

The Path to Cooperative Action during Group Social Dilemmas: A Literature Review, Set of Propositions, and Model Describing How the Opportunity to Communicate Encourages Cooperation

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The Path to Cooperative Action during Group Social Dilemmas: A Literature Review, Set of Propositions, and Model Describing How the Opportunity to Communicate Encourages Cooperation

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Abstract

A social dilemma is a circumstance in which each of an aggregate of people must make an individual decision whether to acquire a short-term benefit for themselves or to forego some of that benefit for the long-term benefit of the aggregate. The intent of this essay is to describe how communication, in terms of both the opportunity to talk and the content of what is said, interacts with other “cooperative mechanisms” – group identity, reciprocity and equity norms, and trust and trustworthiness – to largely determine individual cooperation versus defection. Two variables with relatively complex impacts on the cooperative mechanisms – social value orientation and group size – are also discussed. A model and set of propositions relating these variables are also included, and areas for further are explored.

Highlights

- Defines the two types of social dilemmas; resource and public goods
- Describes the “cooperative mechanisms” of group identity, reciprocity and equity norms, and trust and trustworthiness, all critical for determining cooperation
- Reviews in detail the functions performed by an additional “cooperative mechanism,” communication, in terms both of the sheer opportunity to interact and the content of what is discussed
- Depicts the impact of two other variables, most notably group size and social value orientation, on the cooperative mechanisms
- Includes a model and set of propositions describing the relationships among relevant variables
- Explores some areas for further research and eventual inclusion into the model

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Keywords: social dilemma, resource dilemma, public goods dilemma, group identity, social norms, trust, trustworthiness, communication, cooperation, social value orientation, group size

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Introduction

The goal of this essay is to describe the process by which people facing group social dilemmas and provided with the opportunity to directly communicate with one another come to cooperate for the collective good. In group social dilemmas, participants have to choose between acquiring a short-term benefit for themselves and helping to provide a long-term benefit for the aggregate as a whole. As such, group social dilemmas are an example of “mixed-motive situations,” those that challenge participants with deciding between cooperating with and competing with one another, with the possibility of each betraying the others through defection from any consensual agreements. My interest is not in grand-theoretical attempts to explain the genesis of cooperative action in evolutionary terms (Cronk & Leech, 2013; Henrich & Henrich, 2007), but rather the day-to-day decisions of people to forego some individual profit for the benefit of the group. My

particular concern is with one type, which I will call a *resource dilemma* but which has also been referred to as a *common-pool dilemma*. In a resource dilemma, each individual must choose whether or not to “harvest” from a slowly-regenerating “resource pool” shared among everybody in the aggregate. Real-world resources such as grazing land, fish stocks, electric and geothermal reserves, and clean air and water serve as relevant instances.

I will also include scholarship on a second sub-type, the *public goods dilemma*. Here, each individual has the option of contributing to a common pool that, if but only if sufficiently large, will benefit everybody in the aggregate. In contrast with resource dilemmas, any person’s use of a public good does not limit others’ uses of it. Examples include the decision to contribute to organizations that can benefit aggregates of people, such as labor unions, public television and radio stations, and professional associations. Public goods can be

divided into two ideal subtypes, continuous and step-level. A continuous public good is (in principle) established piecemeal, with the opportunity for use increasing as contributions to it climb. To use Marwell and Oliver's (1993) example, when a library institutes a book drive, the more books that are contributed, the larger the collection that all users can borrow. A step-level public good, in contrast, needs a certain level of contributions before it exists, after which (again in principle) further contributions are unnecessary. Marwell and Oliver's relevant example is a bridge, which requires a given public expenditure to build but then can be used by all travelers without further investment. In real-life, most public goods are a combination of the two, as the library needs a public expenditure to open in the first place while the bridge requires additional resources for upkeep and maintenance. Having said this, the experimental research cited in this essay is generally performed in pure step-level simulations.

Two widely-cited works have provided justification for the claim that, as an expected consequence of individual rationality, social dilemmas will not be solved. In the case of the resource dilemma, Hardin's (1968) introduction to the "tragedy of the commons" galvanized academic interest in its study; according to Google Scholar, as of when I write this (June 2017), it has been cited in other works more than 34,000 times. Hardin envisioned a commons in which each member of an aggregate of people has the opportunity to graze their herd of sheep at no personal expense. It is individually rational for each person to add additional sheep to his herd, as he would reap a gain without any obvious cost. However, if multiple members of the aggregate persist in this practice, eventually the grass will be worn to the ground and everyone would suffer. Hardin's conclusion was that resource dilemmas could never be successfully managed without, in his words, "mutual coercion mutually agreed upon." Yet, dozens of laboratory studies have made it plain that aggregates of people often willingly succeed in protecting resource pools. More importantly, there are examples throughout the world of real-life resource pools maintained by large groups of public citizens, without government oversight, although usually with member surveillance and enforcement of use limits; examples include resources such as fisheries, water supplies, pasture lands, and forests. Political scientist Elinor Ostrom, who became the first female Nobel Lauriat in Economic Sciences for leading research efforts to explain the factors contributing to success or failure of

such attempts, described a rural cooperative in Spain that has regulated water usage among farmers for centuries: rules officially established in 1435 A.D. codified practices in use since before 1238 A.D.

Turning to public goods, the general argument concerning individual decisions whether to contribute are as follows: If a public good has been achieved, a member of the group for whom the good is relevant can take advantage of it whether or not she has contributed to its provision. In that case, the person is better off not contributing, because she will proverbially have her cake and eat it too ("I still have my book, and I can use the library anyway"). If the public good is not achieved, any contribution goes to waste, so a contributor is better off keeping it in the first place ("I'm glad I didn't waste my money on that public radio station that never got off the ground"). In summary, the individually-rational choice is never to contribute, as the chooser reaps higher reward whether or not the public good is attained. Olson (1965), in a book with impact analogous to Hardin (more than 38,000 citations on Google Scholar), provides a more subtle argument; that members of the group for whom a possible public good is relevant will compare the personal benefit from the achievement of the public good to the personal cost of contributing to its provision. As most public goods are at least partly step-level, i.e. take a considerable expenditure to get started, the needed personal contribution may be significant whereas the potential benefits are uncertain and out of individual control. As a consequence, the disincentive to contribute generally outweighs the incentive. There are circumstances in which group members will conclude that the benefit will outweigh the cost, and enough of them will contribute to institute the public good; these will be addressed later in this essay. In general, however, a public good will not be achieved without either compulsory contributions, such as taxes, or incentives designed for individual group members; the latter can include not only economic incentives but also the psychological (self-satisfaction, self-esteem) and social (friendship and fellowship).

Finally, there are circumstances (known by experimentalists as *give-or-take-some*) that combine aspects of resource and public goods dilemmas by allowing people to either contribute to or withdraw from a public resource. Budescu and McCarter (2012; McCarter, Budescu & Scheffran, 2011) provide examples of give-and-take circumstances. For instance, Eastern Europeans with sufficient means contribute money to a pool that those in need can take from; members

of the Church of Latter Day Saints do the same with provisions. Other cases include “free stores,” in which people place no-longer-wanted items that others who want them can take, and give-or-take-a-penny jars at checkout counters.

As with resource dilemmas, aggregates of people often succeed in attaining step-level public goods in experimental simulations, and the real-world is full of professional associations, charities, and other public institutions that succeed due to the willingness of people to contribute to them, although admittedly with individual incentives for the contribution. Further, contrary to the classic Hardin and Olson analyses, what these circumstances present to the participant is a conflict between individual and collective forms of rationality (van Lange & Messick, 1996). In contrast with the individually-rational choice just described, the rational decision for the aggregate as a whole is often to contribute enough to attain the public good or maintain the viability of the resource pool. In addition, having information about the behavioral intentions of other group members can alleviate some of the uncertainty about the consequences of one’s own decision. Given this, it should not be surprising that, among the many factors that have been examined, the most powerful factor increasing the odds of participants opting for the collectively rational option is the opportunity for communication among them (Balliet, 2010; Sally, 1995). Based on findings from experimental simulations, Bornstein (1992b) proposed a set of reasons why communication can engender cooperation in social dilemmas: it allows for the clarification of available choices, enhances trust among participants, reinforces the activation of relevant social norms, encourages a group identity, and allows for the establishment of a collective strategy and member commitments to adhere to it. Many of these factors also appear in Ostrom’s (2003) process model for the management of real-world resource dilemmas and Schroeder, Sibicky and Irwin’s (1995) framework for describing individual decisions when facing social dilemmas.

However, none of the studies inspiring those proposals included the detailed examination of the content of communication occurring when groups face social dilemmas. The only studies published before 2005 examining any communication content (Bornstein, 1992a; Hackett, Schlager, & Walker, 1994; Orbell, van de Kragt, and Dawes, 1988) were limited to noting explicit agreements to contribute to a public good. As a consequence, the precise relationship between

the presence of communication and the proposed reasons for its efficacy has been left unexplained. An inspiration for this essay are the findings in a series of studies (Pavitt, 2011, 2016) intended to tease out the impact of communication content on small group performance and group member perceptions during experimental resource dilemma simulations. In summary, these findings were as follows:

1: Almost all of the groups chose to cooperate, came up with a strategy insuring approximately equal harvests (except when the reward for harvesting varied among members), and followed through with the strategy; defectors were very rare.

2: The most prevalent topic of discussion was the formulation of game strategy, followed by asking for and providing information relevant to the game itself.

3: In contrast with the above-cited studies, explicitly-voiced agreements were rare, with acceptance more often implied by members reiterating and clarifying the strategy.

4: Success at maintaining the resource pool and attaining relatively high individual reward over the long haul was more likely to the extent that agreed-upon strategies were specific (e.g., “Let’s take out five points each round”) rather than general (“Let’s take out a small amount each round”).

5: Discussion relevant to decision procedure was positively associated with resource pool maintenance and long-term harvest, whereas information about the game was negatively linked with these outcomes.

6: The tendency toward equal harvests was *not* associated with specific discussion content, excepting when the reward for harvesting varied among members.

7: In post-discussion questionnaires, participants almost universally reported high levels of group cooperation and coordination, trust in one another, and a sense of group identity.

8: To the extent that variation existed among these post-discussion judgments, higher levels were associated with talk relevant to discussion procedure and specific strategy and negatively linked with discussion about general strategy and information about the game. They were also positively correlated with long-term amount and equality of harvest.

In essence, the specific goal of this essay is to answer the question of how the opportunity for the members of small groups to directly interact with one another usually encourages them to cooperate with one another during social dilemmas. What follows is an attempt to build on earlier theoretical efforts (Bornstein, 1992b; Ostrom, 2003; Schroeder et al., 1995) in light of the just-described findings and

available research, in so doing providing a more sophisticated role for communication than in previous models. This includes linking communication with the rest of a set of what I (Pavitt, 2011, 2016) have previously called the “cooperative mechanisms” germane to group conduct during social dilemmas: group identity, relevant social norms (reciprocity and equity), and trust and trustworthiness. In short, communication functions in two distinguishable ways, in terms of the opportunity itself and the content of what is said. In the following sections, after a summary of my method, I will introduce these cooperative mechanisms, describe other factors significantly impinging on the process, most notably group size and social value orientation, and propose a set of propositions and a model describing how their interrelationships impact on group cooperation during social dilemmas.

Method

I begin this discussion of the method that I used with a description of the boundaries within which the concerns of this paper reside. First, although much of what is included is relevant to larger aggregates, my primary interest is in the small group. Attempts to define the dividing line between small and large groups by size have tended to choose some arbitrary number, usually somewhere around ten. A more principled way of defining what makes a group small was offered by Bales (1950, p. 33); “any number of persons engaged in interaction with one another in a single [or series of] . . . meeting[s] in which each member can . . . give some reaction to each of the others as an individual person, even though it be only to recall that the other was present.”

Having said this, dyads, i.e. aggregates of two people, do not count as groups. The distinction between dyads and groups is particularly germane to the social dilemma circumstance, as it differentiates when those that cooperate can and cannot identify any defecting participant. Due to their fundamentally dyadic nature, some social dilemma circumstances, such as the classic prisoner’s dilemma (Rapoport & Chammah, 1965), the chicken game (Rapoport & Chammah, 1966; Taylor & Hill, 1982), and the assurance game (Skyrms, 2004; Taylor & Hill, 1982), are not included in this review. Studies labeled as group chicken games, in which everyone prospers if enough members contribute an endowment, are in actuality either public goods or resource dilemmas and will be treated as such (Bornstein, Budescu, & Zamir, 1997;

Hertel, Neuhof, Theuer, & Kerr, 2010). Group assurance games are likewise public goods games in which all must contribute to be successful, and multi-person prisoner’s dilemmas are in essence resource dilemmas; see Franzen’s (1995) description of each.

Even within these boundaries, the available literature is enormous, encompassing primarily social and personality psychology, sociology, management science, political science, behavioral economics, and ecology, along with occasional contributions from other fields. My strategy in examining this work was to read available books and use them to identify key references. I proceeded with a method analogous to snowball sampling, following relevant citation chains both backward (what was cited in the key references) and forward (who cited the key references) until I came to the end of each. It is likely that I overlooked some pertinent work; hopefully, future efforts of this type will be able to include what is missed here. Another decision I had to make concerned choosing what to reference when a critical finding was replicated numerous times. In this case, I included three or four exemplars that appeared to be particularly influential.

The Cooperative Mechanisms

Synopsis

The decision process undertaken by the participants in a group social dilemma differs substantially from the strict cost/benefit analysis presumed by Hardin (1968) and Olson (1965). Weber, Kopelman, and Messick (2004) adopted March’s (1994) AIR (Appropriateness/Identity/ Rules) model for general decision making (1994) to the specific social dilemma context. March characterized decision making as a series of three questions people ask themselves: “What kind of situation is this,” “What kind of person am I,” and “What does a person like me do in a situation like this?” Weber et al. added the additional and critical question “How do other people understand this situation” to the mix. The typical participant’s answer [with my comments bracketed within it, and multiple possibilities depending on the type of social dilemma] is as follows: “I am a member of a group with a task [public goods/resource dilemma] requiring me to make a decision whether or not to cooperate with the others, with my choice affecting all of us. As a member of a group, I am

bound by a set of rules [norms]. These rules include reciprocating the actions performed by other group members and [depending on the type of social dilemma] contributing equally/equitably to the provision of a shared resource/profitting equally/equitably from a resource already in place. Until provided with evidence to the contrary, I will assume that the other people also see themselves as members of this group bound by the same rules. This implies that I should trust that they will act consistently with them. For this reason, I will also act consistently with these rules.” This thought process is encouraged by the opportunity for the members of the group to communicate with one another. It alone, however, does not insure that the resource will be successfully achieved/efficiently used. For this insurance, the members must agree upon a strategy for action. Any agreement will, in turn, reinforce the shared perception of group identity, the salience of the relevant norms, and preliminary levels of trust. If group members do act in accordance with their agreement, they will have demonstrated trustworthiness, further strengthening these cooperative mechanisms, whereas defection from the agreement will encourage others to spurn their agreements in turn.

The following sections will describe each of the cooperative mechanisms, and their interrelationships, in detail.

Group Identity

In a widely cited essay, Campbell (1958) proposed that basic Gestaltist perceptual principles such as proximity (objects relatively close to one another are perceived as a unit), similarity (objects alike in some easily identifiable way are perceived as a unit) and common fate (objects sharing the same outcome are perceived as a unit) are potentially as relevant to human interactive behavior as they are to any organization of inanimate objects. If this proposal is in any way correct, then identification as a group of an aggregate of people who are proximate, similar, and share a common fate is a natural outcome of fundamental perceptual processes (see Zander, Stotland, & Wolfe, 1960 for research support). Since the early days of research pertaining to social identity (Billig & Tajfel, 1973), the evidence suggests that an action as simple as merely telling an aggregate of people that they are a group is often sufficient for the aggregate to define itself as such. The collective belief that “we are a group,” characterized by Bar-Tal (1998) as the *fundamental group belief*, is the precursor to other group beliefs about relevant norms

(such as “we divide resources equally”), values (“one should contribute toward the establishment of a public good”), and goals (“we will make optimal use of the resource”). In addition, this self-definition encourages group members to accept these group beliefs as their own, extinguishing the distinction between individual and group interests (Brewer & Schneider, 1990; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). It would follow that an aggregate facing a social dilemma would be particularly prone to conceive themselves as a group, given both that their outcomes are interdependent and that, to a large extent, they share the same fate.

Note that the examples of group beliefs listed above begin with “we.” Gilbert (1989) stressed the importance of collective pronoun usage (we, us, our) in the process of group formation. An informal content analysis of the transcripts from Pavitt (2016) revealed that the first usage of “we” or analogous pronouns (us, our, ourselves) occurred on average on the third speaking turn, and there were about two times as many references to “we” than to “I” and its analogs (me, my, mine, myself) in the first minute of discussion. What’s more, most speaking units containing “I” either referred to past individual harvest or included constructions such as “I guess” or “I think,” whereas discussion of strategy or game rules was almost totally in terms of “we.” Dawes, van de Kragt and Orbell (1990) made the same observation about collective pronoun usage in their groups. In contrast, in an experimental study of analogously-zero history groups making decisions concerning classic scenarios demonstrating judgmental bias resulting from cognitive heuristics (Tversky & Kahneman, 1974, 1981), the ratio was about 5 to 1 favoring “I” and its analogs over “we” and its equivalents (Pavitt & Aloia, 2009). Even in a sample of standing student groups with one assignment working together already under their belts, when deciding on a topic for a second project, the proportion leaned toward “I” by 3 to 2 (Pavitt, Whitchurch, McClurg, & Petersen, 1995). The point is not that the participants in these two studies did not see themselves as groups – quite the contrary, they probably did – but that those experiencing the resource dilemma together most certainly did. There is, then, good reason to believe that the very fact of experiencing a social dilemma together is sufficient for a preliminary perception of group identity to form among the participants.

The establishment of a group identity, among other impacts, activates the salience of relevant group norms. I will turn to those next.

Reciprocity and Equity Norms

There are significant differences among commentators concerning the defining characteristics of a norm, along with pretty much every implication of those characteristics. The following definition is distilled from several published accounts, including some in obvious conflict (e.g., Bicchieri, 2006; Brennan, Eriksson, Goodin, & Southwood, 2013). A norm is a situation-specific regulative (i.e., behavioral) rule relevant to a given social collectivity with the following characteristics:

- 1 – each typical member of the social collectivity expects each other typical member to conform with the rule,
- 2 – each typical member of the social collectivity believes that each other typical member ought to conform to the rule, and believes it correct to disapprove of actions contrary to the rule,
- 3 – each typical member of the social collectivity believes that each other typical member has the same expectation and belief for that first member's actions,
- 4 – these expectations and beliefs are common knowledge within the social collectivity; i.e., Ann is aware of the norm, Ann knows that Bob is aware of the norm, Ann knows that Bob knows that Ann is aware of the norm, and so on, and the same for Bob regarding Ann.

One of the disagreements concerns whether actual behavior has to conform to the norm. Brennan et al. (2013) have argued against this claim, although acknowledging that a norm obviously flouted by most will cease being a norm soon enough. Norms provide expectations for behavior for which participants expect some form of reward for following – either tangible, such as financial gain, or intangible, such as other's or self's approval – and make behavior more predictable (Brennan et al., 2013; Coleman, 1990; Homans, 1974). If norms are sufficiently internalized, then their violation is associated with guilt or shame on the part of the defector and anger on the part of the victim (Henrich & Henrich, 2007). In fact, Brennan et al. considered the most general function of norms to be holding one another accountable for their actions.

There are many different types of norms, such as legal (i.e., the norms undergirding laws), aesthetic (e.g., in Western classical musical composition, the use of microtones is frowned upon, although they are fine in many other genres), linguistic (e.g., forms of politeness), and what I will call *etiquette norms* (e.g., if invited to a dinner party, bring a bottle

of wine). The concern here is for a class of norms that most writers call *social norms* (Brennan et al. used the term *moral* instead). These are norms relevant to more basic values concerning the qualities of sharing, reciprocating, helping, promoting egalitarianism, and insuring social equality. What these have in common is applying pressure for people to act unselfishly (Sripada & Stich, 2006). For this reason, the presence of social norms is particularly helpful in mixed-motive situations, in which there is incentive for selfishness and it is difficult for each participant to influence or predict how one another acts (Coleman, 1990; Voss, 2001).

Henrich and Henrich (2007; see also Bicchieri, 2006; Ullmann-Margalit, 1977) distinguished between cooperation norms, which are relevant when there is concern about defection in social dilemmas, and coordination norms, when such concern is largely missing. Cooperation norms instruct people to cooperate; coordination norms tell them how to go about it. According to Ullmann-Margalit (1977), cooperation norms (which she referred to as *Prisoner's Dilemma norms*) tend to evolve when mutual cooperation is individually better than mutual defection, but individual defection when the others cooperate is the best individual option of all. For this reason, conformity to the norm requires either some form of coercion, which can come from external sanctions but also either internal punishments such as guilt and shame or feelings of obligation.

The acceptance of cooperation as appropriate by all involved parties turns mixed-motive situations into coordination problems. A coordination problem exists when a group of interdependent people intending to cooperate must choose among two or more possible behavioral options allowing them to do so. To use an example from Thomas, DeScioli, Haque, and Pinker (2014), two friends want to meet for coffee, but they need to decide between Starbucks and Peet's. The trick for solving a coordination problem is finding a mutually acceptable option (Cronk & Leech, 2013; Lewis, 1969; Schelling, 1960) and insuring that the decision to choose that option becomes common knowledge among participants. In these cases, as coordinated action results in better individual outcomes than defection when facing coordination problems, coordination norms tend to be self-perpetuating and require neither sanctions nor feelings of obligation to operate (Ullmann-Margalit, 1977).

Social norms become salient when there is something about the situation that cues their relevance (Bicchieri, 2006). For most people, the experience of group membership in the

context of social dilemmas apparently cues a desire for fairness, which is then translated into the activation of the norm for reciprocity (Foddy & Yamagishi, 2009; Ostrom, 2003). When the reciprocity norm is operating, if Ann does something for Bob, then Ann expects Bob to reciprocate, and Bob has an obligation to do so. There is ample research evidence of reciprocity serving as a behavioral standard in social dilemmas. A majority of participants match both the average amount of member contributions (Cress & Kimmerle, 2007; Croson, 2007; Fischbacher, Gächter, & Fehr, 2001) and any increase or decrease in this average (Croson, Fatas and Neugebauer, 2005; Guttman, 1986; Keser & van Winden, 2000) in public good experiments.

When in operation, the norm for reciprocity serves as a cooperation norm, turning social dilemmas into coordination problems (Henrich & Henrich, 2007). The desire for fairness then points to the norm for equity as a salient guide for coordination. In the social dilemma arena, the equity norm usually translates into equality of allocation as an operating background assumption when participants have equivalent opportunities to harvest (Samuelson & Allison, 1994; van Dijk & Wilke, 2000). Messick (1993) described how equality makes a good decision heuristic in this circumstance. When deemed appropriate to the circumstance, it is easy to work with arithmetically; when judged to be inappropriate, it can be used as an anchor that is then adjusted in favor of those deemed deserving extra (see Tversky & Kahneman, 1974, for discussion of the anchoring-and-adjustment heuristic). There is evidence that equality considerations are salient in individual choice during social dilemmas (Messick, Wilke, Brewer, Kramer, Zemke, & Lui, 1983; van Dijk & Grodzka, 1992; van Dijk, Wilke, Wilke, & Metman, 1999). When participants have unequal opportunities to harvest resources, the desire for fairness often leads those with greater opportunity to harvest fewer resources than those with lesser opportunity in an apparent attempt to maintain an equality norm in total monetary gain (Budescu, Rapoport, & Suleiman, 1990; van Dijk et al., 1999). The same motive led participants with greater resources to contribute more to achieving a public good than those with less (Marwell & Ames, 1979; Rapoport & Suleiman, 1993). In Pavitt, Zingerman, Towey, & McFeeters (2006), some of the groups with unequal reward for harvest made an explicit verbalized decision that those disadvantaged should harvest more than those advantaged.

However, several circumstances can serve to short-circuit

both norms. For example, people are more selfish when:

1 – There is some perceived justification for taking more or giving less, such as an individual's belief that they have greater ability at a relevant task (Joireman, Kuhlman, & Okuda, 1994; Samuelson & Allison, 1994), greater responsibility for the group's outcome (e.g., a designated group leader; Samuelson & Allison, 1994), or that they had put in greater effort to get their allotment (van Dijk & Wilke, 1994).

2 – It is difficult to discern how much is equal or equitable, as when a resource pool is perceptually difficult to divide up (Allison, McQueen, & Schaerfl, 1992), or group size is particularly large (Allison et al., 1992), or there is uncertainty in how large the pool actually is (Rapoport, Budescu, Suleiman, & Weg, 1992).

Along with a perception of group identity, the salience of reciprocity and equity norms provide a preliminary reason for group members to trust one another; but a perception of mutual trustworthiness must await cooperative activity. The next section addresses these two concepts.

Trust and Trustworthiness

The concepts of trust and trustworthiness have been well conceptualized by writers in the social sciences, particularly political science. Both concepts are inherently contextual; paraphrasing Hardin (2002), person X trusts a specific person Y to reflect trustworthiness in a specific situation Z. More precisely, trust and trustworthiness are relevant during situations in which the outcomes for the aforementioned person X, whom I will henceforth call the truster, are at least partly dependent on the actions of person Y, whom I will call the trusted. In such situations, the trusted has the option of acting either in the truster's benefit or to the truster's detriment. Trust exists when the truster believes that the trusted will act in the interests of the truster in that given situation (Hardin, 2002). Mayer, Davis, and Schoorman (1995, p. 712; see also, Blomqvist, 1997) supplied a good definition: "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party." It is important to note Barber's (1983) distinction between this sense of trust, relevant to the intent of the trusted, from two others. One of the others is germane to the persistence of the natural order of things, such as we trust that when we take a step, the world beneath our feet will not suddenly disappear.

The second pertains to trusting the trusted's ability; to paraphrase Yamagishi and Yamagishi's (1994) example, we may think that the pilot wants to get us safely to our destination but lack faith in his flying skill. The concern herein is with the intent of the trusted only.

Trust is not normally an issue in circumstances in which the interests of both parties are aligned, such that an action to injure the truster will do the same for the trusted. Yamagishi and Yamagishi (1994) used the term *assurance* rather than trust for this circumstance. It is also irrelevant to contexts in which the concerns of both are opposed, because the truster has no reason to expect actions in her behalf. It follows that trust is most relevant to mixed-motive situations. The specifics of the situation are essential in determining trust; I may trust someone with ten cents, but not with ten dollars (Hardin, 2002). To help define the truster's dilemma, it is useful to apply a fundamental decision-theoretic distinction between decisions under risk and decisions under uncertainty. When the truster has knowledge relevant to the trusted's likelihood of acting in the trusted's behalf, the truster's decision whether to trust is based on the risk associated with the trusted's possible defection. If instead the truster has no such information, the truster is making a decision based on her tolerance for uncertainty. It follows that the truster would have less confidence in the ability to make that decision when made under uncertainty than under risk.

That decision itself is the product of two factors. The first factor goes under several names; consistently with Ensminger (2001), I will call it *generalized trust*. It comprises a willingness to take risks with strangers in mixed-motive situations (Hardin, 2002; Thielmann, & Hilbig, 2015). Generalized trust is synonymous with the idea of trust as an individual disposition, for which both Rotter's (1967) Interpersonal Trust Scale and Yamagishi's (1986) Trust Scale were expressly designed to measure. Generalized trust is partly a product of the degree to which the truster has typically received benefits from other people during past experiences in mixed motive situations (Hardin, 2002). It is also a consequence of the extent to which the truster believes that the average person would comply with situationally-relevant norms, particularly those suggesting reciprocity (Tyler, 2001). If a decision is made solely due to degree of generalized trust, it would more likely qualify as made under uncertainty than under risk (Ensminger, 2001; Yamagishi & Yamagishi, 1994)

The second factor is what Yamagishi and Yamagishi (1994) called *knowledge-based trust*, a belief that the trusted

intends to act in the truster's interest, based on what Thielmann and Hilbig (2015) called *trust cues* such as the truster's past actions, direct communication with the truster (to be discussed in detail below), and information about the truster obtained from third parties (the trusted's reputation). As such, a decision based on knowledge-based trust would be made more in terms of risk than uncertainty. If the relevant evidence is sufficiently persuasive, it can be said that the trusted is deserving of trust; in other words, is trustworthy (Hardin, 2002). The two should be distinguished, as trust is a judgment concerning the future ("Person Y will act in my interests") and trustworthiness a belief about the past ("Person Y has shown herself to be worthy of trust"). If the trusted does display trustworthiness, then the trusted has good reason to expect the truster to benefit the trusted if their respective roles reverse at some future time (Coleman, 1990). As such, trust and trustworthiness should be mutually reinforcing across a sequence of relevant circumstances. Both trust and trustworthiness are cognitions and neither decisions nor actions. As such, the presence of trust must be distinguished from the decision to act on it and the action itself (Hardin, 2002; Mayer et al., 1995). After all, we can choose to act without trust or trust without subsequent action. Sanctioning systems that punish non-cooperators may result in cooperative behavior, but at the expense of trust development and, if the system is subsequently abolished, future cooperation (Mulder, van Dijk, DeCremer, & Wilke, 2006; Tenbrunsel & Messick, 1999).

Situational trust is the judgment that the trusted can be relied on at the given moment. Not surprisingly, both generalized (Mori, 1996; Yamagishi, 1986, 1992) and knowledge-based (Yamagishi & Yamagishi, 1994; Thielmann and Hilbig, 2015) forms of trust are associated with situational trust in social dilemmas. Thielmann and Hilbig also describe situational impacts, such as the benefits and costs of loyalty versus betrayal, as involved in the judgment. In addition, there is evidence that group identity contributes to the establishment of situational trust (Foddy, Platow & Yamagishi, 2009; Platow, Foddy, Yamagishi, Lim & Chow, 2012). As potential explanations for this association, Foddy and Yamagishi (2009) argued that membership in a group implies an expectation of mutual reciprocity, whereas Messick and Kramer (2001) proposed the existence of a social rule stating that trust and trustworthiness are required among group members. This latter proposal is buttressed by evidence that people view trust as a moral commitment, and sometimes

act as if they trust even when they lack confidence that the trusted will act to their benefit (Dunning, Anderson, Schlösser, Ehlebrecht, & Fetchenhauer (2014).

With three of the generative mechanisms in place, group members are ready to cooperate. Cooperation and its linkages with these three will be the next topic covered; the critical role of communication will be described after that coverage.

Cooperation

As with trust, there are multiple senses of the term cooperation. Elster (1989) described five, one of which (*joint ventures*) is the connotation most relevant here. In this sense, to cooperate means to “co-operate”; to do things in tandem (Cronk & Leech, 2013). Cooperation in this sense occurs when members of a collectivity are interdependent and share a goal only achieved through coordinated action, when these two facts are common knowledge among the members, and when they have an agreed-upon action plan (Pruitt & Kimmel, 1977; Schelling, 1971). Cooperation is the norm for participants in social dilemma studies, and when asked why they did so, the majority of research participants studied by Dawes et al. (1990) claimed it “the right thing to do” in these circumstances.

The three previously described cooperative mechanisms work together to make cooperation the “right thing to do.” To begin, Boone and Buck (2003) emphasized the importance of reciprocated beliefs in the trustworthiness of each participant for cooperation. It should then not be surprising that an association between cooperation and one or another measure of generalized trust (Rotter, 1967; Yamagishi, 1986) has been noted in both experimental (Brann & Foddy, 1987; Cox, Ostrom, Walker, Castillo, Coleman, Holahan, Schoon, & Steed, 2009; Parks, Henager, & Scamahorn, 1996; Yamagishi, 1986, 1992) and real-life (Joireman, Van Lange, Kuhlman, Van Vugt, & Shelley, 1997; Van Lange, Van Vugt, Meertens, & Ruiters, 1998) contexts. In Yamagishi (1986), high trusters contributed less to a fund for punishing defectors than low trusters, which likely implies they were more likely to believe that sanctioning was not needed; this result was, however, not replicated in Yamagishi (1992). There is also evidence that situational trust, operationalized as the expectation of others’ cooperation, can be linked with cooperation, directly in some studies (Messick, Wilke, Brewer, Kramer, Zemke, & Lui, 1983; Parks, Henager, & Scama-

horn, 1996; Rutte & Wilke, 1992) and indirectly in others (Alcock & Mansell, 1977; Allison & Kerr, 1994; Bouas Henry, 2000; Mulder, van Dijk, DeCremer, & Wilke, 2006; Stouten, DeCremer, & van Dijk, 2009; see Balliet & Van Lange, 2013, for meta-analysis). Moreover, cooperation is enhanced by evidence of other’s trustworthiness (Tenbrunsel & Messick, 1999).

Bicchieri (2002; Bicchieri & Lev-On, 2007) claimed that social norm activation is the key to cooperation in social dilemmas. The discussion above cites numerous studies indicating the impact of reciprocity and equity norms on cooperation; in addition, two of them (Fischbacher et al., 2001; Keser & Van Winden, 2000) emphasized the point that group members’ cooperation is conditional on one another maintaining these norms. Dawes et al. (1990) opted for group identity as the most important ingredient in cooperation, and it has been linked to cooperation in studies of resource (Baird, 1982; Brewer & Kramer, 1986; Kramer & Brewer, 1984) and public goods (Alfano & Marwell, 1980; DeCremer & van Dijk, 2002a; Rubenstein, Watzke, Doktor, & Dana, 1975; Watzke, Dana, Doktor, & Rubenstein, 1972) dilemmas. In the Alfano and Marwell study, participants were more likely to believe that others would contribute when the whole group would benefit rather than each individual. In the most persuasive demonstration, Kramer and Goldman (1995) and Smith et al. (2003) noted correlations between participant perceptions of group identity and cooperation.

Communication

Meta-analyses (Balliet, 2010; Sally, 1995) have demonstrated that the most important factor influencing cooperativeness in social dilemmas is the presence versus absence of communication among group members. The opportunity to communicate has, in some studies, increased cooperation rates to close to one hundred percent, and in so doing disconfirmed the pessimism inherent in Hardin (1968) and Olson (1965). Concentrating on the types of social dilemmas of interest here, more than ten published resource dilemma studies with widely varying methods have shown the presence of communication to increase the proportion of participants cooperating, the maintenance of the resource pool, the total amount of points harvested, and the number of rounds before resource depletion, along with various relevant self-report variables. representative examples in different disciplines include Bischoff (2007), Dawes, McTavish, and

Shaklee (1977), Edney and Harper (1978), and Janssen and Ostrom (2008). Not all of these studies have been performed with college students; for example, Cardenas, Ahn, & Ostrom (2004) did so with rural Columbians (see also Lopez and Villamayor-Tomas, 2017). Only two published studies of which I am aware failed to replicate the tendency: Caldwell (1976), in which communication was restricted to only one minute every five rounds, and one conducted in several rural villages in India (Ghate, Ghate, & Ostrom, 2013), likely due to pre-existing cooperative social norms. Even in the case of Ghate et al., the presence of communication was still successful in inducing greater equality in harvests. In addition, Jerdee and Rosen (1974) and Janssen (2010) noted cooperation to increase across rounds with communication and decrease across rounds without it, and Cardenas (2011) discussed the fact that repeated communication encourages cooperation more than does a one-shot talk.

Again with widely varying methods, at least twenty published public-goods reports have revealed the presence of communication to increase the probability of individual contribution to the public good, the group provision of that good, and various self-report measures. Representative exemplars in various disciplines include Bouas and Komorita (1996), Braver and Wilson (1986), Frohlich & Oppenheimer (1998), and Ostrom and Walker (1991). Even Twitter-sized chunks encouraged greater contribution rates than no interaction at all (Mäs & Dijkstra, 2014). In Kinukawa, Saijo, and Une, (2000), cooperation rates were greatest when all six members of the group could interact between rounds, lower when only two members could communicate at a time but each person's interaction partner changed between rounds, lower yet when the same two members could communicate between rounds, and lowest with no communication. The only published works I know of in which communication did not have a clear positive impact was Palfrey and Rosenthal (1991), in which interaction was limited to signaling whether one was or was not going to contribute to the public good, and a condition in Mäs and Dijkstra, in which messages were limited to standardized statements of behavioral intention; and even here, the impact was intermediate between no and Twitter-sized discussion.

The important theoretical question is to determine why communication works as it does. A number of conceivable mechanisms have been proposed, with Bornstein (1992b) providing a useful list of possibilities. Bornstein's list includes all three of the previously-described cooperative mechanisms

(group identity development, trust emergence, norm salience), along with helping group members come to understand the situation through clarification of the implications of various choices, allowing group members to coordinate their actions through exchanging information about intended choices, and providing the opportunity to form agreements, make promises, and commit to cooperate. Bornstein's list does not distinguish between factors that occur as consequence of the opportunity to talk and factors that follow from what is explicitly discussed. That opportunity in and of itself encourages the formation of a shared group identity (Bouas & Komorita, 1996; Gaertner, Iuzzini, Witt, & Oriña, 2006; Jans, Leach, Garcia, & Postmes, 2015), reinforces the relevance of reciprocity and equity norms (Bicchieri, 2002; Bicchieri & Lev-On, 2007; Cohen, Wildschut, & Insko, 2010), and fosters situational trust in the form of expectations of one another's cooperation (Boone & Buck, 2003; Bornstein, 1992a; Braver & Wilson, 1986; Cohen et al., 2010; Kerr & Kaufman-Gilliland, 1994, although perhaps only for those with high generalized trust; Mori, 1996). The relationships between communication opportunity and these other cooperative mechanisms are all central to Ostrom's (2003) process model.

Turning to what is explicitly discussed, the fourth possibility on Bornstein's (1992b) list, that communication increases group members' understanding of the situation, has failed to gain research support. Edney and Harper (1978) noted that warning group members about the impact of resource pool depletion and providing group members with a good strategy for maintaining the resource pool did not help the groups perform better when they could not directly interact. Likewise, either receiving comments from earlier public goods game players or overhearing a discussion from an earlier game did not increase cooperation over a no-communication condition (Brosig, Weimann, & Ockenfels, 2003; Kerr & Kaufman-Gilliland, 1994). In my work (this and subsequent mentions in this section are from Pavitt (2011), discussion concerning game rules was negatively associated with group performance. The implication is not that understanding the game is unnecessary, but that communication cannot overcome misunderstanding, and the impact of talk must be found elsewhere.

Nonetheless, communication must be task relevant for it to impact on cooperation and group performance. Irrelevant discussion appears to be no better than no talk at all (Bouas & Komorita, 1996; Cohen et al., 2010; Dawes et al., 1977),

and was unrelated with cooperation and successful resource harvesting in my research. In contrast, task-relevant content has an integral impact on group performance. First, the verbalized establishment of a procedure for conducting the discussion sets the stage for the other functions necessary for successful outcomes (Pavitt, 2011). Second, discussion provides the opportunity to create an action plan (Koukoulis, Levati, & Weisser, 2012; Meleady, Hopthrow, & Crisp, 2013). In my work, the generation of specific strategies was the most prevalent discussion topic and the most strongly associated with positive results, whereas general strategy talk was counterproductive; Lopez and Villamayor-Tomas (2017) noted analogous relationships in their field experiment.

Second, communication is integral to the establishment of common knowledge concerning the action plan (Ostrom, 2003). The role of common knowledge in the genesis of collective action has been well conceptualized by philosophers of action. In Tuomela's (2007) bulletin-board metaphor, one member of a group explicitly proposes a joint action. This proposal and an accompanying action plan are written so to speak on a public bulletin board, allowing responses and revisions from others involved. Those who wish to share the collective intention may choose to explicitly signal their acceptance, although the mere simultaneous hearing of the proposal might be sufficient if its speaker has enough influence to direct the group's action. This latter possibility seems to have occurred regularly in my research groups; most groups apparently accepted an action plan suggested by a verbally dominant member.

Third, communication provides a forum for participants to voice explicit promises to follow the action plan. Tuomela's conception includes the possibility that recognition of the acceptance of the proposed plan leading to common knowledge of the participants' joint commitment to it may be communicated. Several informal content analyses (Bornstein, 1992a; Hackett, Schlager, & Walker, 1994; Orbell, van de Kragt, and Dawes, 1988) noted a tendency for the opportunity to communicate to lead to explicit agreements to contribute to a public good. Along with the existence of relevant norms, such voiced obligations provide a provisional form of situational trust before members have had the opportunity to demonstrate true trustworthiness (Gambetta, 1988; Hardin, 2002). As noted earlier, these were rare in my groups, with acceptance often signaled by questions about the proposed action plan and responses repeating and clarifying it, and the latter was positively linked with successful

performance. In other work, voiced commitments appear to have been significant in some studies (Hopthrow & Hulbert, 2005; Neidert & Linder, 1990; Samuelson & Watrous-Rodriguez, 2010), although less so when unaccompanied by free talk (Wilson & Sell, 1997), and not at all in others (Bochet, Page, & Putterman, 2006; Palfrey & Rosenthal, 1991).

Fourth, communication reinforces the continued development of group identity. As mentioned earlier, action philosopher Gilbert (1989) stressed the role of communication within an aggregate as a necessary part of the process of becoming a group. One person in the aggregate performs an initiatory use of a collective pronoun, in a sense expressing the readiness to share in an action with the others, and the others express their acceptance of this use through its repetition (closing "we"), in so doing making it common knowledge that a group has formed. Lopez and Villamayor-Tomas (2017) uncovered some evidence that group identity-enhancing comments indicating approval and social support of other group members improves group performance. Finally, communication reiterates the importance of relevant social norms. Lopez and Villamayor-Tomas (2017) observed cooperation to improve with negative comments about past outcomes, which they believed to make such norms salient to members of the groups.

Communication performs further functions once the game has begun. There is evidence that positive reinforcement for past cooperation is linked with good group outcomes (Mäs & Dijkstra, 2014). Discussion may help heal the wound of betrayal; when participants in a public goods game discovered that a confederate "partner" had failed to cooperate, messages from the partner explaining and apologizing for the failure led to increased cooperation from the participants when compared to an absence of these messages (Tazelaar, Van Lange, & Ouwerkerk, 2005). In contrast, defection tends to elicit sharp verbal responses (e.g., "Some scumbucket is investing more than we agreed on"), which often were successful in gaining compliance in later rounds (Dawes et al., 1977; Ostrom & Walker, 1991).

Influences on the Cooperative Mechanisms

I next turn to some factors that influence the degree to which the cooperative mechanisms operate during social dilemmas. Some require little explication. For example, following in Olson's (1965) footsteps, both Ostrom (2003) and

Schroeder et al. (1995) noted that cooperation is greater when the payoff for it provides an incentive. In addition, both Pavitt, McFeeters, Towey, and Zingerman (2005). and Janssen (2010) discovered that greater incentives result in more discussion of strategy and less information exchange. The opportunity for the group to punish defectors, i.e., those who refuse to cooperate, also stands as an incentive for cooperation (Shinada & Yamagishi, 2008; Yamagishi, 1986). Cultural differences have been noted in comparisons of Japanese and American resource harvesting (Wade-Benzoni, Okumura, Brett, Moore, Tenbrunsel & Bazerman, 2001). An understanding of the situation in which group members find themselves is crucial (Schroeder et al., 1995). There are others that I believe are particularly ripe for communication research; I will be covering these toward the end of this paper. For now, I limit the discussion to two elements with complex associations with the generative mechanisms but in which communication has received some attention; social value orientation and group size.

Social Value Orientation

As described above, March's (1994) AIR decision-making model included "What kind of person am I" as one of the questions people ask themselves when making decisions. This inclusion implies that individual difference variables should impact on how people respond to social dilemmas, and both Ostrom (2003) and Schroeder et al. (1995) proposed that such variables should impact on cooperative tendencies. I have already discussed one of these variables, generalized trust; here I describe a second, *social value orientation* (SVO), which refers to people's typical responses to potentially conflictual circumstances. SVO has been conceptualized in terms of two orthogonal dimensions, concern with the outcome for the self and concern with the outcome for the other party (Joireman, Shelley, Teta, Wilding, & Kuhlman, 1996; Van Lange, 1999). Three SVO types predominate. Those predisposed to favor good outcomes for both self and other are known as *cooperatives*. Those inclined toward good outcomes for self and bad outcomes for other are called *competitives*. Those prone toward good outcomes for self but ignore those for other are referred to as *individualists*. An occasional altruist who wants good outcomes for other and is unconcerned about self can be found. Sometimes, altruists and cooperatives are grouped as *prosocials* and competitives and individualists are combined as *proselfs*. More than twen-

ty studies have noted higher cooperative responses for prosocials than for proselfs (e.g., Allison & Messick, 1990; DeCremer, 2000; Liebrand, 1984; Van Lange & Kuhlman, 1994; Roch & Samuelson, 1997; see the meta-analysis by Balliet, Parks, & Joireman, 2009), with some uncovering a more specific ordering of altruists (who cooperate no matter what), cooperatives (who cooperate if others do), individualists (who cooperate if it brings personal gain), and competitives (who do not cooperate; Kuhlman & Marshello, 1975; Liebrand, 1984; McClintock & Liebrand, 1988).

SVO has been demonstrated to interact with some of the cooperative mechanisms described above. Prosocials and, to a lesser extent, individualists strive toward equality of individual results (Van den Bergh, Dewitte, & DeCremer, 2006), and awareness of the relevance of norms mediated the relationship between concern with collective outcomes and cooperativeness (DeCremer & Bakker, 2003). The relationship between SVO and group identity is unclear, with cooperatives responding most strongly in a resource dilemma study (Kramer & Goldman, 1995) and proselfs in public goods research (DeCremer & van Vugt, 1999). Although still less so than prosocials, proselfs were noted as more cooperative with someone labelled as honest than with someone described as either intelligent or unintelligent, which the researchers (Van Lange & Semin-Goossens, 1998) equated to attributions of trustworthiness. Nicely integrating many of these thoughts, Bogaert, Boone and Declerck (2008) proposed a parallel moderated mediation model of the impact of social value orientation on cooperation. SVO impacts the general willingness of a person to cooperate with others, which interacts with situational incentives to cooperate such as potential reward for cooperation and degree of group identity to determine the person's preference regarding degree of cooperation. Individualists are particularly influenced by the situation. On a parallel track, SVO impacts characteristic expectations of others' cooperation to be consistent with one's own. These expectations then interact with the actual level of cooperation others display, resulting in situation-specific expectations of reciprocity from others and, along with one's cooperative preference described earlier, degree of cooperation. On this latter track, it is prosocials who are the most affected by context, cooperating with other cooperators but not with others. In contrast, although SVO differences affect communication content in predictable ways (Olekalns & Smith, 1999; Weingart, Brett, Olekalns, & Smith, 2007), with prosocials more likely than proselfs to

form a cooperative action plan (Pavitt, Braddock & Mann, 2009), these differences appear to impact on cooperation rates independently of that content (Kerr & Harris, 1996; Liebrand, 1984).

Group Size

The most influential theoretical discussion concerning the impact of group size is Olson's (1965) on public goods dilemmas. As mentioned earlier, Olson argued that people will be willing to contribute to a public good if they are confident that their potential personal gain from reaching the collective goal outweighs the personal costs for providing their share. However, there will always be a degree of uncertainty about the odds of reaching this potential, and the greater the uncertainty, the lower the incentive to contribute. Uncertainty is a function of the amount of control the individual has over whether the goal will be reached, such that the greater the control, the lower the uncertainty and so the greater the incentive to contribute. Uncertainty is also decreased by greater ease in monitoring the actions of other group members. The larger the group needed to achieve the public good, the less individual control over the outcome, the harder the monitoring process, the more uncertain the hoped-for result, and so the lower the incentive to contribute.

In groups that are so large that the effect of each person's decision whether to cooperate is not "noticeable," the potential personal benefit of contributing is invisible. In these cases, only coercion or personal incentives will provide a good enough reason to contribute. Without either of the latter, the public good will not be attained. In some contrast, when groups are small enough so that either (a) at least one member has complete control, in other words can individually provide the public good, is certain of his impact, and believes his contribution is personally beneficial despite the cost, or (b) each member can see whether one another's contributions are making a "noticeable" effect on the odds of achieving the public good, there is a some possibility of achieving it. In short, the larger the group size, the less likely is public good achievement (see Ullmann-Margalit, 1977, for a somewhat analogous argument). Olson is not alone in this conclusion; Aristotle (1885) provided an early description of the deleterious impact of increased group size on cooperation, and the variable was included in Ostrom's (2003) model. However, as Marwell and Oliver (1993) pointed out, in Olson's account it is not group size per se but rather the

perceived benefit/cost ratio for contributing that would be efficacious, and they disagreed with the implication that this would necessarily worsen as group size increases. Quite the opposite; if start-up costs are equivalent (opening the library and building the bridge cost the same no matter the number of potential tax payers), then the larger the relevant group, the smaller the individual cost for the same benefit, and so the probability of contributing would increase. In conclusion, the odds of provision changing with group size depends primarily on the impact of the latter on the benefit/cost ratio.

In any case, the research results for the impact of group size could not offer clearer support for Olson; all else being equal, at least twelve published studies have demonstrated that members of smaller sized groups take less and are better at maintaining resource pools (e.g., Allison & Messick, 1985; Brewer & Kramer, 1986; Fox & Guyer, 1977), and contribute more and are better at reaching public goods goals (e.g., Marwell & Ames, 1979; McCarter, Rockman & Northcroft, 2010; Yamagishi, 1992) than larger sized groups (see Sally's, 1995, meta-analysis for empirical confirmation). Alencar, Siqueira, and Yamamoto (2008) provided a real-life example of public school children contributing candy bars with analogous findings. Further, some of Olson's explanatory framework has empirical evidence behind it. Members of smaller groups have greater confidence than larger groups in the group's achievement of a public goods goal (Kerr, 1989). These members feel greater personal control (*self-efficacy*) over goal achievement in public goods tasks (Allison & Kerr, 1994; Kerr, 1989). Manipulations decreasing either certainty about cooperation or self-efficacy increased harvesting in a resource dilemma (Au & Ngai, 2003). A viable interpretation of these findings is that people are more likely to contribute if they trust that their cooperation will not be wasted. An implication is that methods for encouraging trust in one another's intention to cooperate will negate the deleterious effect of group size, and again there is supportive work. Allison and Messick (1985) noted that a second experience in a resource task led to smaller harvests and longer pool maintenance for members of six-member groups although not for three-member groups. Moreover, Fox and Guyer (1977) observed that a history of cooperation led later cooperation to be as great in twelve-member groups as in three-member groups. Sato (1988) discovered that cooperation is greater for high generalized trusters in three-member groups than either high trusters in seven-person groups or low generalized trusters in either-sized groups. This latter discovery provides more

evidence that group size effects come down to trust.

Turning to other cooperative mechanisms, Allison et al. (1992) uncovered explicit support for the notion that members of smaller groups are more likely to follow an equality norm in their harvesting from a resource pool than members of larger groups. Allison et al. proposed that such norms may be broken in larger groups because members believe their violation is less likely to be discovered, consistent with Olson's idea that ability to monitor one another becomes more difficult in larger groups. Finally, Balliet's (2010) meta-analysis of studies reveals that communication has a greater impact on cooperation in larger sized groups than small. Consistent with this meta-analysis is Pavitt & Broomell (2016) discovery that the opportunity to communicate extinguished group-size effects for harvesting in a resource dilemma and on participant judgments for all of the cooperative mechanisms. Further evidence was provided by Meleady, Hopthrow, and Crisp (2013)'s finding that members of groups imagining communication with one another increased their contributions to a public good as their group size increased from 6 to 12 to 24.

Model and Propositions

Figure 1 diagrams the relationships among the variables described in this review. In order to maintain simplicity, indirect linkages are minimized and the direction of the linkages are not indicated. The latter and some possible examples of the former are included in the following list of theoretical propositions. The figure is organized according to a distinction among five types of variables: input before discussion, discussion content, output from discussion, process of harvesting/contributing, and results of harvesting/contributing. The propositions are ordered analogously, based on the categorization of the causal variable in each. Both figure and propositions are strongly influenced by Ostrom (2003) and Schroeder et al. (1995) along with the research findings described above.

Input Before Discussion

Proposition 1: Larger group sizes decreases situational trust.

Proposition 2: Greater generalized trust heightens situational trust.

Proposition 3: Increased reward for cooperation favors procedural and specific strategy discussion.

Proposition 4: A more prosocial social value orientation leads to greater reciprocity and equity norm salience than a more proself social value orientation.

Proposition 5: Greater reciprocity and equity norm salience results in more procedural and specific strategy discussion.

Propositions 4 and 5 together imply that norm salience mediates the SVO-to-discussion relationship. It is additionally possible that prosocial SVO independently favors procedural and specific strategy talk.

Proposition 6: More opportunity to communicate favors reciprocity and equity norm salience.

Proposition 7: More opportunity to communicate encourages group identity formation.

Proposition 8: Decreased understanding of the situation heightens the amount of pure information exchange and general strategy discussion.

Discussion Content

Proposition 9: More pure information exchange and general strategy discussion depress the amount and equality of resource dilemma harvest and public goods contributions.

Proposition 10: More pure information exchange and general strategy discussion take time away from procedural and specific strategy discussion.

Propositions 8 and 10 in tandem suggest that the amount of information exchange and general strategy talk mediates the understanding-to-procedural/specific strategy talk relationship. It is highly likely that understanding the situation has an additional direct and positive impact on procedural and specific strategy discussion.

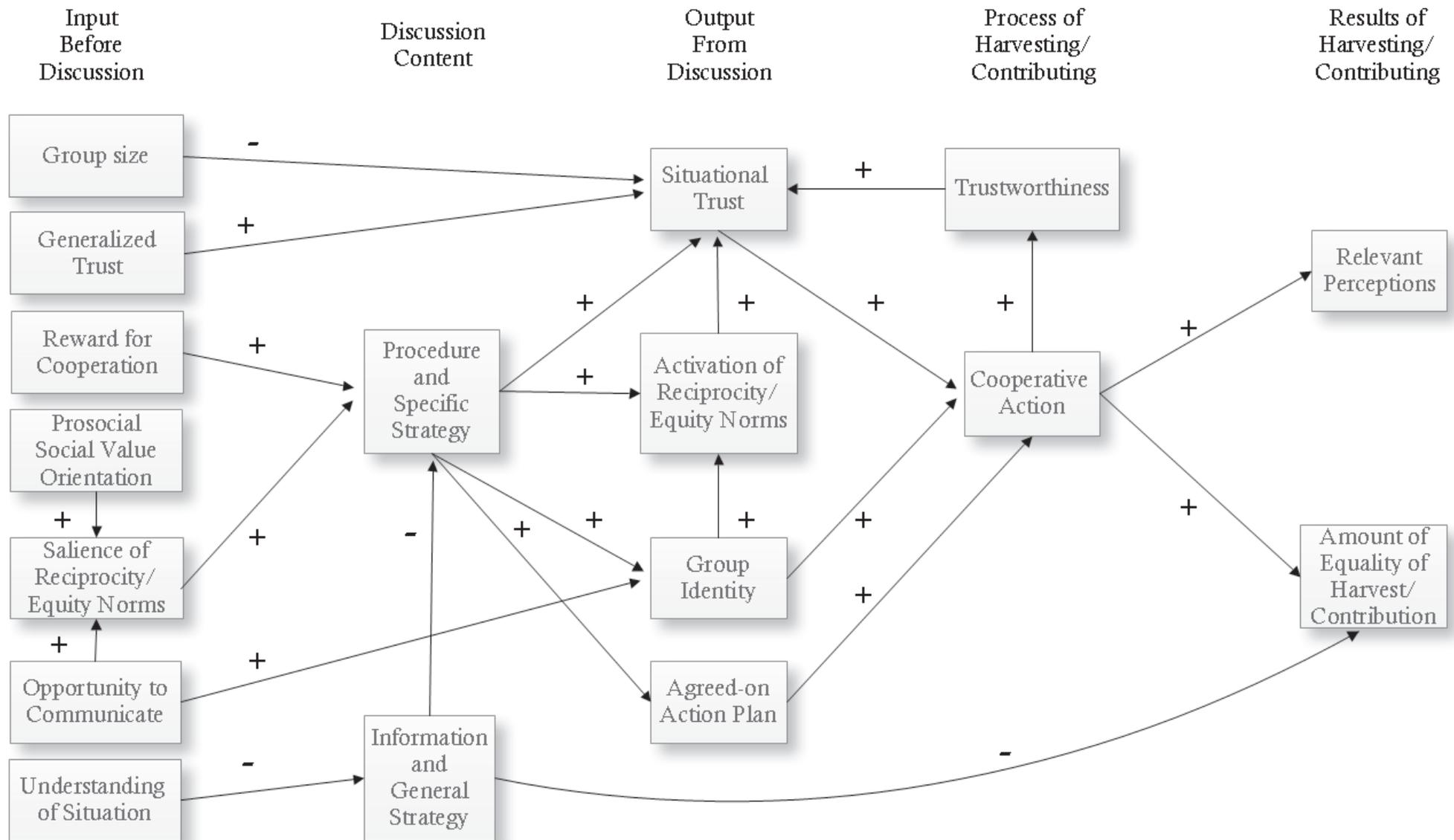
Proposition 11: Greater amounts of procedural and specific strategy discussion amplifies situational trust.

Proposition 12: Greater amounts of procedural and specific strategy discussion encourages the activation of reciprocity and equity norms.

Propositions 5 and 12 simultaneously entail that procedural and specific strategy discussion mediates the linkage between the salience and activation of reciprocity and equity norms. It is almost certain that this latter relationship also occurs independently of communication.

Proposition 13: Greater amounts of procedural and specific strategy discussion results in greater group identity.

Figure 1. Relationships Among Relevant Variables



Proposition 14: Greater amounts of procedural and specific strategy discussion favors the establishment of an agreed-on action plan.

Output From Discussion

Proposition 15: A perception of group identity encourages the activation of reciprocity and equity norms.

Proposition 16: The activation of reciprocity and equity norms increases situational trust.

In addition to the indirect impact of group identity on situational trust as mediated by norm activation, a direct positive relationship likely occurs.

Proposition 17: The presence of an agreed-on action plan increases cooperative action.

Proposition 18: The establishment of group identity encourages cooperative action.

Proposition 19: Greater situational trust results in more cooperative action.

Process of Harvesting/Contributing

Proposition 20: More cooperative action leads to greater perceptions of trustworthiness.

Proposition 21: Greater perceptions of trustworthiness amplifies situational trust.

Proposition 22: More cooperative action results in more positive post-experience perceptions.

Proposition 23: More cooperative action increases the amount and equality of resource dilemma harvest and public goods contributions.

To summarize the major processes being proposed, the sheer experience of being in an interacting aggregate brings to mind norms for reciprocity and equity, accompanied by the beginnings of group identification. Along with prescriptions for each participant's own actions, group identity and norm activation imply a tentative form of situational trust based on the expectations of norm adherence by others. Such trust provides warrant for cooperative action even without behavioral evidence of other participants' trustworthiness. The content of group discussion generally reinforces group identity, norm activation, and situational trust, and is responsible for the generation of a specific plan of action. The result is generally cooperative action consistent with this plan, which provides behavioral demonstrations of trustworthiness and confirms situational trust judgments. The prop-

ositions as stated and diagrammed in [Figure 1](#) probably underestimate the mutual causality among the cooperative mechanisms. For example, in addition to the included relationships, demonstrations of trustworthiness through cooperative action almost certainly reinforce group identity and norm adherence. The whole experience results in the establishment of social capital, nicely defined by Brehm and Rahn (1997, p. 999) as "the web of cooperative relationships between citizens that facilitates resolution of collective action problems." Absence of understanding of the situation directs attention to attempts to understand it and vague action plans, leading to relatively poor outcomes. Nevertheless, such absence does not necessarily impact cooperative mechanism activation. In contrast, factors such as little situational reward for cooperation, aggregate members low on generalized trust and/or with prosocial social value orientations, and larger group sizes, discourages the establishment of the mutual causal influence linkages among the cooperative mechanisms and depresses the chances for cooperative action.

Beyond the Present Model

Scholars have attended to variables beyond those included here, some of which (incentives, punishments, culture, and situation) I mentioned earlier. Here, I will describe three factors that have attracted significant research attention: communication channels, formal leadership, and environmental uncertainty. These issues cannot be integrated into the present model due to insufficient research attention to the role of the cooperative mechanisms. In particular, additional research is needed regarding the impact of communication content. I will finish the section with a short review of what is known about content phases during discussion.

A well-established research practice entails conducting the process of a social dilemma experience, both group discussion and subsequent dilemma experience, via computer, which eases the application of manipulations during the study. A few studies have gone beyond this practice to compare face-to-face discussion with some form of mediated interaction, either by computer or by other techniques such as telephone and closed-circuit television. In summary, findings thus far appear consistent with expectations that would follow from media richness (Daft & Lengel, 1986) and social presence (Short, Williams & Christie, 1976) conceptions. Specifically, the loss of channels results in a decreased per-

ception of involvement with those one is interacting with, leading in turn to greater difficulties in reaching satisfactory decisions. Cooperation during social dilemmas has been consistently greater face-to-face rather than through mediated channels (e.g., Bochet et al., 2006; Brosig et al., 2003; Frohlich & Oppenheimer, 1998; Samuelson & Watrous-Rodriguez, 2010). In fact, Brosig et al. uncovered a complete social presence effect, with both face-to-face and full mediated conditions more cooperative than audio only, which in turn was more cooperative than visual only. At least partly accounting for this difference are lower levels of group identity when discussion is mediated (Samuelson and Watrous-Rodriguez, 2010; see also Samuelson, Poole, ElShinnawy, Vinze, & Baker, n.d). Consistently with the group identity decrement is a lower We/I ratio discerned in Rocco's (1996) informal content analysis. Desirable further study would explore additional content differences between face-to-face and mediated talk. Based on other types of group tasks, past work in other contexts (Hiltz, Johnson, & Turoff, 1986) implies a more business-like, less social discussion.

Installation of a formal leadership structure has been one of the structural solutions to social dilemmas that Olson (1965), Hardin (1968), and Ostrom (2003) believed to be necessary for cooperation. Resource dilemma research suggests that group members favor the designation of a leader when faced with evidence of resource pool overuse, prefer a demonstrated low-end harvester as leader when they cannot vote for themselves, and lean toward a high-end user in those instances in which leadership is desired to combat underuse (e.g., Messick, Wilke, Brewer, Kramer, Zemke, & Lui, 1983; Samuelson, Messick, Rutte, & Wilke, 1984; van Dijk, Wilke, & Wit, 2003). Van Dijk et al. (2003) and DeCremer (2000) discovered that failure to achieve a public good also resulted in a majority desiring leader assignment. Factors that encourage the preference for a leader include democratic or elected leaders rather than autocratic or appointed, a group member rather than an outsider (Van Vugt & DeCremer, 1999, Study 1; see also Rutte & Wilke, 1985), member prosocial SVO (DeCremer, 2000; Samuelson, 1993), and overuse attributed to game difficulty rather than to player greed (Samuelson, 1991). Leaders are evaluated more positively when they succeed in maintaining a resource pool (Wit, Wilke, & van Dijk, 1989), distribute harvests equally among group members (Wit & Wilke, 1988), and show interest in group member input (DeCremer & van Krippenberg, 2002). Participant response to assuming the leadership role has been mixed,

with some studies reporting greater cooperation (Foddy & Crettenden, 1994; Schneider, Foddy, & Bilik, 2004) and others less (DeCremer, 2003; DeCremer & van Dijk, 2005). Reported relationships of group identity with choice of and response to leadership (see Hogg and Reid, 2001, for a theoretical analysis), and of leadership style and subsequent group member behavior (Bass, 1990; especially Part V), have been too complicated to report succinctly here.

The vast majority of the aforementioned studies operationalized "leadership" through experimenter manipulations of the events individual participants experienced. As such, with the exception of when participants were given the role, no actual leader existed. In addition, all of these studies described the antecedents and consequences of an established leader position rather than the leadership-relevant actions that group members can take, no matter their role. In a re-analysis specific to leadership behavior (Pavitt, High, Tressler & Winslow, 2007), good game performance was related with member contributions involving procedural leadership, giving information, and summarizing discussion. Analogous content analytic work in studies with appointed or elected leaders may provide more insight into how those in that role can influence their group toward or away from cooperation.

Environmental uncertainty, or uncertainty about some aspect of the social dilemma, must be distinguished from social uncertainty, or uncertainty about the intentions of other group members; the latter is relevant to trust. Group members facing resource dilemmas may be uncertain about the size of a resource pool or its replenishment rate; those tackling public goods dilemmas could be uncertain about the size of their personal resource or the provision point (i.e., the amount required to obtain the good). In both cases, there can be uncertainty about the size of the group. At least ten published papers (e.g.; Budescu et al., 1990; Gustafsson, Biel, & Garling, 1999; Rapoport et al., 1992) have consistently demonstrated that increases in resource pool size uncertainty result in larger and more unequal harvests and higher estimates of the pool size and others' likely harvest. Proposed explanations in the resource dilemma context (reviewed in Gustafsson et al., 1999) have included a perceptual bias resulting in overestimates of the pool size, a motivation-fueled "wishful thinking" effect, and a belief that the equity norm is less relevant with more uncertainty. de Kwaadsteniet, van Dijk, Wit, & DeCremer (2006) noted these effects as more pronounced for proselfs compared to prosocials. Most relevant work has used one-shot dilemmas, but there is also

evidence (Hine & Gifford, 1996; Roch & Samuelson, 1997) in more true-to-life, repeated-trial dilemmas of greater harvesting in response to increased uncertainty in both pool size and regeneration rate. Analogously, more uncertainty about the provision point in public goods dilemma settings has generally resulted in smaller contributions and less confidence that other group members will contribute (Gustafsson, Biel, & Garling, 2000; Wit & Wilke, 1998). To the best of my knowledge, there has never been a published study allowing for communication within groups facing environmental uncertainty; analogous to the discovery that its presence extinguished the usual group size impact on cooperation (Pavitt & Broomell, 2016), it is possible that discussion will help group members overcome their perceptual biases.

The presence of phases in interpersonal communication has been of interest ever since Bales and Strodtbeck (1951) searched for them in group discussion data. Janssen (2010) noted early rounds in a resource dilemma dominated by discussion concerning game rules and general strategy and later rounds by talk about earlier rounds and specific strategy. Janssen, Anderies, and Joshi (2011), in a give-and-take-some game, observed early rounds to talk about how much to contribute and later rounds to how much to harvest. More data analyses of this type would be welcome, particularly if any located phase structure can be associated with the other cooperative mechanisms, cooperation itself, and game performance.

Conclusion

Beyond modeling what we know, one valuable function of a paper such as this is to point out what is yet to be learned. Along with the just mentioned areas for further inquiry, we know little about the relative importance of the input variables included in the model and the extent to which they might interact with one another. These are just two out of many relevant questions that need answers: Is the impact of group size strong enough to counteract the effect of generalized trust on situational trust? If so, does group size act as an independent factor or a moderator of the generalized trust-to-situational trust association? We have much to learn about the exact relationship among the cooperative mechanisms beyond their mutual causal relationships. I can only hope that the model proposed herein has relevance to real-world groups grappling with social dilemmas critical to their

well-being. There is reason for cautious optimism given that Ostrom's (2003) model was largely built from case studies of such groups.

And so, the ubiquitous call for further research, including studies using methods rarely if ever applied thus far. An often-used manipulation in past work entails informing participants of precipitous drops in the resource pool, implying overharvest and perhaps defection from an agreed-on action plan by at least one group member. Pairing this manipulation with measurement of member judgments relevant to the cooperative principles during different points in the process may indicate whether expected drops in trust and trustworthiness ratings are accompanied by additional decreases in group identification and/or social norm adherence. Such findings would imply the need for bi-directional linkages beyond those in the currently-listed propositions and diagrammed model. Taking advantage of an idea floated by Waldron and Cegala (1992), combining group discussion via computer conferencing with simultaneous recording of participants verbalizing their concurrent thoughts may provide more insights into the relationship among critical factors. A second Waldron/Cegala suggestion with the same goal involves participant viewing recordings of their session and reporting their memories of their thoughts as the session progressed. In a different vein, given the complexity of the relationships among the factors known to be significant in the social dilemma context, computer simulations would allow the implications of countless beginning levels and relative strengths of these factors on subsequent processes and outcomes; see Stasser (1988) for an exemplar in the context of group social influence.

Beyond research, additional theorizing beyond Ostrom (1990) and Schroeder et al. (1995) would be welcome. In short, a scientific theory consists of a model and a scientific explanation. A scientific explanation includes (a) a fundamental motivation for and (b) underlying mechanism governing people's responses to and actions, during any communication-relevant episode (Pavitt, 2009, 2016). In the social dilemma context, SVO likely supplies a fundamental motivator behind the decision to cooperate or to defect, but SVO is undoubtedly tempered by influences from all of the other factors described herein as participants choose their actual goal for participation. Schroeder et al. made a first effort at organizing these relationships, but their work needs to be integrated both with Ostrom's and with other insights from the scholarly community.

Finally, although this effort has been directed toward the mixed-motive circumstance, much of it is relevant to other situations in which people perform tasks in groups, from informal friendship groups to families to training/therapy groups to formal organizational teams to mediated structures of various types (e.g., chatrooms, multiplayer games). Group identity, relevant norms, situational trust, trustworthiness, and communication should operate and interact analogously in these varied contexts as they do in the mixed-motive. Some of the input variables, including understanding of the situation, generalized trust, and social value orientation, should also act independently of context.

Additional cooperative mechanisms could also be identified that have not yet been associated with those considered herein. One of them would probably be participant perceptions of their treatment by the group (*procedural justice*), which includes aspects such as voice (the opportunity to express one's point of view), influence on group decisions, and interpersonal justice (respect and consideration shown by other group members), along with treatment by superiors in formal organization settings (Organ & Moorman, 1993). I close with the hope that others will take on the challenge of extending the model proposed here to these and other contexts.

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