen with a positive frequency, with strictly dominated actions (less than maximal extraction) being chosen persistently and often. Average extraction is relatively stable over time, lying below equilibrium levels, but above efficient levels. The authors rely on data collected in the two common pool resource extraction studies undertaken by

Ostrom *et al.* (1992) [17] and Cardenas (2004) [38] and argue that these patterns can be accurately replicated with a model of payoff sampling equilibrium developed by Osborne and Rubinstein (1998) [39] with some suitable refinements.

The basic idea underlying this solution concept is that individuals try out multiple actions, observe payoffs and subsequently adopt actions that were the most rewarding. A sampling equilibrium is a distribution of actions in a population that reproduces itself, in the sense that the likelihood with which an action is selected under the sampling procedure matches the frequency with which it is currently being used. The authors compare the sampling equilibrium with the more widely-used solution concept of quantal response equilibrium (QRE) introduced by McKelvey and Palfrey (1995) [40], which is based on the idea that individuals make errors when responding to the behavior of others, have accurate beliefs about the distribution of opponent actions and best respond to these beliefs. The authors focus their attention on the logit QRE model, which has one free parameter to capture the rate at which errors are made. The logit QRE explains data from such games extremely well but that does require fine-tuning the free parameter to fit the specific study and its value can vary widely across treatments, even within the class of common pool resource games. If the QRE parameter is constrained to be equal across different games, then payoff sampling provides a superior fit to the data. Cardenas *et al.* argue that their findings are likely to generalize to other complex games with multiple players and strategies. This then provides a road-map to alternative empirical means of analyzing decisions in these games and can help enrich our understanding of behavior in the same.

In third and final paper of this section, Karen Evelyn Hauge and Ole Rogeberg adopt a unique perspective on the public goods game. In a typical public goods game decisions are made by subjects whose payoffs are directly affected by those same decisions. Yet, Hauge and Rogeberg point out, in a variety of social dilemma situations, the decision-making power and authority is delegated to representatives who make binding decisions on behalf of a larger group. In this paper, the authors compare contribution decisions made by individuals with contribution decisions made by group representatives. Their main finding is that contribution behavior differs between individuals and group representatives, but only for women. While men's choices are equally self-interested as individuals and group representatives, women make more cooperative choices as group representatives. This has implications about deciding who should be selected to represent group interests depending on the specific context and the goals intended to be achieved.

## 2.2. Papers in Section 2

There are three papers in this section, all of which focus on the second of the two research questions identified above; *viz.*, they all focus on the issue of sustaining cooperative behavior among group members in social dilemma games over the longer term. The first paper in this section is an innovative study that could also have featured in the final section of this volume as an ingenious application of the social dilemma paradigm. In this paper, Brice Corgnet, Roberto Gonzalez and Matthew McCarter design an intriguing experiment to study the problem of cyber-loafing. Cyber-loafing is a major problem facing organizations where workers, instead of concentrating on the task at hand, spend their time surfing the internet, resulting in loss of workgroup productivity. The authors seek to understand how changes in the decision-making rights about what workgroup members can do on the job affect cyber-loafing and subsequent work productivity. Subjects in this experiment are asked to undertake a monotonous number adding task designed to simulate a data-entry organization. Each member completing a task generates payoff for the group; the social optimum is for each member to complete as many tasks as possible but if some members are working, thereby generating revenue for the group, then others can free-ride by engaging in cyber-loafing. This is what turns this data-entry game into a social dilemma. The authors compare two different types of decision-making regimes: autocratic decision-making, where an experimental monitor ("the boss") decides to turn off internet access part way through the session, while in group voting, group members vote whether to retain or turn off internet access. They report that, while autocratic decision-making and group voting regimes both

curtail cyber-loafing (by over 50%), it is only in group voting that there is a substantive improvement (of 38%) in a cyber-loafer's subsequent work performance. Unlike autocratic decision-making, group voting leads to workgroups outperforming the control condition where cyber-loafing could not be stopped. Additionally, only in the group voting regime did production levels of cyber-loafers and non-loafers converge over time.

In the second paper of this section, Lachlan Deer and Ralph Bayer look at the role of pledges of commitment in a public goods game. There is a voluminous literature on this topic but what Deer and Bayer add to the literature is that they look at the efficacy of pledges where subjects can enter into partnerships but dissolving existing relationships subsequently is costly and the costs are distributed symmetrically or asymmetrically across partners. As the authors point out, there are a number of situations in life where dissolving partnerships is costly. In the marriage market individuals learn about the cooperativeness of their partners in an initial dating stage and may decide to pledge commitment through marriage. Dissolving a marriage through divorce is often costly and the size and distribution of these costs may fall differently on the two partners. Business partnerships can also be thought of as being analogous to a social dilemma with costly dissolution, where partners choose between working to enhance the value of the company versus working for oneself or shirking. Dissolving these partnerships may either be cost-free via informal agreements or costly via lost investments and/or costs to retrieve those investments.

Deer and Bayer find, in line with prior studies, that pledges of commitment alone can increase cooperation and welfare in committed partnerships. The introduction of relatively large and equally split costs yields similar gains. In contrast, pledges of commitment fail to improve cooperation and welfare when the costs to dissolve committed partnerships fall solely on the individual choosing to break up. This result is interesting since much of the earlier work demonstrating the effectiveness of promises or other similar communication mechanisms look at situations where dissolving groups is either costless or shared equally among group members. Deer and Bayer show that in the presence of asymmetric dissolution costs there may be limits to the efficacy of promise-making. When the costs for partnership dissolution are asymmetric and fall solely on the instigator of the breakup, cooperation levels decline. This is mostly due to the fact that in the presence of asymmetric costs, the subject who does not bear that cost anticipates the reluctance of the partner (who bears the cost) to dissolve the relationship; this, in turn, causes the former to act in an opportunistic manner by free-riding.

In the third paper of this section, Michalis Drouvelis revisits the rich literature on altruistic punishments as in Fehr and Gächter (2000, 2002) [20,21]. Except Drouvelis extends current work by comparing behavior in two distinct punishment regimes: first, a standard public goods game with punishment in which subjects are given the opportunity to punish other group members (democratic punishment regime) and second, a public goods game environment where all group members exogenously experience an automatic reduction of their income, irrespective of their behavior (undemocratic punishment regime). However, in the second treatment, subjects do have the power to forego some money to alleviate any punishment for non-free-riders who have been punished unjustly. Drouvelis employs a within-subjects design where subjects experience both environments, democratic and undemocratic punishments. The design is counter-balanced to control for order effects. His findings indicate that average contributions and earnings in the undemocratic punishment environment are significantly lower relative to the standard public goods game with punishment. There is less cooperation and greater free-riding in the undemocratic punishment environment, especially when the undemocratic environment follows after subjects have already experienced the standard public goods game with democratic punishment at the outset. There is much greater alleviation offered to punished subjects when the undemocratic punishment environment comes first followed by the democratic environment. The degree of alleviation in the undemocratic punishment environment is significantly lower when subjects have already had experience with the democratic punishment environment prior to this.

### 2.3. Papers in Section 3

This section consists of four papers that I felt applied the insights from social dilemma research to a series of interesting questions. In the first paper of this section, Davide Dragone, Fabio Galeotti and Raimondello Orsini conduct an artefactual field experiment to compare the individual preferences and propensity to contribute to a public good of three pools of subjects: undergraduate students, temporary workers and permanent workers. As far as the workers are concerned, our *ex ante* assumption would be that permanent workers, who have greater stability of employment, would exhibit higher cooperation levels compared to temporary workers, whose relations are short-term and marked by greater turn-over. However, the authors find that students are more selfish and contribute less than workers, whether temporary or permanent. Temporary and permanent workers have similar other-regarding preferences and display analogous contribution patterns to the public good. The authors suggest that the different contractual arrangements, and the consequent economic and psychological effects, play a minor role compared to other factors. It is likely that socialization and learning on the job (something that is not available to the students) create feelings of community that may have induced both temporary and permanent workers to behave similarly and avoid free-riding opportunities. Also, in-group and mutual insurance considerations may have driven both types of workers to contribute to the public good.

The next three papers do not look at social dilemma games in the strictest sense of the term. However, all of them look at problems that have features of a social dilemma and as such constitute interesting applications of the social dilemma paradigm. In the second paper of this section, Ernan Haruvy and Peter T. L. Popkowski Leszczyc look at behavior in auctions with a price externality. These are auctions where only one bidder wins the auction but all bidders derive utility from the winning price. Such include charity auctions where the benefit to the bidders is relatively direct such as auctions to raise money for schools or churches; with the proceeds going towards enhancing services to members who all bid at the auction regardless of who eventually wins it.

One of the variables that the investigation focused on is the *multiplier*, which represents the degree to which the proceeds from the auction directly affect the bidders. The multiplier here is analogous to the implied marginal per capita returns from the public good as in prior studies. The authors report that bidders bid significantly below their valuations in most conditions and well below the theoretical optimal bid. The empirical findings in the laboratory stand in sharp contrast to theoretical predictions, which suggest that bidders should bid more than their valuations and that these bids should increase in the multiplier. The experimental data from this study show that the bidders facing a moderate to high multiplier do not bid aggressively, which can be explained by bidders perceiving higher benefit to losing than to winning. However, increasing the number of bidders reduces the extent of under-bidding. Moreover, despite a substantial level of underbidding, as the multiplier increases winning prices significantly increase. This is an encouraging finding since it suggests that revenues can be increased, relative to no-externality settings, by conducting auctions with price externality and charitable bidders. Clearly these findings have interesting and implementable insights into the designing of charity auctions.

In the next paper of this section, Israel Waichman, Ch'ng Kean Siang, Till Requate, Aric Shafran, Eva Camacho-Cuena, Yoshio Iida and Shosh Shahrabani undertake a cross-country study of reciprocity in labor markets using the well-known bilateral gift exchange paradigm, which is designed to simulate labor market interaction between employers and employees. This line of work was introduced in a series of papers written by Ernst Fehr and co-authors including Fehr, Gächter, and Kirchsteiger (1997) [41], Fehr, Kirchler, Weichbold, and Gächter (1998) [42], Fehr, Kirchsteiger, and Riedl, (1993, 1996, 1998) [43–45]. Waichman *et al.* extend this line of work to compare the behavior of subjects from five high-income OECD countries: Germany, Spain, Israel, Japan and the USA. This, in itself, adds value since till date no one has undertaken such an ambitious cross-country study of the existence or lack thereof of labor market reciprocity.

Besides exploring whether there are systematic differences in behavior, the authors further examine if any differences arising can be explained by appealing to differing cultural norms in those



countries. They report that in all countries, effort levels are increasing while rejection rates are decreasing in wage offers. The authors document some differences arising purely from matching method: fixed matching versus random re-matching. However, there are some stable differences in behavior across countries in both one-shot and repeated relationships, with the most striking differences being those between Germany and Spain. Germans offer the highest wages, while offers are lowest in Spain. The efficiency wage hypothesis—that higher than equilibrium wage offers are reciprocated by greater than minimum effort levels—is confirmed in all countries except for Spain, where at best it is only weakly supported by the data. On average, overall surplus generated is highest for German subjects and lowest for Spanish subjects. Finally, German subjects also perform better than those of the other countries in terms of effort and overall surplus under fixed matching.

In addition, the authors use the data generated in each country to estimate the parameter measuring aversion to advantageous inequity following the inequity aversion model of Fehr and Schmidt (1999) [46]. While the authors do not observe large differences in aversion to advantageous inequity in Germany, Israel, Japan and the USA, this aversion is considerably lower in Spain. Waichman *et al.* suggest that prevailing labor market norms may at least partially explain these differences. For instance, the fact that Germans offer higher wages and effort than their American counterparts is consistent with the gift exchange game study by Hannan *et al.* (2002) [47], who speculate that country-specific norms explain the lower wages and effort levels of their American subjects in comparison with similar gift-exchange studies conducted by Fehr and colleagues in Europe. Bornhorst *et al.* (2010) [48] also report similar differences between subjects from northern and southern Europe, which is in line with the differences in behavior between German (northern European) and Spanish (southern European) subjects in the current study. These results suggest that the validity of the gift-exchange model and the efficiency wage hypothesis may be culture specific and possibly warrants further examination.

In the final paper of this section Priyodarshi Banerjee, Sujoy Chakravarty and Sanmitra Ghosh also study the impact of one-way, unenforceable pre-play communication in the form of promises like Deer and Bayer (in this volume) except Banerjee *et al.* look at the efficacy of such promises in the context of dictator and ultimatum games. There are two experimental treatments. In the first “no competitive selection” treatment, the proposer in the dictator/ultimatum game makes a promise to the responder about the former’s potential offer to the latter. After hearing the promise regarding how much the proposer will offer, the responder can choose not to proceed with the game at all resulting in both players receiving nothing. In a second and more interesting “competitive selection” treatment there are two proposers who each make a promise about their offers to a single responder. After hearing the promise, the responder can choose one of the two proposers to play with; of course, the responder can refuse to play with either. In a control treatment, the game starts with the proposer making a promise to the recipient, regarding the offer. However, here the rest of the game proceeds exactly as in traditional dictator/ultimatum games with the promise playing no role whatsoever; and the responder does not have any power to terminate the game by choosing not to play any further.

The subgame perfect outcome is the same across each treatment of the ultimatum game; the proposer should offer only a small amount to the responder, which the latter should accept and promises should make no difference whatsoever. Furthermore, on the basis of prior research (see, for instance, Hoffman, McCabe, Shachat and Smith, 1994 [49]) we might expect actual offers to be lower with competitive selection because here the proposer who is selected has acquired the “property right” to make an offer. The authors report that, compared to the control treatment, offers are higher in the ultimatum games without or with competitive selection of the proposer. In fact, when selection is competitive, with two proposers at the outset, offers increase even further as opposed to the treatment where selection is not competitive. No such striking differences emerge in the dictator environment, which does not provide an opportunity for the responder to reject offers; thus selection power carries no benefits in the dictator game. Finally, independent of the game institution or proposer selection mechanism, promises provide credible signals of eventual offers, with a strong positive

correlation between promises and offers, even though the promise made is merely cheap talk. Offers are highly likely to be rejected, if and when the actual offer falls short of the promise made prior to making that offer. This reinforces prior findings that cheap talk messages can improve cooperation in bargaining games with the additional finding that competitive selection of the proposer emphasizes the salutary effects.

### 3. Concluding Remarks

The articles in this volume collectively represent the latest advances in how people think of social dilemma problems, how we may be able to enhance cooperation and reduce free-riding in such problems and how we can extend the lessons learned to a host of other similar issues facing us. We have learned, for instance, that a “take” frame does not necessarily lead to lower cooperation compared to a “give” frame but combining a “take” frame with fine-grained individual level feedback leads to more extreme behavior in terms of both greater cooperation and greater free-riding. We have also learned that a strategy based on payoff sampling may provide a more parsimonious and less parameter dependent way of modelling behavior in common pool resource extraction games. We find that people behave differently in social dilemmas when making decisions of their own as opposed to deciding on behalf of someone else.

In some cases the insights, while not radically new, nevertheless provide reassuring corroboration of firmly held priors. For instance, it comes as no surprise that punitive mechanisms lead to reduced free-riding but it is worth learning that such punitive mechanisms fare much better when arrived at via democratic means than autocratic ones. This is true in the case of standard public goods games but is also true in curbing undesirable social practices like cyber-loafing. Similar corroboration is provided for the intuition that cheap-talk messages can be very effective in enhancing cooperation; but equally there may be mediating factors at play such as the distribution of costs between participants in the social dilemma. Similarly, one would assume that cheap-talk messages would be much less effective in a setting with multiple proposers in an ultimatum game. But it turns out that this is not true; even here cheap-talk promises matter and responders pay careful attention to that promise in deciding whether or not to accept the offer.

Finally, we have innovative applications of the social dilemma paradigm to interesting applications such as charity auctions. We have also seen an ambitious study that identifies interesting and interpretable differences across different subject pools and indeed across countries and cultures when it comes to the gift exchange and efficiency wage model. Collectively, the papers in this volume should provide an excellent reference for researchers working in this area, not only in getting a feel for where current thinking stands but also in terms of identifying avenues for future research.

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